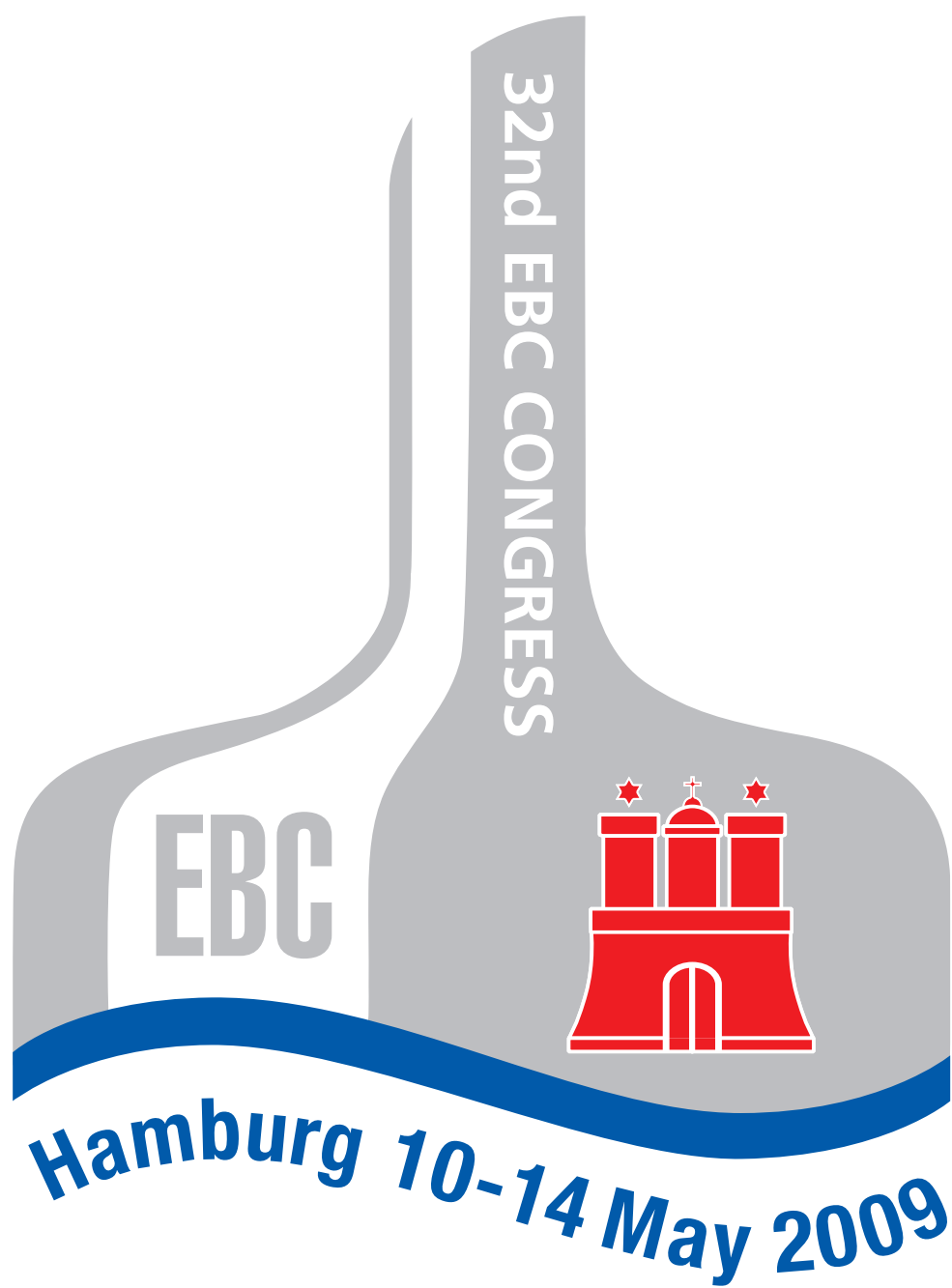
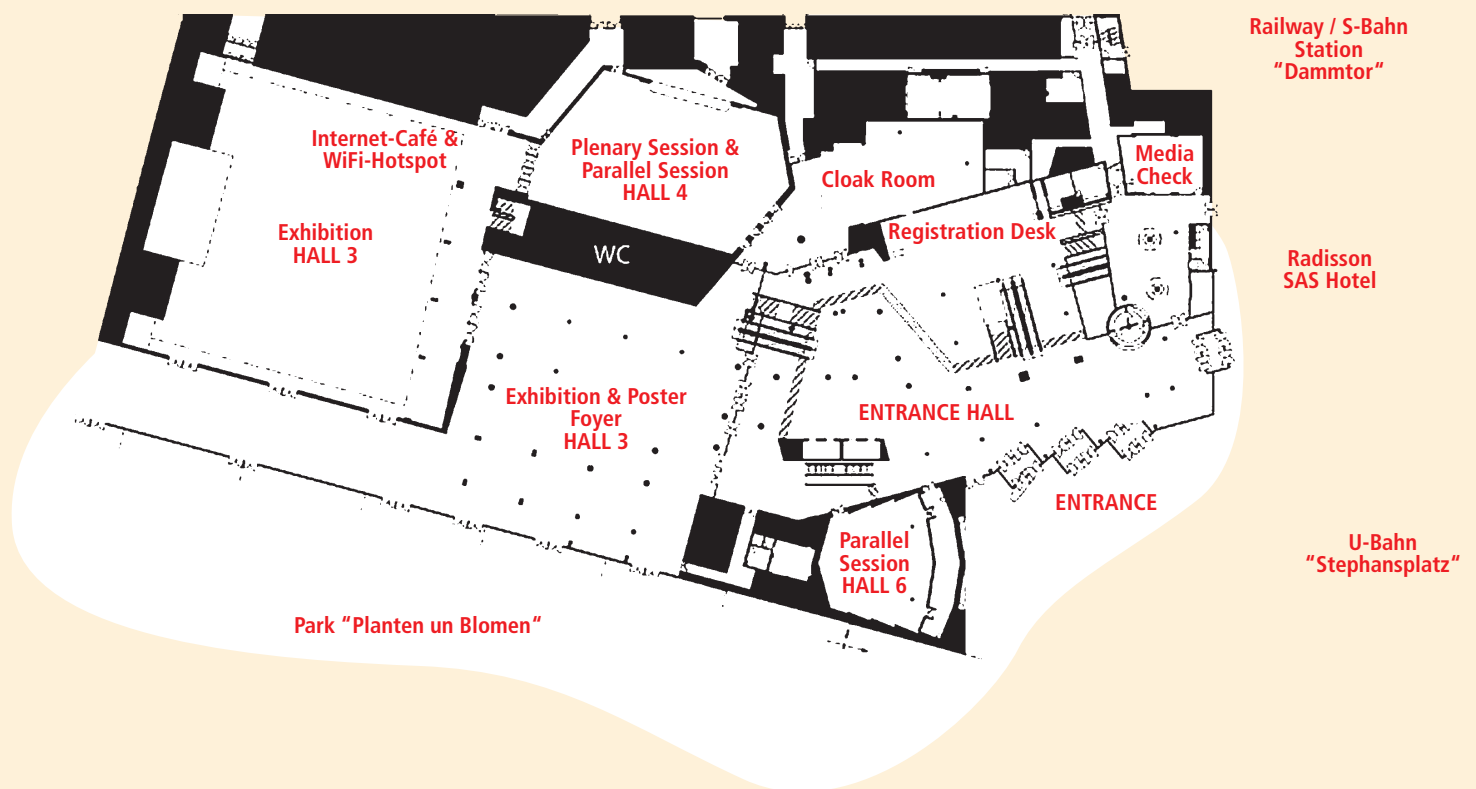


PROGRAMME



CCH – CONGRESS CENTER HAMBURG



EBC Definition

"EBC is the scientific and technical arm of The Brewers of Europe"

EBC Mission Statement

"To facilitate knowledge creation and transfer, and collaboration, between industrial and academic organisations, for the benefit of the brewing industry, consumers and the community"

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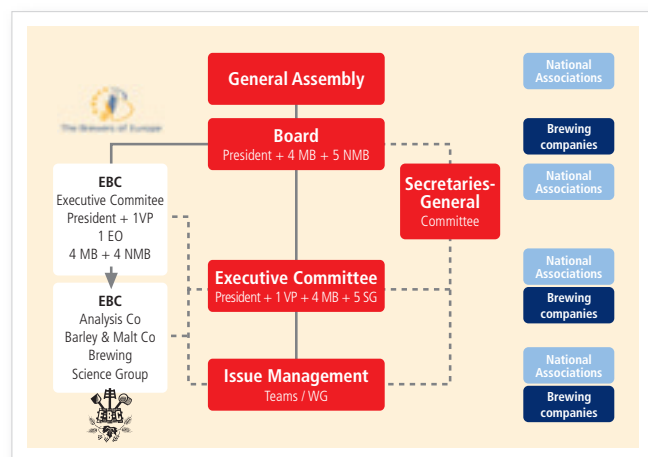
The European Brewery Convention (EBC) in 2009

At the end of 2007, EBC merged with The Brewers of Europe, the umbrella organisation for the brewing sector in Europe. EBC therefore defines itself as the scientific and technological arm of The Brewers of Europe. EBC enjoys autonomy status and is responsible for the congress, the committees and groups, technical symposia and for its own budget within the organisational framework of The Brewers of Europe. EBC is a world-class brand synonymous with technical excellence in brewing and quality assurance of raw materials, process and product.

The merger was marked by the physical move in January 2008 of the EBC secretariat from their Zoeterwoude offices in The Netherlands, to Brussels. EBC's budget is made up largely by subscriptions paid by the national trade organisations. In order to reflect the merger which had gone hand-in-hand with a reduction in staff and rental expenses, EBC has reduced its operating budget by over 9% for 2008 and a further 24.5% for 2009, passing on significant savings to the European brewing sector.

The governance of EBC used to rest on the Council and Board, headed by the EBC president and 4 vice-presidents. In order to reflect the new EBC, both these bodies were disbanded and replaced by the EBC Executive Committee, with the EBC president and only one vice-president. The Executive Committee is composed of members of the major brewers, non-major brewers, academic institutes and trade organisations. Its membership currently stands at 13.

The Brewers of Europe and EBC: Structure



Organigram of The Brewers of Europe and EBC Structure

Key: VP = Vice-President, MB = Major Brewer, NMB = Non-Major Brewer, SG = Secretaries-General, EO = Executive Officer

Composition of the EBC Executive Committee:

- ☐ Christian von der Heide, President, Diageo Global Beer (IE)
- ☐ Hans-Georg Eils, Vice-president, Karlsberg Brauerei (DE)
- ☐ John Brauer, Executive Officer, EBC / The Brewers of Europe (EU)
- ☐ Han van der Veen, Advisory Treasurer, Bavaria Lieshout (NL)
- ☐ Patrick Boivin, IFBM (FR)
- ☐ Christopher Burghardt, AB-InBev Western Europe (BE)
- ☐ Roberto Cavalli, Birra Peroni, SABMiller (IT)
- ☐ Wiggert Deelen, Heineken Nederland Supply (NL)
- ☐ Frank Lynch, Guinness, St. James's Gates Dublin (IE)
- ☐ Jan Niewodniczanski, Bitburger Braugruppe (DE)
- ☐ Esko Pajunen, Carlsberg Research (DK)
- ☐ José Fernando Vidal, Mahou-San Miguel (ES)
- ☐ Jan Veselý, Český Svaz Pivovarů a Sladoven (CZ)

There are 4 "Associate Members" from North and South America, Japan and Australia with observer status on the EBC Executive Committee. These are:

- ☐ Kenkichi Aoki, Asahi Breweries (JP)
- ☐ Peter Rogers, Fosters AAP (AU)
- ☐ David Ryder, Miller Brewing Co. (US)
- ☐ Carsten Zufall, Cerveceria Polar (VE)

The EBC Selection Committee

This committee was tasked with reviewing the scientific and technical contributions for the EBC congress. This programme reflects the collective input of the selection committee. Members of this committee were drawn from the Executive Committee, as well as the chairpersons of the three EBC committees and groups – Analysis Committee, Barley & Malt Committee and the Brewing Science Group.

The EBC Organising Committee:

- ☐ Hans-Georg Eils (Chairman), Karlsberg Brauerei
- ☐ John Brauer, EBC / The Brewers of Europe
- ☐ Thomas Bühler, GEA Brewery Systems
- ☐ Peter Hahn, Deutscher Brauer-Bund
- ☐ Erika Hinzmann, Deutscher Brauer-Bund
- ☐ Jan Niewodniczanski, Bitburger Braugruppe
- ☐ Claudia Zügler-Hingst, Carlsberg Deutschland

Welcome Message from the EBC President

In my capacity as the recently elected President of EBC, I cordially invite you to Hamburg and to Germany in general for the 32nd EBC Congress 10-14 May 2009. This marks the third time an EBC Congress has been held in this country: In 1955 the congress was organised in Baden-Baden and, in 1979, in Berlin-West.



Hamburg has a long and proud past, from its century-long association with the Hanseatic League, arguably one of the most successful trade associations in history to its rise as one of the great port cities of Europe, to its almost total destruction in the second world war, to its rise from the ashes to become a truly dynamic, modern and international city in tune with its North-German roots. I hope you will take the opportunity to experience and enjoy some of the architectural and cultural gems that this city has to offer during the congress.

The organising committee is determined to ensure that the 32nd EBC congress will be a memorable event for you:

- memorable for the learning experiences afforded by the sharing of technical knowledge and expertise through the presentations, posters, exhibition and technical visits programmes
- for the opportunities to gain insight into the non-technical issues pertaining to our industry
- for the unparalleled exposure to networking and friendship building, and
- for the significant enjoyment and camaraderie afforded by the social tours, the technical tours and simply, the beer

Participants in previous EBC Congresses have asked for more discussion and a somewhat less hurried pace to encourage better networking and scientific exchange. In response, the local organising committee has reduced the number of both the presentations (15% less than at the previous congress in Venice) and number of parallel sessions. As in preceeding congresses we have grouped presentations, both oral and posters, into a number of functional categories which should appeal to everyone in the brewing industry, the allied industries and academic institutions.

We have taken your constructive criticism regarding the trade exhibition at Venice 2007 to heart. Not only has the local organising committee worked hard in collaboration with our partners Interplan AG to allay fears of the supplier industries having to play second fiddle, we have also made the trade exhibition area a real centre piece of the whole congress.

We hope that you are planning to stay over on the evening of Wednesday 13 May to allow you to attend the Farewell Party at the *Kultur und Gewerbespeicher* situated in the spectacularly preserved warehouse district by the docks. There you have the opportunity to live it up on the last night of the congress, in the company of old friends and new acquaintances. Also, make sure you're on one of the exciting technical tours that the committee has been able to line up for you on Thursday 14 May.

Christian von der Heide

(Technical Director Global Beer DIAGEO plc.)
EBC President

Welcome Message from the host country

On behalf of the organising committee for the EBC congress I hereby welcome you to Hamburg and the 32nd EBC congress. The organising committee, composed of representatives of the German Brewers' Association – *Deutscher Brauer-Bund* – as well as members of the German brewing industry and EBC, have worked hard over the last 1 ½ years to make this congress a success.



It has become an open secret that the concept of 'value-for-money' has been one of the deciding key-factors when drawing up the congress budget. The registration fees have been significantly reduced, the management structure has been kept flat and, last but not least, we have striven for a more integrated involvement of the supplier industries. At the same time, however, we believe that the scientific and technical programme is one of the best, ever. All this, however, would not have been possible without the dedicated input from the members of the local organising committee, or the support offered by sponsors and exhibitors alike. A heartfelt vote of thanks is hereby offered to all parties concerned.

Hamburg is often referred to as Germany's gateway to the world. It's century-old history is intimately intertwined with seafaring, maritime trade and – of course – an early forerunner of the European Union, the Hanseatic League. Hamburg, together with other port cities such as Lübeck, Danzig, Riga, Copenhagen, Bergen (and even London at some stage) ruled the waves of the Baltic and the North-Sea. Its architecture and focus on all things maritime still bear testimony to those days. Not surprisingly, people for Hamburg are renowned for their openness and tolerance. It is perhaps a lesser-known fact that this city also has a great history of beer-brewing: With so many international trade connections, beer from Hamburg became famous all over northern Europe.

I hope you have allowed for some extra time before, during or after the congress to take in the sights and sounds of this wonderfully vibrant city.

Wishing you a good congress with many opportunities for renewing old friendships and extending your knowledge and expertise of the world of brewing, I remain with kind regards,

Hans-Georg Eils

(Technical Director Karlsberg Brauerei)
Chairman Local Organising Committee EBC 2009 Hamburg

SOCIAL PROGRAMME

SUNDAY, 10 May 2009

Hafengeburtstag Hamburg - Harbour Birthday

Visit the "World's greatest port festival" in Hamburg at the port promenade. At 17.00 hrs you can watch the "Grand departure parade".

Opening Ceremony and Welcome Party

18.30 – 23.00 h

Location: CCH – Congress Center Hamburg – Hall 4, exhibition Hall 3 & Foyer Hall 3

A variety of German beers will be offered together with a combination of regional and international specialities.

MONDAY, 11 May 2009

Pub Night

GlobalMalt GmbH & Co. KG offers a pub night in Hamburg's bars to the registered participants. Please note that number of tickets is limited. Tickets can be ordered on a first-come first-served base.

WEDNESDAY, 13 May 2009

Farewell Party sponsored by GEA

18.00 – 23.00 h

Location: *Kultur- und Gewerbespeicher* in the warehouse district of Hamburg

Enjoy the last evening of the congress in a typical maritime location of Hamburg with delicious food and German beer. Dress Code: business casual. A bus transfer from the Congress Center to the event location will be provided.

PARTNER PROGRAMME

All tours start and finish at CCH – Congress Center Hamburg.

MONDAY, 11 May 2009

Old Hanseatic Town Lübeck

08.30 – 17.00 h

The old and proud Hanseatic city of Lübeck, near the Baltic Sea, offers an atmosphere of Thomas Mann's literature with its famous *Buddenbrook* family story. Step right into the story by visiting the *Buddenbrook* house with an accompanying exhibition. Marzipan is a sweet delight for which Lübeck is famous for all over the world. Get a taste of fresh marzipan in the Niederegger marzipan shop, and enjoy the rich history of this picturesque town.

Complimentary for registered partners

Incl. bus, guide (English), fees, lunch in a traditional Lübeck restaurant

TUESDAY, 12 May 2009

Guided Bicycle Tour

10.00 – 14.00 h

Bicycles will be supplied to the CCH. Your city guide will show you the most interesting sights of the city. You will learn about curiosities and personalities of Hamburg's history, as well as lots of interesting background stories. The tour is 16 km long. Refreshments will be offered during the tour.

Price per person € 40.00

Incl. bicycles, guide (English), refreshments

TECHNICAL TOURS

THURSDAY, 14 May 2009

Detailed information can be found on the congress website

www.ebc2009hamburg.org

All tours start and finish at CCH – Congress Center Hamburg.

TOUR 1

Holsten-Brauerei / Carlsberg Germany Group, Hamburg

price per person: € 30.00

Tour 1a 07.30 – 13.15 h [arrival Hamburg airport: 12.45 h]

Tour 1b 11.30 – 16.15 h [arrival Hamburg airport: 15.45 h]

www.holsten.de and www.carlsberg.de

TOUR 2

GlobalMalt GmbH & Co. KG, Hamburg

price per person: € 30.00

Tour 2a 09.00 – 12.30 h [arrival Hamburg airport: 12.00 h]

www.globalmalt.com

TOUR 4

GEA Tuchenhausen, Tuchenhausen Brewery Systems GmbH, Büchen

price per person: € 40.00

08.30 – 14.00 h [arrival Hamburg airport: 13.30 h]

www.gea-brewery.com

TOUR 5

Flensburger Brauerei, Flensburg – and – KRONES AG's Flensburg facility

price per person: € 50.00

a combined visit: 08.00 – 18.30 h [arrival Hamburg airport: 18.00 h]

www.krones.com

TOUR 6

Brauerei Beck & Co InBev Deutschland, Bremen

price per person: € 45.00

08.00 – 17.30 h [arrival Hamburg airport: 17.00 h]

www.inbev-deutschland.de and www.beckundco.de



GENERAL INFORMATION

Exhibition

The exhibition will be located in Hall 3 & Foyer Hall 3. The Welcome Party, coffee breaks and lunch breaks will also take place in this area. The internet pub is located in here as well.

The exhibition opening hours are:

<i>Sunday, 10 May 2009:</i>	<i>during Welcome Party</i>
<i>Monday, 11 May 2009:</i>	<i>10.00 – 19.15</i>
<i>Tuesday, 12 May 2009:</i>	<i>08.00 – 19.00</i>
<i>Wednesday, 13 May 2009:</i>	<i>08.00 – 16.30</i>

Congress Language

The congress language is English. Simultaneous translations will not be provided.

Dress Code

The dress code is business casual for the evening events.

Congress Venue / Congress Secretariat

The conference will take place at the

CCH - Congress Center Hamburg

Am Dammtor / Marseiller Straße

D – 20355 Hamburg

Phone: +49 (0)40 / 35 69 - 0

Fax: +49 (0)40 / 35 69 - 21 83

The registration desk in the CCH – Congress Center Hamburg will be open as follows:

<i>Sunday, 10 May 2009:</i>	<i>14.00 – 20.00</i>
<i>Monday, 11 May 2009:</i>	<i>07.30 – 18.00</i>
<i>Tuesday, 12 May 2009:</i>	<i>07.30 – 18.00</i>
<i>Wednesday, 13 May 2009:</i>	<i>07.30 – 17.30</i>

Contact details during the congress are as follows:

Phone: +49 40 35 69 50 32

Fax: +49 40 35 69 52 99

Email: ebc@interplan.de

The CCH is a non-smoking building.

Notice board

Congress announcements and messages for delegates will be posted on a notice board near the registration desk. No announcements will be made during the sessions unless absolutely necessary. Please check the board regularly.

Lunch / Refreshment

Lunches will be served to all delegates from Monday through to Wednesday in the exhibition area. Lunches for partners are not foreseen; these are included in the tours where indicated. By courtesy of the hosts, beer and mineral water are available throughout the congress in the exhibition area as well.

Transportation in Hamburg

After picking up their name badge at the CCH, all delegates and partners are entitled to use the public transport system in Hamburg for free from Sunday – Wednesday. No shuttle service will be available.

Please take your name badge with you when using the public transport system – it is your ticket!

Insurance

Registration fees do not include insurance of any kind. It is strongly recommended that all delegates take out their own travel and medical insurance prior to coming to the congress. The organisers will not take any responsibility for any participant failing to insure.

SOME SUGGESTIONS FOR ...

RESTAURANTS in Hamburg

Tarantella

The Bistro Restaurant located in the building of the "Casino" offers a modern cuisine. In the summer you can also wine and dine on the terrace. Stephansplatz 10 · 20354 Hamburg · Phone: 040 – 650 677 90

Hofbräuhaus

A traditional Bavarian Restaurant located close to the Lake Alster. A fresh beer and sausages are just one "must have". Esplanade 6 · 20354 Hamburg · Phone: 040 – 34 99 38 38

Restaurant Maral

The restaurant offers a variety of Asian food and Sushi as well as Euro-Asian food. Grosse Bleichen 21 · 20354 Hamburg · Phone: 040 - 34 01 51

Restaurant Bacco

A stylish Italian Restaurant with a touch of modern cuisine. Poolstrasse 20 · 20355 Hamburg · Phone: 040 – 350 184 30

Restaurant Parlament

This traditional restaurant located in the cellar of the Town Hall offers typical German cuisine. It offers a terrace situated in the inner courtyard of the Town Hall. Rathausmarkt 1 · 20095 Hamburg · Phone: 040 – 70 38 33 99

BARS around the CCH

Fusion Bar

This stylish and trendy bar is located in the SIDE Hotel. Drehbahn 49 · 20354 Hamburg · Phone: 040 – 30 99 90

Cave Bar

This lifestyle bar is located in an ancient water tower, which is now a 5star hotel – The Mövenpick Hotel. Sternschanze 6 · 20357 Hamburg · Phone: 040 – 33 44 110

Café de Paris

The most beautiful Bar and Brasserie located in a former butchery one can enjoy wine, beer and traditional French snacks. Rathausstrasse 4 · 20099 Hamburg · Phone: 040 – 32 52 77 77

Riverlounge in the Alster-Pavillion

The informal bar "Alex" located at the Jungfernstieg offers cocktails, beer and wine while enjoying the look over the Lake Alster. Jungfernstieg 54 · 20354 Hamburg · Phone: 040 – 35 01 87 15

Ciu' Die Bar

Enjoy the fantastic view over the Lake Alster while choosing from more than 1000 spirituous beverages. Ballindamm 14-15 · 20095 Hamburg · Phone: 040 – 32 50 60 60

The Reeperbahn, a famous street, offers a variety of bars, bistros and amusements for everybody.

SCIENTIFIC PROGRAMME:

SUNDAY, 10 May 2009

14.00 - 20.00

Registration

18.30 - 23.00

Opening Ceremony in Hall 4 and Welcome Party in the Exhibition in Hall 3 & Foyer Hall 3

1. Holsten Brewery Choir
2. Wolfgang Burgard, President of Deutscher Brauer-Bund (German Brewers Association)
3. Senator Axel Gedaschko, Member of the Senate of the Free and Hanseatic City of Hamburg
4. Christian von der Heide, President EBC
5. Holsten Brewery Choir

Introductions by the EBC Executive Officer John M. Brauer



MONDAY, 11 May 2009**PLENARY SESSION – HALL 4**

07.30 - 18.00 **Registration**
 10.00 - 19.15 **Exhibition**

CONGRESS OPENING AND KEY-NOTE SESSION*Chair: Hilary Jones, former President EBC, United Kingdom*

- | | | |
|---------------|----|---|
| 08.30 - 09.00 | L1 | Challenges facing the German and European Brewers
<i>Wolfgang Burgard, President of the German Brewers Association, Hamburg, Germany</i> |
| 09.00 - 09.30 | L2 | The Brewers of Europe and EBC: Teamed up to shape a beer-friendly business environment
<i>Alberto da Ponte, President of The Brewers of Europe, Vialonga, Portugal</i> |
| 09.30 - 10.00 | L3 | Progress in German barley and hop breeding
<i>Horst-Gevert Bellmer, former Vice-President EBC, Bremen, Germany</i> |

10.00 - 10.30 COFFEE BREAK**MEDIA, MANAGEMENT AND INDUSTRY ISSUES***Chair: Christopher Burghardt, AB-InBev, Belgium*

- | | | |
|---------------|----|---|
| 10.30 - 11.00 | L4 | Thinking beyond grey pinstripes – sustainable development and the limits of “greenwashing”
<i>Ina Verstl, Communications, Germering, Germany</i> |
| 11.00 - 11.30 | L5 | Continuous improvement (CI) concepts and brewery management
<i>Axel G. Kristiansen, Scandinavian School of Brewing, Copenhagen, Denmark</i> |
| 11.30 - 12.00 | L6 | Fear not the messenger!
<i>R. Laurence Nelson, Advantage Publishing Ltd., Reigate / Surrey, United Kingdom</i> |
| 12.00 - 12.30 | L7 | Enabling the technical future of today's brewery
<i>Alastair Pringle, AB-Inbev, St. Louis MO, USA</i> |

12.30 - 14.00 LUNCH BREAK, EXHIBITION, POSTERS**13.00 - 14.00 POSTER SESSION P001 – P045 (see page 14/15)****RAW MATERIALS & FOOD SAFETY***Chair: Annika Wilhelmson, VTT, Finland*

- | | | |
|---------------|-----|---|
| 14.00 - 14.30 | L8 | <i>Fusarium langsethiae</i> on brewing barley: infection in the field and survival during the malting process
<i>Régis Fournier, IFBM, Nancy, France</i> |
| 14.30 - 15.00 | L9 | Are free and masked <i>Fusarium</i> mycotoxins only safety issue for brewers and maltsters?
<i>Jana Hajslova, Inst. Chem. Technol., Prague, Czech Republic</i> |
| 15.00 - 15.30 | L10 | Can amine profiles be a discriminant parameter of brewing products?
<i>Maria Daria Fumi, Univ. Cattolica del Sacro Cuore, Piacenza, Italy</i> |
| 15.30 - 16.00 | L11 | Barley-associated microbial biofilms in malting
<i>Arja Laitila, VTT, Finland</i> |

16.00 - 16.30 COFFEE BREAK**RAW MATERIALS & FOOD SAFETY***Chair: Dietrich Mönch, GlobalMalt GmbH & Co. KG, Germany*

- | | | |
|---------------|-----|---|
| 16.30 - 17.00 | L12 | Development of molecular markers linked to powdery mildew resistance genes in Hop (<i>Humulus lupulus</i> L.) to support breeding for resistance
<i>Stefan Seefelder, Bay. LfL, Wolnzach, Germany</i> |
| 17.00 - 17.30 | L13 | Prediction of barley and <i>Fusarium</i> activities during malting using transcriptional profiling
<i>Annika Wilhelmson, VTT, Finland</i> |
| 17.30 - 18.15 | L14 | Fungal hydrophobins as a beer gushing factor – current knowledge and future aspects
<i>Tuija Sarlin, VTT, Finland</i>
Gushing phenomenon – new findings regarding the causes and the possibility of technological controlling measures
<i>Frank Rath, VLB, Berlin, Germany</i>
Identification of new gushing producer fungi
<i>Patrick Boivin, IFBM, Nancy, France</i> |

GUSHING SESSION

Subject to change

TUESDAY, 12 May 2009**PARALLEL SESSION – HALL 4**

07.30 - 18.00 Registration
 08.00 - 19.00 Exhibition

SENSORY & QUALITY I*Chair: Behnam Taidi, Brasseries Kronenbourg, France*

- 08.00 - 08.30 L15 The influence of radical reactions on the haze formation in stabilized beer
Thomas Kunz, Technical University Berlin, Berlin, Germany
- 08.30 - 09.00 L16 An examination of binary foam stabilizer systems in lager beer
Thomas H. Shellhammer, Oregon State Univ., Corvallis OR, USA
- 09.00 - 09.30 L17 The relationship between matrix foaming potential, beer composition and foam stability
Petr Kosin, Pivovar Budějovický Budvar, Czech Republic
- 09.30 - 10.00 L18 Improvement of tap hygiene and draught beer quality with "a flush a day"
Heinz Dauth, TUM, Freising-Weihenstephan, Germany

10.00 - 10.30 COFFEE BREAK**SENSORY & QUALITY I***Chair: Patrick Boivin, IFBM, France*

- 10.30 - 11.00 L19 Sensory evaluation of body and mouthfeel – a panel training!
Martina Ingeborg Gastl, TUM, Freising-Weihenstephan, Germany
- 11.00 - 11.30 L20 Sensory and chemical characterization of lagers of the Italian market
Gianluca Donadini, Univ. Cattolica del Sacro Cuore, Piacenza, Italy
- 11.30 - 12.00 L21 Synergistic and suppression effects of flavour compounds in beer
Stefan Hanke, TUM, Freising-Weihenstephan, Germany

12.00 - 14.00 LUNCH BREAK, EXHIBITION, POSTERS**13.00 - 14.00 POSTER SESSION P046 – P088 (see page 16/17)****SENSORY & QUALITY II***Chair: Martina Gastl, TUM Weihenstephan, Germany*

- 14.00 - 14.30 L29 The (in)stability of the beer's bitter taste – Elucidation of the mechanisms involved in trans-iso-alpha-acid degradation and formation of bitter off-taste compounds upon beer storage
Thomas Hofmann, TUM, Freising-Weihenstephan, Germany
- 14.30 - 15.00 L30 The influence of dark specialty malts on beer flavour stability
Sem M.G. Vandecan, K.U. Leuven, Belgium
- 15.00 - 15.30 L31 Impact of colour adjustment on flavour stability of pale lager beers with a range of distinct colouring agents
Andrés Furukawa, ICB, Heriot-Watt Univ., Edinburgh, United Kingdom
- 15.30 - 16.00 L32 Stay or swap? The decision is yours
Deborah K Parker, BRI, Nutfield / Surrey, United Kingdom

16.00 - 16.30 COFFEE BREAK**SENSORY & QUALITY II***Chair: Guido Aerts, KaHo St. Lieven, Belgium*

- 16.30 - 17.00 L33 An enzymatic solution to improve the oxidative stability of wort and beer flavour stability – the role of catalase
Anne Mette Frederiksen, Novozymes, Bagsvaerd, Denmark

17.00 - 18.00 Exhibition and Posters*Subject to change*

TUESDAY, 12 May 2009**PARALLEL SESSION – HALL 6**

07.30 - 18.00 Registration
08.00 - 19.00 Exhibition

EDUCATIONAL REVIEWS*Chair: Richard Sharpe, BRI, United Kingdom*

- 08.00 - 08.30 L22 Cardboard or Bread? The relative importance of oxidative and Maillard pathways of beer ageing
Carsten Zufall, Cerveceria Polar CA, Caracas, Venezuela
- 08.30 - 09.00 L23 The potential of plant breeding for improvement of quality traits in barley and the benefits for the processing industry demonstrated by long term evaluation of barley varieties
Markus Herz, Bay. LfL, Freising, Germany
- 09.00 - 09.30 L24 Volatile phenols in beer: Formation of 4-vinylguaiacol during wort fermentation and its fate during beer ageing
Nele Vanbeneden, K.U. Leuven, Belgium
- 09.30 - 10.00 L25 Flavour, froth and finesse - the legacy of hops to beer (a review)
Paul Hughes, ICB, Heriot-Watt Univ., Edinburgh, United Kingdom

10.00 - 10.30 COFFEE BREAK**EDUCATIONAL REVIEWS***Chair: Jan Niewodniczanski, Bitburger Braugruppe, Germany*

- 10.30 - 11.00 L26 Fusel alcohol formation by yeast
Richard Dickinson, Cardiff University, United Kingdom
- 11.00 - 11.30 L27 The origin of beer-spoilage lactic acid bacteria and its implications in micro quality control in breweries – A review
Koji Suzuki, Asahi Breweries Ltd., Ibaraki, Japan
- 11.30 - 12.00 L28 A critical review of the design of large capacity fermentation vessels and the methods used for their management.
Christopher A Boulton, Univ. Nottingham, Loughborough, United Kingdom

12.00 - 14.00 LUNCH BREAK, EXHIBITION, POSTERS**13.00 - 14.00 POSTER SESSION P046 – P088 (see page 16/17)****ENVIRONMENT / SUSTAINABILITY***Chair: Lex Rontelap, Heineken, The Netherlands*

- 14.00 - 14.30 L34 The Brewers of Europe – securing our future
Pjotr van Oeveren, Heineken, Zoeterwoude, The Netherlands
- 14.30 - 15.00 L35 Use of ionized air for reducing odour emissions in brewhouse vapours
Alexander Hofmann, GEA Brewery Systems, Kitzingen, Germany
- 15.00 - 15.30 L36 Sustainable energy supply in brewing industry
Ludwig Scheller, GEA Brewery Systems, Kitzingen, Germany
- 15.30 - 16.00 L37 Developing a corporate climate strategy
Johnnie Rask Jensen, Danfoss Solutions A/S, Kolding, Denmark

16.00 - 16.30 COFFEE BREAK**PROCESS & PACKAGING EFFICIENCY I***Chair: Simon Wade, SABMiller, United Kingdom*

- 16.30 - 17.00 L38 Large mash filters – improved results from new generation mash filter systems in practice
Jens Voigt, TUM, Freising-Weihenstephan, Germany
- 17.00 - 17.30 L39 Efficient formation and stripping of DMS during a brewing process without "boiling"
Gert De Rouck, KaHo St.-Lieven, Gent, Belgium
- 17.30 - 18.00 L40 Capacity increase and energy savings with a proline-specific endo protease
Jeroen L van Roon, DSM Food Specialities, Delft, The Netherlands

Subject to change

WEDNESDAY, 13 May 2009**PARALLEL SESSION – HALL 4**

07.30 - 17.30 Registration
 08.00 - 16.30 Exhibition

PROCESS & PACKAGING EFFICIENCY II*Chair: Roland Folz, VLB Berlin, Germany*

08.00 - 08.30 L41 A new approach to control bottle conveyors
André Sorgatz, TUM, Freising-Weihenstephan, Germany

08.30 - 09.00 L42 Model based diagnosis - a new approach for the downtime analysis in complex bottling plants
Tobias Voigt, TUM, Freising-Weihenstephan, Germany

09.00 - 09.30 L43 On-site produced disinfectants in the brewery – analytics, monitoring and technological aspects
Christoph Kunzmann, VLB, Berlin, Germany

09.30 - 10.00 L44 Procedural aspects for a better lautering performance
Johannes Tippmann, TUM, Freising-Weihenstephan, Germany

10.00 - 10.30 **COFFEE BREAK**

PROCESS & PACKAGING EFFICIENCY II*Chair: Guido Aerts, KaHo St. Lieven, Belgium*

10.30 - 11.00 L45 Modern process engineering for fermentation and storage cellars
Peter Gattermeyer, Kronen AG (Steinecker), Freising, Germany

11.00 - 11.30 L46 Extending approaches for production planning, process simulation and optimization
Martin Nagel, TUM, Freising, Germany

11.30 - 12.00 Exhibition and Posters

12.00 - 14.00 **LUNCH BREAK, EXHIBITION, POSTERS**

13.00 - 14.00 **POSTER SESSION P089 – P132 (see page 18/19)**

WEDNESDAY, 13 May 2009**PLENARY SESSION – HALL 4****FUTURE PERSPECTIVES***Chair: Hilary Jones, former President EBC, United Kingdom*

14.00 - 14.30 L54 Nutritional changes of barley, rye and buckwheat during malting
Elke Arendt, Univ. College Cork, Republic of Ireland

14.30 - 15.00 L55 Evaporation of unwanted wort flavour components in the cold section of the brewery
Michael Dillenburger, Hertel GmbH, Salzburg, Austria

15.00 - 15.30 L56 Beer shades to match your lipstick and other adventures in new product development
Caroline Walker, BRI, Nutfield / Surrey, United Kingdom

15.30 - 16.00 L57 Maltose syrup production from barley in a standard brewhouse
Patrick Bahns, GEA Brewery Systems, Kitzingen, Germany

16.00 - 16.30 **COFFEE BREAK**

FUTURE PERSPECTIVES*Chair: Christian von der Heide, President EBC, Diageo, Ireland*

16.30 - 17.00 L58 Evaluation of the amino acid composition and fermentation performance of barley worts
Stefan Kreis, Novozymes, Bagsværd, Denmark

17.00 - 17.30 L59 Closing Session

18.00 - 23.00 Farewell Party in the Kultur- und Gewerbespeicher

Subject to change

WEDNESDAY, 13 May 2009**PARALLEL SESSION – HALL 6**

07.30 - 17.30

Registration

08.00 - 16.30

Exhibition

YEAST, FERMENTATION & MICROBIOLOGY*Chair: Tomáš Brányik, Institute of Chemical Technology Prague, Czech Republic*

08.00 - 08.30 L47 The rate of uptake and release of Ca, Mg and Zn ions by serially repitched yeast slurry during industrial fermentation process

Aleksander Poreda, Univ. Agriculture, Krakow, Poland

08.30 - 09.00 L48 The effect of the timing of wort aeration on ester formation

Taku Irie, Asahi Breweries Ltd., Ibaraki, Japan

09.00 - 09.30 L49 Feast or famine: how yeast manage amino acid metabolism during the aerobic to anaerobic transition: left to themselves, or with a little help from their friends

Peter John Rogers, Foster's Group Ltd., Abbotsford, NSW, Australia

09.30 - 10.00 L50 Sulphite production by lager yeast in high gravity glucose rich worts: Clarifying the role of cloudy worts

Eric J Samp, Miller Coors Brewing Co., Golden CO, USA

10.00 - 10.30

COFFEE BREAK**YEAST, FERMENTATION & MICROBIOLOGY***Chair: Katherine Smart, University of Nottingham, United Kingdom*

10.30 - 11.00 L51 Microbial T-RFLP screening as a solution for premature yeast flocculation (PYF) assurance for malt

Evan Evans, Univ. Tasmania, Australia

11.00 - 11.30 L52 Towards an understanding of hop resistance in beer spoiling *Lactobacillus brevis*

Rudi F. Vogel, TUM, Freising-Weihenstephan, Germany

11.30 - 12.00 L53 Phenotype MicroArrays - a new method for yeast characterization and measuring yeast metabolism?

Samantha Louise Walker, BRI, Nutfield / Surrey, United Kingdom

12.00 - 14.00

LUNCH BREAK, EXHIBITION, POSTERS

13.00 - 14.00

POSTER SESSION P089 – P132 (see page 18/19)**WEDNESDAY, 13 May 2009****PLENARY SESSION – HALL 4***Subject to change**see programme page 12*

POSTER LIST / POSTER SESSIONS:

Poster presenters will be available at their posters during the respective sessions.

MONDAY, 11 May 2009 · 13.00 – 14.00 p.m. · FOYER HALL 3

	Abstract title	First author	Institute / company
Session name / topic: Analysis (raw materials, process, product, safety)			
P001	A rapid and simple method for analysis of bitterness in beer by FTIR spectroscopy	Helmut Klein	Brau Union Österreich AG, Quality Assurance & Development, Linz, Austria
P002	Cryoscopy as an analytic tool in lactic acid fermentation	Moritz Krah	TU München, Lehrstuhl für Technologie der Brauerei I, Center of Life and Food Sciences Weihenstephan, Freising, Germany
P003	Loop-mediated isothermal amplification to detect and identify beer spoilage <i>Lactobacillus</i> sp. bacteria	Nobuyuki Hayashi	Kirin Brewery Company, Limited, Research Laboratories for Brewing, Yokohama, Japan
P004	A rapid non-destructive method for quantification of fungal infection on barley and malt kernels	Sabrina Bodevin	Carlsberg A/S, Carlsberg Research Laboratory, Valby, Denmark
P005	New oxidation destructive analysis (NODA)	Jan Savel	Budweiser Budvar, N.C., R&D, Ceske Budejovice, Czech Republic
P006	Sorghum: An underestimated source of antioxidants and healthy polyphenols for gluten-free beer production	Meike Bröhan	Université catholique de Louvain, Unité de Brasserie et des Industries Alimentaires, Louvain-la-Neuve, Belgium
P007	Characterization of volatile compounds in beer by means of comprehensive 2D-gaschromatography mass spectrometry	Emanuele Boselli	Università Politecnica delle Marche, SAIFET, Ancona, Italy
P008	Practical brewer's approach to near infrared spectroscopy	Adam Broz	Budweiser Budvar, N.C., Production, Ceske Budejovice, Czech Republic,
P009	New cognitions on the gushing phenomenon	Manuel Christian	Technische Universität München, Research Center Weihenstephan for Brewing and Food Quality, Freising-Weihenstephan, Germany
P010	Effect of the redox potential modification using gases, on the wort oxidation and quality	Dominique Ibarra	AIR LIQUIDE, CRCD - Bioresources Group, Jouy-en-Josas, France
P011	New method for characterizing high-molecular protein fractions in wort using a charge analyzing system	Jean Titzte	Technische Universität München, Research Center Weihenstephan for Brewing and Food Quality, Freising-Weihenstephan, Germany
P012	Multi-parametric sensor (MEMs) for brewing control and quality assessment	Axel Kather	Rockwell Automation, Unterschleissheim, Germany
P013	A straightforward method for the determination of viscosity-inducing arabinoxylans in wort and beer	Jürg Obrecht	Novozymes Switzerland AG, Customer Solution Brewing, Dittingen, Switzerland
P014	Survey of emergent mycotoxins on malting barley	Benjamin Neugnot	IFBM, R&D, Vandoeuvre, France
P015	Intrinsic antifungal properties of (9S,12S,13S)-9,12,13-trihydroxy-10E-octadecenoic acid (THOE) - formation induced by mechanical stress in barley and malt	Leif A Garbe	TU Berlin / VLB, Analytics, Berlin, Germany
P016	Malting process parameters evaluation by near-infrared spectroscopy in reflectance (NIR)	Valeria Sileoni	University of Perugia, Department of Economic and Food Sciences, Perugia, Italy
P017	Evaluation of malt quality by near-infrared spectroscopy in reflectance	Ombretta Marconi	University of Perugia, Italian Brewing Research Center, Perugia, Italy
P018	Correlation study between β -glucans and viscosity during wort production in a pilot-scale brewhouse	Giuseppe Perretti	University of Perugia, Italian Brewing Research Center, Perugia, Italy
P019	Predictability and optimization of PVPP-stabilization in beer using anthocyanogenes, polyphenols and total oxygen content figures by means of a neural network	Steffen Hanusch	Karlsberg Brauerei GmbH, Technology & Development, Homburg, Germany
P020	Meura's laboratory mash filtration test	Ariane Dewulf	Meura sa, Research and Development, Péruwelz, Belgium
P021	Use of a copper coil as a faster alternative to traditional conversion of vicinal diketones precursors	Luís Moreira Gonçalves	Faculty of Sciences, University of Porto, Department of Chemistry, Porto, Portugal
P022	Application of ATP bioluminescence based methods in brewing and beer tapping	Ondrej Koucky	Drinks Union (Heineken Czech Rep.), Usti nad Labem, Czech Republic
P023	Particle measurement in beverages - a new tool for a statement on Gushing	Christopher Nüter	Versuchs- und Lehranstalt für Brauerei in Berlin (VLB Berlin), Central Laboratory, Berlin, Germany
P024	Possible use of advanced microscopical techniques to evaluate the ultra structure of grain	Alexander Mauch	University College Cork, Food and Nutritional Sciences, Cork City, Ireland

MONDAY, 11 May 2009 · 13.00 – 14.00 p.m. · FOYER HALL 3

Abstract title	First author	Institute / company
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Session name / topic: Analysis (raw materials, process, product, safety)

P025	Contamination of barley with <i>Fusarium</i> species related to the occurrence of discoloured kernels, mycotoxin content and consequences for the brewing process	Michael Heß	Technische Universität München, Phytopathologie, Freising, Germany
P026	Analytical profiling of varietal floral and spicy hop essences by SPME in combination with monodimensional and comprehensive two-dimensional GC	Filip Van Opstaele	KaHo St.-Lieven Laboratory of Enzyme, Fermentation and Brewing Technology/M2S, KUL Association, Leuven Food Science and Nutrition Research Centre (LForCe), K.U.Leuven, Gent, Belgium
P027	Characterization of reductones by ¹³ C-NMR spectroscopy	Leif A Garbe	TU Berlin / VLB, Special Analysis, Berlin, Germany
P028	A novel method for the detection of arabinoxylans	Frank Rath	VLB Berlin, Research Institute for Raw Materials, Berlin, Germany
P029	Fuchsin Index (FI)	Josef Dvořák	Research Institute of Brewing and Malting, Plc., Analytical Testing Laboratory, Prague, Czech Republic
P030	Determination of sulphur dioxide by flow-through chronopotentiometry and its importance for brewing practice	Pavel Dostálek	Institute of Chemical Technology Prague, Department of Fermentation Chemistry and Bioengineering, Prague, Czech Republic
P031	Development of a FMEA (failure mode and effect analysis) as an instrument of weak-point analysis in a brewery; using the example of the keg filling plant at Karlsberg Brewery, Germany	Garlef Tietje	Karlsberg Brauerei GmbH, Homburg/Saar, Germany
P032	Modified Gushing Test - Reproducible gushing analysis through optimised and harmonised analytical conditions	Frank Rath	VLB Berlin, Research Institute for Raw Materials, Berlin, Germany
P033	Novel proteomic studies performed with UPLC chromatography and nano ESI-QTOF-MS/SMSMS: Comparison of the protein content in unhopped wort, cold wort and bright beer	Fabienne Decker	Brauerei C & A. Veltins, Meschede, Germany
P034	A new method of sensory evaluation	Hans Scheuren	Technische Universität München (TUM); Lehrstuhl Maschinen- u. Apparatetechnik (MAK), Freising, Germany
P035	Improvement of the evaluation of the mashing conversion yield and the sparging efficiency	Jan Schneider	University of Applied Sciences Ostwestfalen-Lippe, Beverage Technology, Lemgo, Germany
P036	Spoilage yeasts in breweries and their detection by realtime multiplex PCR	Jutta Schönlung	GEN-IAL GmbH, Troisdorf, Germany

Session name / topic: Beer quality: Foam & haze

P037	Carrageenan - an effective tool for wort clarification in the brewhouse (laboratory vs industrial trials)	Piotr Antkiewicz	University of Agriculture in Krakow, Fermentation Technology and Technical Microbiology, Krakow, Poland
P038	Haze-related phenolic structures generated through beer aging. Proposal of a sensitive colloidal instability assay using microwells	Julie Laille	Université catholique de Louvain, Unité de Brasserie et des Industries Alimentaires, Louvain-la-neuve, Belgium
P039	Relationship of temperature, particle size and clarification - an investigation in haze stability of wheat beer	Cem Schwarz	Lehrstuhl für Technologie der Brauerei I, TU München-Weihenstephan, Freising, Germany
P040	Gushing malt leads it to gushing beer?	Mbaka Malanda	IFBM, Vandoeuvre, France
P041	Upstream beer stabilisation during wort boiling by addition of gallotannins and/or PVPP	Hannes Withouck	KaHo St.-Lieven Laboratory of Enzyme, Fermentation and Brewing Technology/M2S, KUL Association, Leuven Food Science and Nutrition Research Centre (LForCe), K.U.Leuven, Ghent, Belgium
P042	Effect of surfactants on beer foam stability and collapse	Martin Baszczyński	Institute of Chemical Technology, Department of Fermentation Chemistry and Bioengineering and, Institute of Chemical Process Fundamentals ASCR, Department of Multiphase Reactors, Prague, Czech Republic
P043	High-speed imaging of beer foam formation: Effect of surfactants	Pavel Novak	Institute of Chemical Process Fundamentals of the ASCR, v. v. i., Department of Multiphase Reactors and, Institute of Chemical Technology Prague, Department of Fermentation Chemistry and Bioengineering, Prague, Czech Republic
P044	Expression of the hydrophobin FcHyd5p from <i>Fusarium culmorum</i> in <i>Pichia pastoris</i> and evaluation of its contribution to gushing	Georg Lutterschmid	TU-München - Lehrstuhl für Technische Mikrobiologie, Freising, Germany
P045	New best practise approach to traditional stabilisation	Mika Unting	ISP, Cologne, Germany

TUESDAY, 12 May 2009 · 13.00 – 14.00 p.m. · FOYER HALL 3

	Abstract title	First author	Institute / company
Session name / topic: Beer quality: In-package and dispense			
P046	Gushing suppressing effects of hop constituents	Stefan Hanke	TU München, Lehrstuhl für Technologie der Brauerei I, Freising, Germany
P047	Updated research results on the flavour stability of beer in plastic packagings	Roland Folz	VLB-Berlin, Research Institute for engineering and packaging, Berlin, Germany
P048	Assuring the microbiology of draught beer	David Quain	Heriot-Watt University, International Centre for Brewing and Distilling, Edinburgh, United Kingdom
P049	Decomposition of the iso- α -acids in bottle conditioned and pasteurised beers	Stefano Buiatti	University of Udine, Department of Food Science, Udine, Italy
P050	Should brazen-equipment still be used in beer dispensing systems these days?	Heinz Dauth	TU München, Lehrstuhl für Maschinen- und Apparatekunde, Freising-Weihenstephan, Germany
P051	A novel method for measuring total package oxygen	Frank Verkoelen	Haffmans BV, Sales, Venlo, Netherlands

Session name / topic: Beer quality: Sensory & flavour

P052	Beer categorization: A new way to understand beer expertise	Maud Lelièvre	ISA, Lille, France
P052a	The influences of membrane filtration on taste stability and haze formation	Dick Meijer	Norit Process Technology BV, Enschede, Netherlands
P053	Beer bioflavouring by refermentation: a sensorial comparison between bottle conditioned and industrial beers	Stefano Buiatti	University of Udine, Food Science, Udine, Italy
P054	Occurrence of thiols in beer: Impact of bottle refermentation	Sabrina Nizet	Université catholique de Louvain, Unité de Brasserie et des Industries Alimentaires, Louvain-la-Neuve, Belgium
P055	Quantitative analysis of the content of aromatic alcohols in Czech beer using SPE and GC-MS	Jiří Čulík	Research Institute of Brewing and Malting, AZL, Praha, Czech Republic
P056	Impact of organic practices on organoleptic properties of beer	Laurent Mélotte	Université catholique de Louvain, Unité de Brasserie et des Industries Alimentaires, Louvain-la-Neuve, Belgium
P057	Development of light beers with improved fullness and prolonged flavour stability	Koen Goiris	KaHo St.-Lieven Laboratory of Enzyme, Fermentation and Brewing Technology/M2S, KUL Association, Leuven Food Science and Nutrition Research Centre (LfoRCe), K.U.Leuven, Ghent, Belgium
P058	Screening of different enzymes able to hydrolyse cystein adducts, a new source of hop flavours	Jacques Gros	Université Catholique de Louvain, Unité de Brasserie et des Industries Alimentaires, Louvain-la-Neuve, Belgium
P059	Identification of a new off-flavour in "light stable" beers	Jacques Gros	Université Catholique de Louvain, Unité de Brasserie et des Industries Alimentaires, Louvain-la-Neuve, Belgium
P060	The sorting task: Another method to obtain beer sensory descriptions	Sylvie Chollet	Institut Supérieur d'Agriculture, Food Department, Lille, France
P061	Relevance of non-thermal process steps on Strecker aldehyde formation after wort boiling	Andreas Stephan	Bitburger Braugruppe GmbH, Bitburg, Germany
P062	Thermal influence on Strecker aldehyde formation during wort boiling	Andreas Brandl	Bitburger Braugruppe GmbH, Bitburg, Germany
P063	Contribution of staling compounds to various types of aged flavours occurring in lager beer by studying their concentration evolutions and flavour thresholds	Daan Saison	Centre for Malting and Brewing Science, Microbial and Molecular Systems - KULeuven, Heverlee, Belgium
P064	Sensory properties of iso- α -acids and their derivatives	Nicole Schulze	TU Braunschweig, Institute of Food Chemistry, Braunschweig, Germany
P065	LC-MS/MS studies on the influence of the pH value on the formation of novel iso- α -acid degradation products in beer	Annika Brock	Bitburger Braugruppe GmbH, Bitburg, Germany
P066	Interactions in beer flavour release and perception	Rebecca Clark	Division of Food Sciences, University of Nottingham, Sutton Bonington, Loughborough, Leicester, United Kingdom
P067	Determination of flavour active monophenols in beer using liquid-liquid extraction with pH adjustment and GC-MS	Femke L. Sterckx	KULeuven, Centre for Malting and Brewing Science, Heverlee, Belgium
P068	Identification of novel unique flavor compounds derived from Nelson Sauvin hop and synergy of these compounds	Kiyoshi Takoi	Sapporo Breweries Ltd., Frontier Laboratories of Value Creation, Yaizu, Japan

TUESDAY, 12 May 2009 · 13.00 – 14.00 p.m. · FOYER HALL 3

	Abstract title	First author	Institute / company
Session name / topic: Beer quality: Sensory & flavour			
P069	Masking solution for off-flavours In alcoholic beverages: The Olfactoscan®	Catrienus de Jong	NIZO Food Research, Flavour, Ede, Netherlands
P070	Improving flavour stability of the final beer through the use of innovative natural antioxidant	Nicolas Declercq	AEB GROUP, R&D Beverage Division, San Polo, Italy
P071	Laboratory- and pilot plant-scale study on the creation of carbonyl compound-sulphur dioxide adducts	Marcel Karabín	Institute of Chemical Technology Prague, Department of Fermentation Chemistry and Bioengineering, Prague, Czech Republic
P072	Quantification of flavour active cis- and trans-(4,5)-epoxy-2E-decenals in beer by GC-NCI MS with isotope standards	Konrad Neumann	TU Berlin / VLB, Special Analysis, Berlin, Germany
P073	Comprehensive chemical-analytical profiling and characterisation of Belgian 'kriek' beers	Jessika De Clippeleer	KaHo St.-Lieven Laboratory of Enzyme, Fermentation and Brewing Technology/M2S, KUL Association, Leuven Food Science and Nutrition Research Centre (LForCe), K.U.Leuven, Gent, Belgium
P074	The effect of CO ₂ extracted malt on flavour and foam stability	Ralf Mezger	NATECO2 GmbH & Co. KG, Wolnzach, Germany

Session name / topic: Brewing and malting microbiology

P075	Decision maker tool for evaluation of T2 and HT2 toxins contaminated malting barley	Julie Toussaint	IFBM, Molecular Biology, Vandoeuvre-les-Nancy, France
P076	Rapid detection of yeast in brewery rinse water	Chris D Powell	Lallemand Inc, Genetic Identification Laboratory, Montreal, Canada
P077	Moulds presence management for a better Gushing risk control	Carol Verheecke	ECCLOR, Research & Development, Betheny, France
P078	Anti-bacterial activity of lysozyme in pitching yeast and effect of lysozyme on yeast fermentation	Maarten de Groot	FORDRAS S.A., Lugano, Switzerland
P079	A new method to determine yeast viability by phase contrast microscopy	Alexandre Godoy	Fermentec, Piracicaba, Brazil
P080	Culture-independent PCR-DHPLC technique for profiling of microbial communities in malting and brewing process	Riikka Juvonen	VTT Technical Research Centre of Finland, Biotechnology, Espoo, Finland
P081	The survival of pathogens in wort and beer - the ethanol and pH hurdles	Garry Menz	University of Ballarat, Institute of Food and Crop Science, School of Science & Engineering, Ballarat, Australia
P082	The antifungal protein from <i>Aspergillus giganteus</i> fights filamentous fungi on barley	Anja Spielvogel	University of Technology Berlin, Microbiology and Genetics, Berlin, Germany

Session name / topic: End of beer processing, including auxiliary and process aids

P083	Polymer pipelines for beer and softdrink - an economic alternative to stainless steel	Stefan Buchner	Polymer Consult Buchner GmbH, Hamburg, Germany
P084	Fluxcalcination of Kieselguhr - influence of the fluxing agent on formation of crystalline phases, permeability, colour and suitability as filter aid	Thomas Schleicher	Technische Universität München, Institute of Resource and Energy Technology, Freising, Germany
P085	Technological and economical reconsideration of depth filtration - Becopad	Alfons Witte	Begerow, E: GmbH & Co., Langenlonsheim, Germany
P086	Simultaneous filtration and stabilisation of the beer: Potentiality of Oxidised High Density Polyethylene (PEox) as filter aid	Laurence Van Nederveelde	Institut Meurice, Brewing Sciences, Brussels, Belgium
P087	Using microalgae for breweries for CO ₂ mitigation and biomass production	Laurenz Thomsen	Jacobs University Bremen, Geoscience, Bremen, Germany
P088	Beer stabilisation by polyamide sorbents	Zbyněk Černý	Katchem Ltd., Prague, Czech Republic

WEDNESDAY, 13 May 2009 · 13.00 – 14.00 p.m. · FOYER HALL 3

	Abstract title	First author	Institute / company
Session name / topic: Environmental: General / Utilities and co-products			
P089	Reduction of beer value chain's environmental impact with the use of proline specific endo-protease (PSEP) demonstrated by a comparative Life Cycle Analysis (LCA) screening of PSEP in beer production	Ron Duszanskyj	DSM Food Specialties, Delft, Netherlands
P090	Change from a pilot plant brewery to a competence center of brewing and environment technology	Hans-Joerg Menger	Ziemann Group, Ludwigsburg, Germany
P091	Microbial and enzymatic hydrolysis of brewer's spent grains	Thomas Herfellner	TU München, Institute of Resource and Energy Technology, Freising, Germany
P092	Marketing co-products to the feed industry	Michael B Spandern	Spandern Agribusiness Consulting, Bordesolm, Germany
P093	Protect the environment, save energy and work towards a sustainable future!	Michel Brueren	Haffmans BV, Sales Department, Venlo, Netherlands

Session name / topic: Hops, hop chemistry and analysis

P094	The cis-resveratrol/cis-piceid ratio is proposed as a new indicator of the hop freshness	Vesna Jerkovic	Université catholique de Louvain, Laboratoire de brasserie et des industries alimentaires, Louvain-la-neuve, Belgium
P095	Origin of hops - determination by isotope ratio mass spectrometry (IRMS)	Roland Schmidt	NATECO2 GmbH & Co. KG, Wolnzach, Germany
P096	A new approach to the production of isomerized hop extracts	Martin Biendl	Hopsteiner HHV GmbH, Mainburg, Germany
P097	Radical scavenging capacity of hop-derived products in view of health and brewing applications	Arne Heyerick	Ghent University, Laboratory of Pharmacognosy and Phytochemistry, Ghent, Belgium
P098	Effect of Bordeaux mixture (copper sulfate) on 4-Mercapto-4-methylpentan-2-one content in hop cones	Masahito Morimoto	Asahi Breweries, Department of Flavor and Chemical Analysis Research Laboratories of Brewing Technology, Moriya, Japan
P099	Scanning electron microscope (SEM) examination of lupulin glands of different hop varieties	Frithjof Thiele	University College Cork, Department of Food & Nutritional Science, Cork, Ireland

Session name / topic: Malt production & quality

P100	Contribution of free phenolic acids and flavanols to antioxidant activity in malting process of barley	Marta Fontana	University of Udine, Department of Agriculture and Environmental Sciences, Udine, Italy
P101	T2 and HT2 toxins elimination by GRAS micro-organisms in steeping waters	Emmanuel Jean Rondags	Chemical Engineering Sciences Laboratory, National Center for Scientific Research, Biotechnological Processes Engineering, Vandoeuvre les Nancy, France
P102	Effect of interactions existing between barley dormancy and exogenous conditions of germination on some selected parameters of malt quality	Josef Prokes	Research Institute of Brewing and Malting Prague, RIBM Brno, Brno, Czech Republic
P103	Behaviour of organic radicals in different malt types during the malting and mashing process	Frank-Jürgen Methner	Technische Universität Berlin, Institute of Biotechnology, Berlin, Germany
P104	Impact of the steeping process on the modifications of lipid transfer protein (LTP) from malt	Jean-Luc Runavot	IFBM-Qualtec, Vandoeuvre les Nancy, France
P105	Protein fractions in two-row barleys as malt quality index	Stefano Buiatti	University of Udine, Department of Food Science, Udine, Italy
P106	Chasing the premature yeast flocculation factor from barley to beer	Gillian M Fisher	BRI, Nutfield, United Kingdom
P107	Studies of flavour development during malt roasting processes	David John Cook	University of Nottingham, Division of Food Sciences, Loughborough, United Kingdom
P108	CANCELLED		

Session name / topic: Management, training, maintenance and financials

P109	Demand response and dispatchable industrial loads for the use in virtual power plants	Jochen Lambauer	Institut für Energiewirtschaft und Rationelle Energieanwendung, Universität Stuttgart, Stuttgart, Germany
P110	Development of a demonstrator application for the model based weak point analysis of bottling plants	Stefan Flad	TU München, Lehrstuhl für Lebensmittelverpackungstechnik, Freising, Germany

WEDNESDAY, 13 May 2009 · 13.00 – 14.00 p.m. · FOYER HALL 3

	Abstract title	First author	Institute / company
Session name / topic: Microbial physiology and genetics			
P111	Quorum sensing of brewery biofilm microbes	Outi Priha	VTT Technical Research Centre of Finland, Espoo, Finland
P112	Prediction of flocculation ability of brewing yeast inoculates by flow cytometry, proteome analysis and mRNA profiling	Franziska Heine	Helmholtz Centre for Environmental Research - UFZ, Environmental Microbiology, Leipzig, Germany
P113	Differences in growth behaviour of <i>Pectinatus frisingensis</i> isolates in beer	Inge Suiker	Heineken Supply Chain, Research & Innovation, Brewing Science, Zoeterwoude, Netherlands
P114	Analysis of metabolic activities of beer-spoilage lactic acid bacteria in chinese beer	Fei Qian	Lehrstuhl für Technologie der Brauerei I, TUM-Weihenstephan, Freising, Germany
P115	Methods for rapid authentication and differentiation of brewing yeast strains	Tithira Tirangika Wimalasena	University of Nottingham, Division of Food Sciences, Loughborough, United Kingdom

Session name / topic: New Packaging Development / New Process Development

P116	New insights in label removal	Georg Wenk	Research and Teaching Institute for Brewing (VLB), Research Institute for Engineering and Packaging (FMV), Berlin, Germany
P117	Practical experiences on the use of UVC-lights as a part of disinfection in filling process	Kaisa Tapani	Oy Sinebrychoff Ab, Laboratory, Kerava, Finland
P118	Filtration and stabilization results from a brewery using a kieselguhr free filter aid	Nikolaj Schmid	BASF SE, EMN-EB, Ludwigshafen, Germany
P119	New apparatus and procedure to enhance the utilisation of bitter-acids	Marcus Hertel	HERTEL GmbH, Salzburg, Austria
P120	Novel malt-based isotonic beverages	Moritz Krah	TU München, Lehrstuhl für Technologie der Brauerei I, Center of Life and Food Sciences Weihenstephan, Freising, Germany
P121	Industrial results of precoat filtration on a candle filter with regenerable filter aid	Juerg P. Zuber	FILTROX AG, CTO, St. Gallen, Switzerland
P122	Kvass - a Russian fermented cereal based beverage	Martin Zarnkow	TU München, Lehrstuhl für Technologie der Brauerei I, Freising, Germany

Session name / topic: Novel raw materials for beer production

P123	Advances in the production of gluten free malt and beer	Elke Arendt	University College Cork, Department of Food & Nutritional Science, Cork, Ireland
P124	Development of a hops kettle addition extract to replace aroma hop pellets	Michael Babb	Kalsec Inc, Kalamazoo, United States
P125	<i>Ganoderma lucidum</i> - medical mushroom as a raw material for beer with excellent sensorial and pharmacodynamic properties	Ida J Leskošek-Čukalović	Faculty of Agriculture, Food Technology and Biochemistry, Belgrade, Serbia

Session name / topic: Wort production

P126	Critical factors at mashing-in influencing lipid oxidation	Sofie Malfliet	KaHo St.-Lieven Laboratory of Enzyme, Fermentation and Brewing Technology/M2S, KUL Association, Leuven Food Science and Nutrition Research Centre (LForCe), K.U.Leuven, Gent, Belgium
P127	Influence of mashing diagramme on arabinoxylan hydrolysis	Marc Schmitt	IFBM, R&D, Vandoeuvre, France

Session name / topic: Yeast and fermentation

P128	Impact of cell wall mannoproteins on flocculation of <i>S. cerevisiae</i> and <i>S. pastorianus</i>	Trevor P Cowley	University of Nottingham, Biosciences, Loughborough, United Kingdom
P129	Zinc supplementation to multi-brew fermentations and zinc toxicity	Behnam Taidi	Carlsberg, Technical and Development, Strasbourg, France
P130	Yeast vitality determination based on intracellular NAD(P)H fluorescence measurement	Tomáš Brányik	Institute of Chemical Technology Prague, Department of Fermentation Chemistry and Bioengineering, Prague, Czech Republic
P131	Predicting lager yeast petite formation	Katherine A Smart	University of Nottingham, School of Biosciences, Loughborough, United Kingdom
P132	Dry yeast - myths and facts	Chris Powell	Lallemand Inc., Research and Development, Montreal, Canada

ABSTRACTS LECTURES:

L 01

Challenges facing the German and European Brewers

Wolfgang Burgard¹

¹President of Deutscher Brauer-Bund, Berlin, Germany

DESCRIPTION OF TOPIC:

In comparison/contrast to the European and World brewing industry the scenery of the German brewers is still characterised by a high number of independent, mostly local acting, small and medium sized breweries, although a strong movement towards concentration has taken place over the past years.

Despite the different structures the main challenges facing the brewing industry worldwide affect us all. These incorporate economic, technological, environmental as well as political, social and consumer issues. Some approaches, how the brewing industry, the brewers associations and the brewing scientific community can act and work together in order to meet these challenges will be presented and discussed during the present EBC-Conference, but some more activities are needed.

L 02

The Brewers of Europe and EBC: Teamed up to shape a beer-friendly business environment

Alberto da Ponte¹

¹President of The Brewers of Europe, Vialonga, Portugal

DESCRIPTION OF TOPIC:

We, at the Brewers of Europe, are the voice of the European brewing sector. And with over 50 years of experience and presence in the heart of Europe, liaising daily with the various EU institutions and other European and international organisations, our 27 national member associations have entrusted us to get the positive message on beer out there in the open. 2008 was both an eventful and transitional year for The Brewers of Europe - firstly with the association celebrating its 50th anniversary, then with the election of a new president and finally when we adopted a new strategy and operational plan for the years going forward 2009-2011. The overarching vision for the strategy is that within the next couple of years this organisation and its Members will have teamed up to shape a beer friendly EU business environment. The association that has emerged from this review process is now stronger operationally, better profiled vis-à-vis the EU institutions and international organisations and is also more focused on a set of strategic business priorities with clear policy objectives, or what we like to call, "must win battles."

I look forward to telling you more about The Brewers of Europe and the collaboration with EBC when we meet in Hamburg in May.

L 03

Progress in German barley and hop breeding

Horst-Gevert Bellmer¹

¹former Vice-President EBC, Bremen, Germany

DESCRIPTION OF TOPIC:

The remarkable progress achieved in hop breeding in Huell, one of the world leading hop research centers, is based on the wide variability of genetic resources available including worldwide wild hop germplasm. The new Huell hop cultivars are characterised by their improved, broad resistance/tolerance to the most common diseases with low application of pesticides, their fine aroma and/or high alpha acid contents and increased yield. New breeding programs focus on hops adapted to low trellis systems or plants with a high content of e.g. specific health-promoting or anti-oxidative polyphenols. The "Berlin Program" of the German Brewing Barley Association offers the opportunity to select the best new varieties at an early stage for their agricultural, malting and brewing criteria by means of field trials, micromalting and -brewing and pilot brews in an industrial scale. Thus, the introduction of new promising varieties could be reduced by approx. 2 years, an economic advantage for breeders and farmers as well as for the industry. In the last decade the most successful German brewing barley varieties were cultivated in more than 11 European countries. They allow considerable cost saving malting and mashing techniques due to their faster modification and higher enzymatic power. It has to be pointed out that this progress in hop and barley breeding has been achieved without the application of genetic engineering. In the near future, innovative selection techniques using molecular markers for quality and resistance will support and speed up breeding of even more competitive varieties in hop and barley.

Wolfgang Burgard



Born in 1948. Studied at the Universities of Freiburg and Mannheim, diploma in economics (Diplom-Volkswirt). Professional career: Marketing and Sales, Binding Brauerei AG Frankfurt (1972-1980); Export Manager, Dortmunder Actien Brauerei, (1980-1984), Sales Director, Dortmunder Actien Brauerei (1984-1989), Executive Board Chairman, Dortmunder Actien Brauerei (1990-2001); Chairman of Management Board, Carlsberg Deutschland GmbH, Mönchengladbach (2001-2008); Executive Board Chairman, Holsten-Brauerei AG (2004-2008); since 2008 Member of Management Board, Holsten-Brauerei AG and Member of Management Board, Carlsberg Deutschland GmbH, Mönchengladbach

Alberto da Ponte



Alberto da Ponte, Managing Director, 56 years old, is a graduate in Finance from the Instituto Superior Ciências Económicas e Financeiras, has a Senior Finance Course from Harvard Business School and a Proficiency Degree from Instituto Britânico. Before joining SCC in May 2004 he was Managing Director of Unilever Bestfoods and Lever Elida Portugal, CEO of Cadbury Shweppes Portugal and Member of the Euroboard of Schweppes Beverages, CEO of Jerónimo Martins Distribuição, Marketing and Sales Director of Elida Fabergé and had a "Special Appointment" for reorganization of Sales Department of Unilever Malaysia as well as a 5 year period in Unilever Belgium and Spain. At the present he is the President of the Portuguese Beer Association (APCV), Member of the Board of The Fladgate Partnership, Member of the Consultative Council of ISCTE (Lisbon University of Management Application) and President of Brewers of Europe.

Horst-Gevert Bellmer



Studies: Brewing Science at the Technical University of Munich (Weihenstephan), Graduate Engineer (1969). Taking Doctorate at Technical University of Munich; academic supervisor: Prof. Dr. L. Narziß; subject: study of polyphenols and their polymerisation index (1975). Appointments: 1962-1964: apprenticeship as Brewer and Maltster at Förster & Brecke, Hameln; 1969, Head of Laboratory at Haake-Beck Brauerei AG, Bremen; 1977, Assistant to Technical Director at Beck & Co., Bremen; 1980 Technical Director of Beck & Co.; 1991 Deputy Managing Director; 1993: Managing Director. May 2002: Beck & Co. becomes Interbrew Deutschland. Vice President Operation and Planning. He was a member of Committees of the Versuchs- und Lehranstalt in Berlin, of the Technical University of Munich and of the Deutscher Brauer-Bund in Bonn. Retired in Juli 2004. Board member of the Society for Hop Research since 1993.

L 04

Thinking beyond grey pinstripes - sustainable development and the limits of “greenwashing”

Ina Verstl¹¹Communications, Germering, Germany

DESCRIPTION OF TOPIC:

The economist Milton Friedman famously argued that the business of business is business, and that companies keen on philanthropy should maximise shareholder returns and let those individual shareholders decide which philanthropies are the worthiest.

However, what is the business of business in the age of globalisation? How can multinational brewing companies operate in cultures with different laws, norms and values, with investors scrutinizing their every measure in case it (negatively) impacts the bottom line, all the while stakeholders want to see action and not just words?

Results: This paper will show that for almost a decade now brewing companies have grappled with the issue of corporate social responsibility - which aims to define what businesses are responsible for and what they should do to secure long-term growth (read: “sustainable development”). More driven by circumstance than being drivers of change, brewers have had to realise that even if they do more than what the law requires, society’s expectations of their social responsibilities have increased.

L 05

Continuous improvement (CI) concepts and brewery management

Axel G. Kristiansen¹¹Scandinavian School of Brewing, Valby, Denmark

DESCRIPTION OF TOPIC:

Statistical tools have been used in breweries since approx. year 1900 successfully. After 1945 use of CI has gained momentum, and since 2000 have been intensively used at large brewing groups to achieve competitiveness.

Results: Without increasing manning, leading breweries are now achieving lower manufacturing costs, less waste, less energy - and electricity consumption, higher extract yields and speedier processes.

L 06

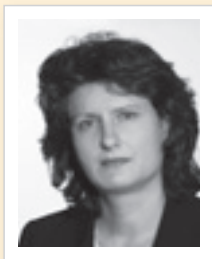
Fear not the messenger!

R Laurence Nelson¹¹Advantage Publishing Ltd, Reigate, United Kingdom

DESCRIPTION OF TOPIC:

As the industry consolidates there is a clear distinction emerging amongst leading multinational brewers in their interactions with the media. One approach is characterised by those who remain pro-active, viewing contacts with journalists as beneficial and as a means to push out positive stories from behind the mash tun and into the public domain. The other, increasingly evident, approach is to keep media contacts to the minimum as with market-required financial announcements. It is easier to control the message than ever before, what with pseudo-interviews with corporate leaders on web-based services such as Cantos in London, and phone-in presentations that remove the journalist from the subject. There is a case to be made that despite occasional journalistic sensationalism the brewing industry by-and-large has a positive story to tell and more to gain from a proactive attitude than fear from being open and honest with journalists. Think of work with indigenous barley farmers in India and sub-Saharan Africa, work with alcohol abuse prevention community programmes worldwide, and efforts to upgrade environmental performances - there are hundreds, thousands, of story possibilities for each and every brewing concern. This paper would review examples of best practice, and suggest fruitful avenues of story developments working both independently and in co-operation with journalists. It would also review the rise of new internet journalism, the cult of the amateur writer turned pundit thanks to blogs, home websites, etc.

Ina Verstl



Ina Verstl is a free-lance journalist specialising in exploring the modern trends and dynamics in the global brewing industry. She lives and works near Munich / Germany

Axel G. Kristiansen



MSc. Food Science 1979 Diploma Master Brewer 1984 Master Brewer Carlsberg Copenhagen 1984 - 87 Process Manager Carlsberg UK 1987 - 90 Packaging Manager Carlsberg Copenhagen 1990 - 91 Brewhouse manager Carlsberg Copenhagen 1991 - 93 Brewery consultant Carlsberg Int. 1993 - 97 Technical Director Carlsberg Italy 1997 - 99 Regional Technical Manager Carlsberg Int. 1999 - 2004 Director Scandinavian School of Brewing 2004 -

R Laurence Nelson



The presenter, Larry Nelson, is well known in the global brewing industry as the editor of *Brewers Guardian*, the international brewing industry magazine. Larry, a Canadian who has resided in the UK outside London for many years, boasts more than two decades of journalistic experience. He has been awarded a Masters in Journalism by the University of Westminster in London and a BA in Economics from Dalhousie University, Halifax, Nova Scotia.

L 07

Enabling the technical future of today's brewery

Alastair T. Pringle¹

¹AB-InBev, St. Louis MO, USA

DESCRIPTION OF TOPIC:

The nature of the brewing industry continues to change in the first decade of the 21st century. The challenge for the brewery laboratory is not only to foresee the future, but to enable the company's technical future. Approaches that have involved basic research and an instrument focus were successful in the past. However, these approaches are less appropriate in the new business environment, where a greater emphasis is placed on cost and timeliness. In response to the changing environment, a solution-focus approach is needed, where efforts are evaluated on their merit to produce practical, robust solutions. To achieve this, the laboratory needs to be staffed with personnel who are not only technically skilled, but can act as business-savvy knowledge-brokers capable of directing problem solving efforts. Therefore, the role of the organization, people, and the use of outside resources needs to be re-evaluated. In the future the approach to problems will rely more heavily on treating brewing processes as black boxes, using a solution focus and sharing knowledge. Examples of the traditional and solution-based approach for yeast performance and beer freshness will be discussed. Another important function of the laboratory is to capture institutional knowledge and make it readily available. This can be achieved through web-based tools that aid in troubleshooting production issues. Ultimately the technical future will be enabled by quickly generating simple, cost effective solutions.

L 08

Fusarium langsethiae on brewing barley: infection in the field and survival during the malting process

Régis Fournier¹

¹IFBM, Molecular Biology, Vandoeuvre les Nancy, France

DESCRIPTION OF TOPIC:

The goal of this work is to better understand and manage the appearance and establishment of *Fusarium langsethiae* on brewing barley. We have acquired data concerning this mould, on the basis of complementary competence (epidemiology, etiology, toxicology, molecular biology), from barley culture (study of the growth and the etiology of the contamination to the field) to the finished products.

Results: Symptoms and T2/HT2 toxins appeared during the culture at the stages around flowering. Within the spikelets, some seeds stopped their growth and turned black. We have shown that these seeds contain high amount of T2/HT2 toxins. During the malting process, most of *Fusarium* DNA and T2/HT2 toxins are washed out at the steeping step, but an increase of DNA during the germination step is the proof that viable fungi can be a threat because of subsequent toxin production.

L 09

Are free and masked *Fusarium* mycotoxins only safety issue for brewers and maltsters?

Jana Hajslova¹, Milena Zachariasova¹, Marta Kostelanska¹, Alexandr Mikyska², Jaromir Fiala³

¹Institute of Chemical Technology Prague, Department of Food Chemistry and Analysis, Prague, Czech Republic, ²Research Institute of Brewing and Malting, Prague, Czech Republic, ³Institute of Chemical Technology Prague, Department of Fermentation Chemistry and Bioengineering, Prague, Czech Republic

DESCRIPTION OF TOPIC:

Fusarium mycotoxins are the toxic secondary metabolites produced by fibrous fungi of the *Fusarium* genus. They can contaminate a wide spectrum of cereals (wheat, barley, maize, rice), cereal-based products (malt, beer, bread, breakfast cereals) and also feed-stuffs. They can be detected in free form, but nowadays also as altered masked form. Little is known about the occurrence, bioavailability and further transformations of some of these bound compounds, which additionally also escape usual analytical detection techniques used for routine control. This issue is not only brewers and maltsters issue, but responsibility has all cereal sector and future limits can influence all of us.

Masked mycotoxins (especially deoxynivalenol-3-glucoside) have been largely discussed recently, because they can influence possible EU mycotoxin limits for cereals and cereal-based product.

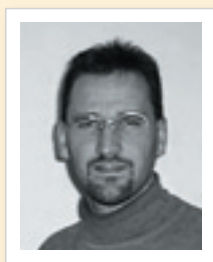
Results: Free and masked *Fusarium* mycotoxins were monitored in beer production chain. Cross-reactivity of deoxynivalenol-3-glucoside of commercial ELISA test kits was found.

Alastair T. Pringle



Alastair began working in the retail trade of brewing industry in the North of England when he was 18 years old. He obtained biology degrees from Trent Polytechnic, Nottingham and a doctorate in microbiology from the University of Bath, U.K. Subsequently, he was a post-doctoral fellow at the University of Kansas and Virginia Tech, and an adjunct assistant professor in the Department of Microbiology at UCLA. Alastair joined Anheuser-Busch, St. Louis, MO in 1984 as a research manager in the Corporate Research and Development Department. Since 1989 he held the position of Director of Brewing Research in both Corporate R&D and in the Brewing Technical Center. In this position Alastair directed research to solve issues in malting, brewing, fermentation, finishing, beer freshness, and new products. Today he is a consultant to the food and beverage industry. Alastair is a member of, MBAA, ASBC, IBD, and the EBC brewing science sub-group.

Régis Fournier



Studies
PhD in Molecular Biology, University Henri Poincaré (Nancy, France), 1997.

Appointment
1998-2000: Post doctoral position in the Molecular Immunology Division of the Medical Research Foundation (Royal Perth Hospital, Perth, Australia). Study of the regulation of the human Interleukin-5 transcription.
Since mid-2000: Molecular Biology Division Manager. In charge of the development of the Molecular Biology Division at the Institut Français des Boissons, de la Brasserie et de la Malterie (French Institute for Beverage, Brewery and Maltery, Vandoeuvre lès Nancy, France).

Jana Hajslova



Professor - Institute of Chemical Technology Prague
Head of research team - Food quality and chemical safety and Testing laboratory of the Department of Food Chemistry and analysis which is accredited according to the International standard ISO/IEC 17025:2005 by the CAI, signatory of the ILAC-MRA and participates regularly in proficiency testing (FAPAS, EU PT, IRMM, IAEA, etc.) Research - aimed at the development, optimization and implementation of analytical techniques involves almost all classes of hazardous organic compounds related to food processing chain: Persistent environmental contaminants (POPs); Residues of modern pesticides, veterinary drugs, etc.; Mycotoxins; Phytoestrogens; Natural toxins; Processing contaminants.

L 10

Can amine profiles be a discriminant parameter of brewing products?

Maria Daria Fumi¹,
Gianluca Donadini¹

¹Università Cattolica del Sacro Cuore, Piacenza, Italy

DESCRIPTION OF TOPIC:

Amines play important physiological roles: they are essential for cell proliferation and growth; they have psychoactive and vasoactive functions, however a high amine level within the blood is a hazard for human health and some of them have a sensory impact on foods and beverages.

In beer the presence of amines is affected by several factors such as the raw material, the brewing technology and the presence of decarboxylase -positive microorganisms. Our purpose is to verify whether amines can be considered as chemical descriptors to differentiate the brewing products.

The content of amines in all-malt and adjunct worts with different hops products was detected before and after high gravity bottom fermentation in industrial scale processes

Results: The highest total amine levels were detected in adjunct worts. Differences in single amine were found in all malt and adjunct worts. In comparing fermented and non fermented worts no significant changes in biogenic amine was found except for 2 samples in which 40 - 50% increases were detected.

The PCA discriminates the adjunct from all-malt products and links the adjunct worts to putrescine, cadaverine, histamine, tyramine.

The all-malt samples were separated in correlation to the different hop products.

L 11

Barley-associated microbial biofilms in malting

Arja Laitila¹, Mari Raulio², Annika Wilhelmsson¹, Mirja Salkinoja-Salonen²

¹VTT Technical Research Centre of Finland, Biotechnology, Espoo, Finland, ²University of Helsinki, Department of Applied Chemistry and Microbiology, Helsinki, Finland

DESCRIPTION OF TOPIC:

Barley grains are always rich in microbes. The multitude of microbes actively interacts with the barley kernels, and thus has great effects on the properties of the final malt and beer. Although the knowledge of microbes associated with barley and malting ecosystem is increasing, only little is known about the structures of complex microbial communities in the barley tissue. This study investigated the formation and the ultrastructure of microbial biofilms in malting.

Results: Microbial cells and fungal hyphae were located between the testa and outer epidermis of the barley kernels. The soaking of barley during the steeping phase invigorated microbial growth and production of exocellular polymeric substances (EPS). The EPS matrix covered up to 90% of the surfaces in the outer layers of barley. Several microbes expressed appendages anchoring the cells to the kernel tissues and to each other, resulting in dense networks underneath the outer epidermis. The production of an amorphous EPS matrix was greatly reduced by application of *Lactobacillus plantarum* as a starter culture. The high-gravity mashing and Büchner-filtration tests showed that the wort separation was 30% more efficient when *L. plantarum* was applied. Suppression of EPS-producing bacteria by *L. plantarum* during the steeping could partly explain this difference.

L 12

Development of molecular markers linked to powdery mildew resistance genes in Hop (*Humulus Lupulus* L.) to support breeding for resistance

Stefan Seefelder¹, Rebecca Seidenberger¹, Anton Lutz¹, Elisabeth Seigner¹

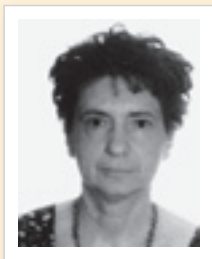
¹Bavarian State Research Center for Agriculture, Hop Research Center Hüll, Freising, Germany

DESCRIPTION OF TOPIC:

With this research funded by the European Hop Research Council (EHRC) and Scientific Fund of the German brewing industry (Wifö) new efforts have been started to support powdery mildew (PM) resistance breeding in hop.

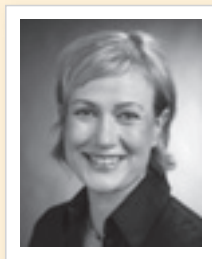
Results: The analysis of expressed genes in PM resistant and susceptible plants revealed specific fragments of genes (TDFs= transcript-derived fragments) which were only expressed in resistant hops several hours after contact with PM. Thus, it was assumed that these newly expressed fragments are involved in the defence reaction to powdery mildew which starts 4 to 24 hours after contact with the pathogen. These TDFs were isolated and finally sequenced. This sequences were compared with already known resistance genes in other crops. Based on detected sequence similarities it was deduced that several TDFs in this studies are involved in the defence or resistance reaction to PM. From several differentially expressed TDFs sequence homology to genes involved in the resistance reactions of other crops to various fungi could be identified.

Maria Daria Fumi



Maria Daria Fumi graduated in biology. She is a research scientist at the Institute of Oenology and Food Engineering - Faculty of Agriculture - Catholic University - Piacenza - Italy. She is a lecturer of Food Biotechnology, Wine Microbiology at the Faculty of Agriculture. Her main research activities concern biotechnological application in fermented beverages (wine, beer and vinegar) to optimize the fermentation process, to reduce mycotoxin contamination, and to improve chemical and sensorial characters. She is also involved in studies on indoor air quality in food-compatible environment.

Arja Laitila



Dr. Arja Laitila studied Food Microbiology at the University of Helsinki. She holds a PhD in Food Sciences. Joined VTT Technical Research Centre of Finland in 1993. She has participated in several national and international projects related to microbes in plant-based bioprocesses. Since January 2008, she has been a team leader of Microbes and Cereal Processing at VTT. Her particular expertise is malting and brewing microbiology.

Stefan Seefelder



Born 1967; Graduated 1995 in Biology at the University of Regensburg; Since 1995 research worker at the hop research centre at the LfL. Responsible for the genome analytical work; 1999 PhD in Biology at the Technical University of Dresden; Thesis: Identification of molecular markers in hop (*Humulus lupulus* L.); Principal investigator in projects focusing on the development of disease resistance markers and the identification of quality markers (QTLs). Activities: Molecular marker development, differential display, linkage-mapping, QTL-mapping; diversity studies; Molecular characterisation of hop varieties The hop research centre dedicates its scientific and agronomic work on the sake of the brewing and hop industry.

L 13

Prediction of barley and Fusarium activities during malting using transcriptional profiling

Annika Wilhelmson¹, Jari J. Rautio²,
Meri Kokkonen³, Marika Jestoi³, Arja Laitila¹

¹VTT Technical Research Centre of Finland, Espoo, Finland,
²PlexPress, Helsinki, Finland, ³Finnish Food Safety Authority Evira,
Helsinki, Finland

DESCRIPTION OF TOPIC:

The malting process can be defined as an ecosystem consisting of barley and the diverse microbial community associated with the grain. Recent developments in molecular biology have opened new possibilities for monitoring this complex ecosystem. Traditionally, biological events related to malting have been monitored by analysing enzymes or metabolites. In many cases malting could also be monitored by analysing the expression of the genes that control these events. VTT has developed a high-throughput method TRAC (transcriptional profiling with affinity capture) that can be used to monitor the expression of tens of genes simultaneously. The method was applied to simultaneously analyse the activities of barley and microbes during malting.

Results: The gene expression of both barley and Fusarium fungi were detectable during malting. Strong expression of Fusarium genes was detected in steeping. The expression pattern of genes related to both fungal growth and trichothecene biosynthesis changed when fusaria were inactivated before malting.

L 14

Fungal hydrophobins as a beer gushing factor - current knowledge and future aspects

Tuija Sarlin¹, Markus Linder¹,
Tiina Nakari-Setälä¹, Silja Home¹, Arja Laitila¹

¹VTT Technical Research Centre of Finland, Espoo, Finland

DESCRIPTION OF TOPIC:

Gushing is a term used to describe spontaneous overfoaming of beer on opening of the packaged product, and it is often associated with heavy Fusarium infection of barley and malt. Our studies have indicated that fungal proteins called hydrophobins act as the gushing factors of beer, although other mechanism maybe involved in the gushing phenomenon. Hydrophobins are small, moderately hydrophobic proteins that are produced and secreted by filamentous fungi. This presentation gives a critical review of the current knowledge on hydrophobins and their relation to gushing. Furthermore, the fate of hydrophobins in the malting and brewing process will be discussed. New data on characterisation of hydrophobins from *F. graminearum* and the related species are presented.

Results: Fungi produced hydrophobins in the field and during malting. Mashing process released hydrophobins from the malt and some of the hydrophobins survived the brewing process to end up in the beer. We found five hypothetical proteins with high sequence similarity to hydrophobins in the *F. graminearum* genome database. One putative hydrophobin gene was expressed in *T. reesei* and a hydrophobin was isolated from the culture filtrate of the transformant. Highly similar hydrophobin genes were also found from the genomes of the other *Fusarium* species.

L 14

Gushing phenomenon - new findings regarding the causes and the possibility of technological controlling measures

Frank Rath¹

¹VLB Berlin, Research Institute for Raw Materials, Berlin, Germany

DESCRIPTION OF TOPIC:

Gushing, the spontaneous overfoaming of beer, is a very grave quality problem for the breweries concerned. Especially problematical is the primary gushing resulting from the raw materials since it cannot securely be prevented by technological procedures. Despite intensive efforts, research has not yet been able to fully clarify the complex interrelationships involved in the gushing phenomenon. Above all, the affect of technological parameters during the malting and brewing processes has been insufficiently investigated.

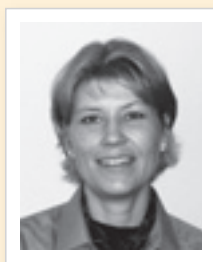
Results: Malts with a high gushing risk have a greatly increased Fusarium contamination. Heavy gushing could be induced using otherwise inconspicuous control malts spiked with low quantities of contaminated material. Large changes to the gushing potential could be observed during the malting process. Especially critical phases are steeping and withering. Possibilities to reduce the gushing risk by technological means during malting are discussed. In brewing trials the gushing potential of the beers could be influenced, amongst others, by high temperature boiling, lowering the pH, pasteurisation or the use of proteolytic enzymes.

Annika Wilhelmson



Annika Wilhelmson (Doctor of Science in Technology) works as Senior Research Scientist at VTT Technical Research Centre of Finland. She graduated from Helsinki University of Technology in 1992. Since then, she has been working in projects related to malting, brewing and plant biotechnology at VTT. In 1994-95, she spent 6 months at the ICBD at Heriot-Watt University as a visiting research student. Her research topics have included genetic engineering of plants, barley and malt quality, and the biochemistry of malting and mashing. She is currently chairman of the Malting Barley Genetics and Physiology Subgroup of the EBC Brewing Science Group.

Tuija Sarlin



Tuija Sarlin received a MSc (Tech.) in Chemical Engineering with a major in microbiology and biotechnology from the Helsinki University of Technology in 1995. She began employment with Technical Research Centre of Finland in 1995 as a research scientist in the Microbiology research field. She was focusing on cereal microbiology, mainly Fusarium and its metabolites in malting and brewing processes. Since then, she has participated in several national and international projects. She is currently working on her PhD degree whose subject is characterization and detection of hydrophobins responsible for beer gushing.

Frank Rath



PROF. RATH, Frank (born in 1957) Studies: 1980-1986: Agricultural Science at the Rheinische Friedrich-Wilhelms-University of Bonn; 1993: PhD. Appointments: 1986: Scientific Collaborator at the Research Department/Plant Production and Physiology, Weissheimer Malzfabrik, Andernach; 1986-1990: Scientific Collaborator at the Research Institut of Raw-Materials within the Research an Teaching Institute of Brewing in Berlin (VLB); 1990-1998: Head of the Research Department/Plant Production and Physiology, Weissheimer Malzfabrik, Andernach; since 1999: Head of the Research Institut of Raw-Materials within the Research an Teaching Institute of Brewing in Berlin (VLB), since 2006: Professor at the TU of Berlin, Member of various national and European panels of experts.

L 14

Identification of new gushing producer fungi

Patrick Boivin¹¹IFBM, Vandoeuvre, France

DESCRIPTION OF TOPIC:

Gushing has been a concern in the European malting and brewing industry in 2007/2008. Fungal infection of barley, in particular by species of *Fusarium*, was known to cause beer gushing. Malting barley from harvest 2007 gave a high number of malt positive gushing and beer gushing without correlation with mycotoxins content. The aim of this investigation was to isolate and identify the main fungi that contaminated malting barley and malt, and to test their gushing and mycotoxin potential.

Results: Different fungi strains that contaminated malting barley from harvest 2007 were isolated and identified. The main fungi were *F. graminearum*, *F. culmorum*, *F. paee*, *F. Langsethiae*, *F. avenaceum*, *F. tricinum*, *F. moniliforme*, *Microdochium nivale*, *Alternaria* ssp. Gushing potential and mycotoxins production were carried out with several strains of each species isolated from malting barley.

All strains of each *Fusarium* species produced different kind of mycotoxins but were not gushing positive. *Alternaria* gave slightly gushing sample positive on other and all strains of *Microdochium nivale* that produced no mycotoxins gave highly gushing positive samples.

L 15

The influence of radical reactions on the haze formation in stabilized beer

Thomas Kunz¹, Frank-Jürgen Methner¹¹Technische Universität Berlin, Institut für Biotechnologie, Fachgebiet Brauwesen, Berlin, Germany

DESCRIPTION OF TOPIC:

The interactions between polyphenols and proteins have been identified as the main reaction system for haze formation in beer. Nevertheless chill haze or permanent haze formation can be observed in stabilized beer (PVPP / silica gel) after a certain storage time. It is also well known that the presence of oxygen, higher temperature, light, metallic ions and mechanical influences accelerate the haze formation during storage, but the responsible reaction mechanism could not be enlightened satisfactorily up to now. Also the described approach according to an oxidation reaction which activates polyphenols by generating ortho-chinons is not able to explain haze formation in stabilized beer completely.

Results: Our investigations on detached haze by solid measurements using ESR at 77 K have shown ESR signals in haze, which can not be found in filtrate. The different ESR-signals are caused by stabilized organic radicals and ions like Fe³⁺. These results indicate an interrelation of haze formation with the Fenton reaction system. The comparison of the "Endogenous Antioxidant Potential (EAP)" decrease and haze formation during shelf life showed an important coherence. At the achievement of the EAP zero value the formation of radicals and Fe³⁺, Cu⁺ ions from the Fenton- and Haber-Weiss reaction system are extremely increasing and chill haze formation in beer starts with a deceleration of 1-2 °C (40°C) and cold days changes. With higher oxygen and iron content in beer the EAP decreases faster and haze formation starts earlier.

L 16

An examination of binary foam stabilizer systems in lager beer

Thomas H. Shellhammer¹, Takeshi Kunimune¹¹Oregon State University, Dept. of Food Science and Technology, Corvallis, United States

DESCRIPTION OF TOPIC:

Foam stability studies have often examined hop acids singly for their foam stabilizing effect, however many brewers utilize dual systems of foam stabilizers. In this study, foam stabilizing properties and cling formation patterns of lager beer to which iso-alpha-acid (Iso), tetrahydro-iso-alpha-acid (Tetra), hexahydro-iso-alpha-acid (Hexa), and propylene glycol alginate (PGA) were added were investigated.

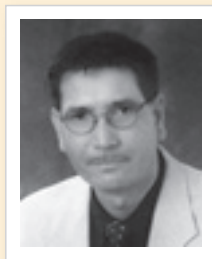
Results: The magnitude of foam stabilizing power of each compound was dependent on the test employed, especially in the case of PGA. The foam stabilizing effects of these compounds were found to be additive for both NIBEM and Steinfurth measurements, though FSF results showed somewhat hyperbolic tendency. In identifying equi-foam stability concentrations among the 4 compounds, the substitution of 1 ppm of Tetra or Hexa yielded the same improvement of foam stability as adding 28 ppm PGA. Using Steinfurth FSF values this substitution equality changed to 1 ppm of Tetra or Hexa in place of 4.8 ppm of PGA. NIBEM-CLM measurements revealed that PGA had a minimal effect on cling formation while Tetra and Hexa concentrations as low as 1 ppm showed significant improvement to foam cling adherence.

Patrick Boivin



He is Scientific Director at IFBM. He has been Visiting Professor at Nancy Food Engineer School. He received BSc in Biology and Biochemistry from Rouen University (1983), MSc in Biotechnology from Compiègne Technology University (1984) and PhD in Microbiology, Enzymology and Bioconversion from Compiègne University (1987). He was Post-Doctoral Fellow at Baylor University, Texas, U.S.A., 1987-1989. He received Master in Business and Administration in 1998 from French Institute of Management. Since 1989 he has been working at IFBM. He is a member of the EBC board and Brewing Science Group, Chairman of the contaminants Sub-group and a member of the French Barley-Malt-Beer Committee. He has published several papers, reviews and patents.

Thomas Kunz



After qualifying as a certified technician in preservation engineering (1991-1993), Thomas Kunz completed his basic studies in chemistry at Isny University of applied science (1994-1995) and his basic studies in food chemistry at Wuppertal University (1995-1998), before starting to study food technology at Trier University of applied science (1998-2002). After graduating, he worked as a chartered engineer in the field of ESR spectroscopy at the Institute of Bio Physics at Saarland University (2002-2004). Since January 2005, he has been employed as a PhD student at the Research Institute for the Technology of Brewing and Malting at VLB and Technische Universität Berlin. His main research focus lies in analyzing radical reaction mechanisms in beer and other beverages using ESR spectroscopy.

Thomas H. Shellhammer



Dr. Shellhammer is the Nor'Wester Professor of Fermentation Science and Associate Professor in the Department of Food Science and Technology at Oregon State University where he leads the brewing science education and research programs. During the 2008-2009 academic year he is on sabbatical leave from OSU and is working at the Technische Universität Berlin and the Versuchs- und Lehranstalt für Brauerei (VLB) as a Fulbright Scholar and Alexander von Humboldt Fellow. His brewing research examines processing and raw material interactions on beer quality along with novel processing techniques. A significant portion of his research activities are directed towards the investigation of hops and beer quality. Dr. Shellhammer received his Ph.D. in Food Engineering from University of California, Davis in 1996 and worked as Assistant Professor of Food Science at The Ohio State University for four years prior to his move to Oregon in 2001.

L 17

The relationship between matrix foaming potential, beer composition and foam stability

Petr Kosin¹, Jan Savel¹, Adam Broz²

¹Budweiser Budvar, N.C., R&D, Ceske Budejovice, Czech Republic,
²Budweiser Budvar, N.C., Production Department, Ceske Budejovice, Czech Republic

DESCRIPTION OF TOPIC:

Foam stability is, beside the sensory stability, one of the hottest topics of today brewery research. The usual approach to improve beer head is to look for its components, describe them, design a test to assess them, conclude which raw materials are richer in these components and can bring more of them to the beer. Although these results are usually very interesting, the real usability of such results is quite limited, because it is a number one priority of any brewery to keep all other quality parameters of the beer unchanged.

Results: Twelve different beer samples from the market were tested for basic analytical composition and foam stability. Although lower in proteins, higher foam stability of non-alcoholic beers compared to lagers indicate that the key to stable foam doesn't necessarily have to be only in the high content of foam positive proteins.

L 18

Improvement of tap hygiene and draught beer quality with "a flush a day"

Heinz Dauth¹, Johannes Tippmann¹, Albert Bauch²

¹TU München, Lehrstuhl für Maschinen- und Apparatekunde, Freising-Weihenstephan, Germany, ²Brouwerij Nacional Balashi, Santa Cruz, Aruba

DESCRIPTION OF TOPIC:

The understanding of the necessity of cleaning but lack of practice is a quite common game in selling draft beer. Without any doubt, hygiene is a crucial parameter for sales success in the draft beer scene. But the obvious question is, how much care is essentially needed and furthermore which kind of care is leading to a sufficient level of quality? Instead of an unverified assumption, scientific investigations are needed to answer these questions. This presentation discusses the impact of tap cleaning on the microbiological situation at the tap itself and for the whole dispensing system. In other words - is tap care worth the effort?

Results: The first sample indicated the microbiological situation at the tap and the following sample represented the beer line behind the tap or rather the situation of the dispensing system.

L 19

Sensory evaluation of body and mouthfeel - a panel training!

Martina Ingeborg Gastl¹, Anke Kiesslich¹, Alexander Quadt², Joachim Tretzel²

¹Technische Universität München; Lehrstuhl für Technologie der Brauerei I, Freising, Germany, ²DöhlerGroup, Darmstadt, Germany

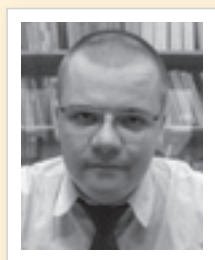
DESCRIPTION OF TOPIC:

The balance and harmony of the beverage matrix seems to be the basis of good Drinkability, therewith mouthfeel and body of a beverage. Mouthfeel is a product's physical and chemical interaction in the mouth. The term is used in many areas related to the testing and evaluating of foodstuffs (beer-tasting, non-alkohol beverages, rheology). By the sensory evaluation of beer the impressions of beer's smell, taste, body, carbonisation taste and bitterness were evaluated mostly in a score system from 1 to 5. The importance of beer-tasters achieving a common understanding of terms describing beers mouthfeel is important. For this reason the beer industry has a standardised terminology wheel of mouthfeel and taste terms, but nevertheless the description and characterisation of the attributes body, mouthfeel or smoothness in sensory evaluation is mostly not very specific.

Results: The elaboration of terms and concepts for panel training with regard to the attributes body and mouthfeel is described.

The successes of panel training and the practicability of the taste schema were checked in different matrix compositions.

Petr Kosin



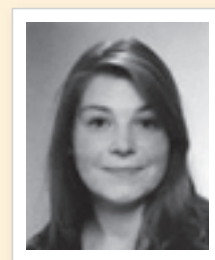
Petr Kosin received an engineering (M.S. equivalent) degree in brewing and malting at the Institute of Chemical Technology Prague, Faculty of Food and Biochemical Technology, Department of Fermentation Chemistry and Bioengineering, Prague, Czech Republic, in 2006. He worked on his diploma thesis, „Application of Modern Methods for Yeast Activity Control in Brewery,“ at Budweiser Budvar, N.C. in Ceske Budejovice. He has been working in research and development at Budweiser Budvar, N.C. since his graduation. He also has been studying for his Ph.D. degree at the Institute of Chemical Technology, Prague, Czech Republic, since 2007. His dissertation deals with customer perception of beer quality parameters.

Heinz Dauth



Graduated as an Engineer for Food Technology and Biotechnology at the TU München - Weihenstephan in 1993. Afterwards appointed as a Scientific Researcher at the Chair of Process Engineering (Prof. Sommer) in Weihenstephan. Doctoral thesis completed in 1999 in the field of mechanical process engineering. Since 2003, Scientific Assistant and University Lecturer at the Chair of Process Engineering, TU München. His main interests of research are bulk solids technology, dispensing technology, process engineering for specific problems in the food and beverage industry. He is also responsible for the industrial cooperation programme of the institute. Furthermore he is working as an Assistant Professor at the Weihenstephan University of Applied Sciences lecturing about process engineering.

Martina Ingeborg Gastl



Born in 1974. Technical graduation as brewer and maltster in Klosterbrauerei Andechs, Germany (1994-1996); study of brewing science and beverage technology at TU München-Weihenstephan, Germany (1996-2002). From 2002 till 2006 doctoral thesis on the chair for brewing technology Lehrstuhl für Technologie der Brauerei I (TU München-Weihenstephan) about Technological influence on lipid degradation in terms of improvement of beer flavour stability. Since 2002 scientific employee and since 2005 scientific assistant and head of the GC/HPLC laboratory at Lehrstuhl für Technologie der Brauerei I (TU München-Weihenstephan), since 2007 head of the malt laboratory (TU München-Weihenstephan).

L 20

Sensory and chemical characterization of lagers of the Italian market

Gianluca Donadini¹, Maria Daria Fumi²¹Università Cattolica del Sacro Cuore, Institute of Entomology and Plant Pathology, Piacenza, Italy, ²Università Cattolica del Sacro Cuore, Institute of Oenology and Food Engineering, Piacenza, Italy

DESCRIPTION OF TOPIC:

The Italian beer market is dominated by bottom fermented lager beers which have 97% market share. Sensory descriptions of beer are usually self-highlighted by producers, and beer descriptions are most of the time subjective in nature and biased by the effort to catch consumers' attention and favour marketing purposes. Sensory profiling techniques in turn are effective in objectifying these descriptions. This study extensively investigated the sensory profile of lagers of the Italian market to map out its structures. Then it explored the chemio-physical properties and the flavour active compounds generated during fermentation of a subset of 10 samples chosen on the base of their market share. Flavour compounds included higher alcohols, short-chain fatty acids and esters. These compounds are usually present in trace and in lagers with a% ABV from 4 to 5.5 they seldom reach their threshold level, most of the time reaching levels around the threshold value. However they can affect the flavour profile due to a synergistic effect on individual flavour.

Results: Lagers were discriminated ($P < 0.05$) with sensory profile techniques. Cardboard-like, metallic and estery flavours were the most discriminating descriptors. Likewise flavour active compounds discriminated ($P < 0.05$) our samples. Relationships between sensory and analytical data were mixed.

L 21

Synergistic and suppression effects of flavour compounds in beer

Stefan Hanke¹, Markus Herrmann¹, Werner Back¹¹TU München, Lehrstuhl für Technologie der Brauerei I, Freising, Germany

DESCRIPTION OF TOPIC:

The noticeable beer flavour is the result of complex interactions of different aroma compounds. On one side there are pleasant flavour impressions from hops and desired fermentation by products. On the other hand Off-flavours (stale flavours, diacetyl, DMS) can be present in beer and result in an undesired flavour. Esters produce a fruity flavour which can mask other flavours. Another positive flavour compound is the hop derived linalool. It is known to be a good indicator and main contributor to the hoppy flower-like flavour. Beers with a hoppy flavour show a better flavour stability.

Results: Additive flavour effects are a widespread phenomenon and have been reported repeatedly. The threshold of some stale flavour compounds if combined can be 80% lower than that of single substances in beer. We tested typical stale flavour compounds like 2- and 3- methylbutanal, gamma-nonalactone and others pure and in combination with chemical similar stale flavours. There was an increase in intensity of the combinations compared to the single compounds. Beside the stale flavours some hop volatile compounds, like geraniol, linalool, beta-caryophyllene, were in the focus of our experiments. They were tested single and combined with other hop compounds as well as 2-phenylethanol. Because of the huge chemical diversity of the hop compounds additive effects could not be observed between the hop compounds in the same extend as between stale flavours. We also tested the influence of esters on the threshold of diacetyl, DMS and 3-methylbutanoic acid. The positive esters masked the negative off-flavours.

L 22

Cardboard or Bread? The relative importance of oxidative and Maillard pathways of beer ageing

Carsten Zufall¹¹Cerveceria Polar CA, Caracas, Venezuela

DESCRIPTION OF TOPIC:

There are two fundamental chemical pathways involved in beer staling, namely:

- a) the oxidation of fatty acids and their derivatives and
- b) the Maillard reaction.

Both pathways are characterized each by a specific set of stale flavour descriptors attributed to them. While pathway a) is considered as being linked to rancid, papery or cardboard notes, reaction scheme b) is regarded as the origin of burnt, caramel- and bread-like notes. The relative importance of the two stale flavour types is assessed by examining aroma characteristics of force-aged industrial beer samples.

Results: Force-aged industrial beer samples have been examined over a period of almost four years and their flavour characteristics compared. In a general overview of all beers studied, no clear tendencies become visible. However, although most beers show a blend of flavour characteristics attributable to both pathways, some can be characterized predominantly by the descriptors belonging to only one of the two reaction schemes. More detailed studies reveal that hopping with conventional products versus light-stable (reduced) isohumulone extracts marks a difference in the type of stale flavour which emerges during forced ageing. In our experience, conventionally hopped beers tended to show mostly cardboard and similar flavours linked to pathway a) while so-called light-stable beers hopped with reduced isohumulone extracts gave primarily burnt, bread- and caramel-like stale flavours attributable to scheme b).

Gianluca Donadini



Gianluca Donadini obtained a degree in biology from the University of Parma. He received two Master degrees in Food Security and in Oenology and Sommelierie from the Università Cattolica del Sacro Cuore, Piacenza, Italy. As secretary of AIDASA, at the Institute of Entomology and Plant Pathology, Università Cattolica del Sacro Cuore, he was responsible for the articulation, development and administration of scientific research projects focused on biogenic amines, mycotoxins, heavy metals and pests in beer. He undertook researches that concerned consumer science and sensory analysis of food and beverages. He presented poster and oral communications at the 2004 WBC, 2005 ASBC, 2005 EBC of Prague, 2006 IBD of Hobart, 2007 EBC of Venice and 2008 IBD of Auckland.

Stefan Hanke



Stefan Hanke was born in 1980. From November 1999 to July 2004 he studied brewing science and beverage technology at Munich Technical University (Weihenstephan), graduating as an engineer with a Dipl.-Ing. degree. During his studies he worked for and received practical training at different German brewing and malting companies. Since September 2004 he has been a scientific employee at the Lehrstuhl fuer Technologie der Brauerei I, Freising-Weihenstephan, Germany (Professor Back). From December 2006 until May 2007 he headed the institute's Small Scale and Pilot Scale Brewery Department. Since May 2007 he has been responsible for the HPLC and GC Laboratory of the institute. His main research topics are the influence of hops on beer drinkability, as well as the influence of beer matrix on bitter taste.

Carsten Zufall



Carsten Zufall is Corporate Manager for Quality, Innovation and Development at Cerveceria Polar, C. A., Caracas (Venezuela), leading quality management, brewery-related research and new product design. He graduated in Brewing Science from Berlin University of Technology in 1990 and subsequently completed a Ph. D. (Dr.-Ing.). Following postdoctoral lecture qualification, he was awarded Associate Professorship (Priv.-Doz.) in Brewing Science in 2001. Carsten is a member of the EBC Brewing Science Group, the EBC Executive Board, the Editorial Board of the Journal of the Institute of Brewing, ASBC, MBAA, the German Brewmasters' and Maltmasters' Association (DBMB) and the VLB Alumni Association, and the Cerveceros Latinoamericanos association. His current research activities include beer flavour stability, flavour chemistry, sensory analysis and environmental topics.

L 23

The potential of plant breeding for improvement of quality traits in barley and the benefits for the processing industry demonstrated by long term evaluation of barley varieties

Markus Herz¹, Kerstin Krumnacker¹,
Sabine Mikolajewski², Guenther Schweizer¹,
Guenter Henkelmann², Max Baumer¹

¹Bavarian State Research Center for Agriculture, Institute for Crop Science and Plant Breeding, Freising, Germany, ²Bavarian State Research Center for Agriculture, Department for Quality Assurance and Analysing, Freising, Germany

DESCRIPTION OF TOPIC:

A part of the quality parameters of barley is determined by the genetic disposition of the raw material. This means that besides environmental conditions the barley variety is responsible for a large part of the processability. During the parallel development of processing technology and quality potential of barley varieties, plant breeding represents the major part.

Results: Results of official variety trials confirm the improvement of all important quality parameters by plant breeding.

Results of comparative field trials in the context of GABI MALT show uniquely how quality and processability of barley was improved. During this time all important parameters were adapted to the needs of the processing industry. Malt extract could be increased by two percent. Friabilimeter grew from 70% to over 90%, Kolbach index was increased from 37% to 45%. The major part of this improvement is due to the efforts of plant breeding. Increased extract yield, improved cytolytic and proteolytic performance of the malt result in optimal supply of yeast with nutrients, optimisation of the duration of attenuation, maintenance of foam and taste stability and improvement of the usage time of the filters.

L 24

Volatile phenols in beer: Formation of 4-vinylguaiacol during wort fermentation and its fate during beer ageing

Nele Vanbeneden¹, Freddy R. Delvaux²

¹Katholieke Universiteit Leuven, Heverlee, Belgium, ²Katholieke Universiteit Leuven, Leuven, Belgium

DESCRIPTION OF TOPIC:

4-vinylguaiacol (4VG) is known to be an essential contributor to the aroma of many top-fermented beers (especially German and Belgian wheat beers). In this study, we identify critical control points to optimize its concentration in beer. Secondly, since already several authors reported appreciable temperature dependent losses of 4VG during the storage of beer leading to a steady decline of the phenolic flavor impression, we examined its degradation patterns during beer ageing.

Results: The effect of the yeast strain, temperature, pH, pitching rate and initial precursor level were investigated. Clearly, the first means for optimizing the final content in beer is by controlling the release of precursors in the brewhouse and the choice of a suitable yeast strain. It was also shown that current practices like top-cropping and applying counter-pressure, can severely affect 4VG formation and may affect the ratio between 4VG and esters leading to an unbalanced beer. Finally, the decrease of 4VG during beer ageing was examined. A new vanilla-like compound in beer, apocynol, was identified as the main degradation product. In the presence of oxygen, substantial amounts of vanillin were also detected.

L 25

Flavour, froth and finesse - the legacy of hops to beer (a review)

Paul Hughes¹

¹Heriot-Watt University, Edinburgh, United Kingdom

DESCRIPTION OF TOPIC:

The properties of the iso-alpha-acids mean that these compounds are able to support beer foam, elicit bitterness and act as potent antimicrobials against Gram-positive bacteria. In this paper, we review the state-of-the-art for each of these quality issues, emphasising recent developments in areas such as the identification of the so-called T2R bitterness receptors, and the application of molecular dynamics for the exploration of hop acid-protein binding.

Results: Around 40 T2R (bitterness) receptors have been tentatively identified. This variation can help to explain why there is so much structural diversity of bitter compounds. These G-protein coupled receptors bind bitter compounds to the outside of the receptor which triggers a cascade ultimately resulting in bitterness perception. There is still the possibility that the ability of hop acids to partition into lipid bilayer membranes might enable them to by-pass the T2R receptors and interact directly with receptor cells. Molecular dynamics simulations have clearly demonstrated that hop acids not only associate with proteins, but also with themselves.

Markus Herz



Graduated 1995 at the Technical University of Munich (TUM); PhD in Agricultural Sciences at TUM; Thesis: „Genetic mapping of QTLs including agronomic characters and malting quality of barley using molecular markers“. Since 2000; principal investigator of a sub-project of the German national plant genome project GABI, analysing functional genomics of malting quality in barley. Since April 2006 Head of the Barley breeding group at the LfL. Interests: Barley Breeding, malting quality molecular marker development, linkage-mapping. The institute for plant breeding focuses on development of adapted plant material as basis for plant breeders, molecular markers and their application in plant breeding.

Nele Vanbeneden



In 2002, Nele Vanbeneden graduated at the Catholic University of Leuven (Belgium) as M.Sc. in Applied Biological Sciences and Engineering. After graduation, she started working as scientific researcher at the Department of Industrial Sciences at the Hogeschool Gent. In January 2004, Nele returned to the Centre for Malting and Brewing Science to start a PhD on the subject 'Release of hydroxycinnamic acids and formation of volatile phenols during the beer production process'. For this research, she was granted financial support by IWT Vlaanderen. In 2007, she received her PhD-degree in Bioscience and Engineering after which she started on an industrial research project concerning mixed fermentation systems in collaboration with an industrial partner brewery.

Paul Hughes



Paul has a PhD in chemistry and joined the Brewing Research Foundation in 1990, before joining Heineken in 1999. He has worked intensively on quality- and safety-related research projects. In 2005 Paul was appointed Professor of Brewing at Heriot-Watt University, and in 2006, assumed the position of Director of the International Centre for Brewing and Distilling. Paul holds several positions within the world's brewing organisations, including International Director of the ASBC and chair of the EBC brewing science sub-group on modelling in brewing.

L 26

Fusel alcohol formation by yeast

Lucie A Hazelwood¹, Jean-Marc Daran¹,
Antonius J. A. van Maris¹, Jack T. Pronk¹,
J Richard Dickinson²

¹Delft University of Technology, Biotechnology, Delft, Netherlands,
²Cardiff University, Cardiff School of Biosciences, Cardiff, United Kingdom

DESCRIPTION OF TOPIC:

Fusel alcohols and the esters derived therefrom are important flavour and aroma constituents in beers. Consistent batch-to-batch maintenance of the desired concentrations of these compounds is essential. The aims have been (1) to define the steps of the biochemical pathway (the 'Ehrlich pathway'), (2) to identify the enzymes involved and the genes which encode them, and (3) to understand the biochemical and genetic regulation associated with changes in yeast's growth and environmental conditions.

Results: Leucine, isoleucine, valine, phenylalanine, tyrosine, tryptophan and methionine that are present in wort serve as the starting materials for the formation of isoamyl alcohol, 'active' amyl alcohol, isobutanol, 2-phenylethanol, tyrosol, tryptophol and methionol (respectively). The steps of the Ehrlich pathway are transamination in which the amino acid is converted into an alpha-keto acid, then decarboxylation in which the alpha-keto acid is converted to an aldehyde. The aldehyde is then reduced in a NADH-linked reaction resulting in formation of the appropriate fusel alcohol. In aerobic conditions (not found in beer production), the aldehyde could be oxidized to the corresponding fusel acid. Four transaminases, 5 TPP-dependent decarboxylases, 16 alcohol dehydrogenases and 8 aldehyde dehydrogenases have roles in the pathway depending mainly upon the amino acid, growth phase of the yeast and other cultivation conditions. Transcriptional regulation of the structural genes explains most, but not all of the regulation observed. Posttranslational modification(s) of enzymes remain to be discovered.

L 27

The origin of beer-spoilage lactic acid bacteria and its implications in micro quality control in breweries - a review

Koji Suzuki¹

¹Asahi Breweries, Ltd., Research Laboratories of Brewing Technology, Moriya-shi, Japan

DESCRIPTION OF TOPIC:

Lactic acid bacteria (LAB) have been recognized as major spoilage microorganisms in the brewing industry. These spoilage LAB exhibit strong hop resistance and grow in beer, a harsh environment where ordinary LAB cannot survive. It has been also known that beer-spoilage LAB strains are rare in nature and almost exclusively isolated from brewery environments. However, questions remained in a state of mystery as to how these spoilage LAB have emerged in the brewing history and acquired beer-spoilage ability in the evolution of these bacteria.

Results: Recent studies increasingly suggest that beer-spoilage LAB emerged as brewers began the cultivation of hop for brewing. Since then, beer-spoilage LAB presumably chose brewing environments for their habitats, and progressively developed intricately complex mechanisms to survive in beer. Therefore, the adaptation of beer-spoilage LAB to beer environments appears to be quite a long process, which most likely can be traced back over a thousand years. Strikingly, deep association of spoilage LAB with beer environments led to the acquisitions of hard-to-cultivate characteristics on ordinary culture media and the accumulation of common resistance genes among different species of beer-spoilage LAB. These phenomena are significantly relevant for micro quality control (QC) tests in breweries, such as detection and identification of beer-spoilage LAB.

L 28

A critical review of the design of large capacity fermentation vessels and the methods used for their management

Christopher A Boulton¹, Mikkel Nordkvist²

¹University of Nottingham, Division of Food Sciences, Loughborough, United Kingdom, ²ISO-mix A/S, Copenhagen, Denmark

DESCRIPTION OF TOPIC:

The majority of the world's major international beer brands are produced via high gravity fermentations performed in large capacity cylindroconical fermenters. In order to maximize productivity large batch sizes, high wort concentration and elevated temperatures are used. This exposes yeast to hostile conditions. It is relatively common to encounter a lack of balance between brewhouse and fermentation and protracted fermenter fill times are common. This requires decisions as to when and at what rate should pitching and oxygenation be made. Typically these decisions are empirical. At previous EBC congresses it has shown that management of fermentation can result in heterogeneities that persist throughout most of fermentation. The conclusions that may be drawn from these factors are that precise regulation of parameters such as pitching rate, temperature and oxygenation are not sufficient to ensure predictable fermentation performance, high crop viability and consistent beer quality. Here a review is presented of current best practice of the control of fundamental fermentation control parameters. This is extended to discuss how these fermentation variables can be manipulated to provide a predictable outcome. Results are presented which illustrate the problems that may be encountered with some current control regimes together with those where ameliorative actions have been put into place. A simplified fermenter design is presented which seeks to address some of the problems described here.

Results: The results of fermentations performed at several commercial breweries are presented.

J Richard Dickinson



J Richard Dickinson is Reader in Yeast Metabolism at Cardiff University and Professor of Molecular Biology at Salzburg University. He is the author of over 170 publications and co-editor of 'The Metabolism and Molecular Physiology of *Saccharomyces cerevisiae*'. He has researched yeast metabolism for more than 30 years. His special interest is the catabolism of amino acids to fusel alcohols and the role of these compounds in yeast development. He enjoys collaborations with brewers and distillers on projects great and small.

Koji Suzuki



Koji Suzuki received an M.S. degree in agricultural chemistry from Tokyo University, Japan. He joined Asahi Breweries, Ltd. in 1992 as a microbiologist. Since 2003, he has functioned as chief researcher in the Research Laboratories of Brewing Technology and principally studied beer-spoilage bacteria. He received a Ph.D. degree from Tokyo University in 2004 and an award from the Brewing Society of Japan in 2007 for his work concerning the hop resistance in beer-spoilage lactic acid bacteria. He is currently a vice-chairman of BCOJ Analysis Committee and serves on an editorial board of Journal of the Institute of Brewing. He is also appointed as a visiting lecturer for brewing microbiology at Tokyo University and has published many peer-reviewed articles and book chapters in this field.

Christopher A Boulton



A degree, in microbiology, and doctorate, in biochemistry, were obtained at the University of Hull. After a number of post-doctoral fellowships at the same establishment this was followed, in 1984, by employment as Fermentation Microbiologist in the R&D Department of Bass Brewers. Since that time a variety of technical roles within Bass Brewers and latterly Coors Brewers were undertaken in which an interest was further developed in studying brewing yeast and fermentation. In 2006, appointed Special Professor in Brewing Science and in August, 2007, Teaching Fellow at the University of Nottingham. Author of more than 60 original papers and review articles. Co-author with David Quain of *Brewing Yeast and Fermentation* and with Dennis Briggs, Peter Brookes and Roger Stevens of *Brewing Science and Practice*.

The (in)stability of the beer's bitter taste - elucidation of the mechanisms involved in trans-iso-alpha-acid degradation and formation of bitter off-taste compounds upon beer storage

Thomas Hofmann¹, Daniel Intelmann², Gesa Haseleu²

¹Technische Universität München, Lehrstuhl für Lebensmittelchemie und molekulare Sensorik, Freising, Germany, ²Technische Universität München, Freising, Germany

DESCRIPTION OF TOPIC:

Although it is long known that the typical bitterness of fresh beer is mainly imparted by the cis/trans-iso-a-acids, the bitter taste induced by these compounds is not stable and a significant decrease in intensity as well as a change in bitter quality is observed with increasing age of the beverage. Various studies showed evidence that the amount of trans-iso-a-acids in beer decreases during aging, whereas the cis-iso-a-acids seem to be rather stable. As scientific data on these degradation are lacking, the objective of the present study was to elucidate the mechanisms involved in storage-induced iso-a-acid degradation and formation of unpleasant and harsh bitter compounds in aged beer. **Results:** Aqueous solutions of purified trans-iso-a-acids were incubated, the reaction products formed were isolated, and their structures determined by means of NMR and LC-MS. Based on the chemical structures of these previously unknown degradation products and guided by stable isotope labeling experiments, a novel conclusive reaction pathway was proposed explaining why and how the trans-a-acids are degraded via a non-oxidative mechanism, whereas the cis-iso-a-acids stay rather stable during beer storage. By means of HPLC-MS/MS, all previously unknown compounds were identified and quantified in various beers and were demonstrated as the predominant degradation products accounting for almost 100% of the loss of trans-iso-a-acids in aged beer. Furthermore, sensory studies revealed a change of bitter quality for some degradation products as well as somewhat higher bitter recognition thresholds when compared to the data obtained for the trans-iso-a-acids.

The influence of dark specialty malts on beer flavour stability

Sem M.G. Vandecan¹, Pieter De Nève¹, Niels Daems¹, Daan Saison¹, Freddy R Delvaux¹

¹Katholieke Universiteit Leuven, Centre for Malting and Brewing Science, Leuven, Belgium

DESCRIPTION OF TOPIC:

Dark specialty malts can have a tremendous impact, not only on flavour and colour but also on beer flavour stability. The influence of these malts on the latter generates contradictory evidence. Therefore, reducing power assays were combined with a sensory and analytical approach to investigate the influence of different types of specialty malts on flavour stability.

Results: DPPH and Fe-dipyridyl values remained constant during ageing in the colour malt beer. The severe drop in reducing power of caramel malt beer was accompanied by a spectacular decrease of sensory appreciation. However, the fresh and aged beer still scored significantly higher during sensory analysis than its colour malt counterpart. Staling compounds such as the Strecker aldehydes, furfural, HMF and lipid oxidation products were more abundant in aged colour malt beer. By contrast, furfurylthylether was higher in the caramel malt beer. The evolution of maltol and furaneol was monitored to explain the drop of caramel notes in aged caramel malt beer.

Impact of colour adjustment on flavour stability of pale lager beers with a range of distinct colouring agents

Andrés Furukawa¹, Paul Hughes¹

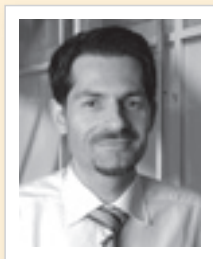
¹Heriot-Watt University, International Centre for Brewing and Distilling (I.C.B.D.), Edinburgh, United Kingdom

DESCRIPTION OF TOPIC:

The research aimed to investigate the influence and improvement of flavour stability of pale lager beer products by using ten selected colouring agents such as specialty malts, beer colour extract and artificial caramel colorant. Likewise, it was determined whether the adjustment of colour by using the colouring agents mentioned could be a relevant tool for improving the beer flavour stability; either by means of chemical effects or by psychophysical responses as colour appearance.

Results: The colour appearance attributes (lightness, colourfulness, hue, opacity and clarity) of the locally-brewed beers either by psychophysical assessment or physical measurements did not match with the corresponding EBC values. This may indicate EBC method does not allow understanding the true colour perception of the beers by the consumers. Likewise, it was found that apparently using a specific group of specialty malts for colour adjustment can improve the beer flavour stability.

Thomas Hofmann



Ph.D. at Technical University of Munich (1995), habilitation (1998), Deputy director of the German Research Centre for Food Chemistry (DFA) (1999-2002), Full professor (C4) and director of the Institute for Food Chemistry, University of Münster (2002-2006), Full professor and chair of Food Chemistry and Molecular Sensory Science at the Center of Life and Food Sciences Weihenstephan, Technical University of Munich (since 2007)

Sem M.G. Vandecan



Sem graduated in Bio-Engineering in Chemistry, option Food Technology. He carried out his master's thesis at the Laboratory for Molecular Cell Biology in cooperation with the Centre for Malting and Brewing Science (K.U.Leuven) on the ethyl ester production during fermentation. After graduation, he joined the Centre for Malting and Brewing Science to start a Ph.D. Sem investigates the flavour in specialty malts and the formation of flavour and colour during the roasting process.

Andrés Furukawa



Andrés Furukawa is currently conducting research for his Ph.D. degree in Brewing at the International Centre for Brewing and Distilling (I.C.B.D.), Heriot-Watt University, Edinburgh, Scotland. He received his Brewmaster Diploma from Versuchs- und Lehranstalt für Brauerei (V.L.B.) Technische Universität Berlin (T.U.B.), Berlin, Germany in 2003. In 2002, he received his Bachelor of Science Diploma in Food Chemistry at the Universidad Nacional Autónoma de México (U.N.A.M.). He has worked in production department as for Lemke Brauerei GmbH, Berlin, Germany, Cervecería Modelo S.A. de C.V. (Corona), Santa Fe Beer Factory S.A. de C.V., Mexico City. He has carried out a professional internship in production and quality assurance for Warsteiner Brauerei Haus Cramer KG, Warstein, Germany.

L 32

Stay or swap? The decision is yours

Deborah K Parker¹

¹BRI, Flavour & Innovation, Nutfield, United Kingdom

DESCRIPTION OF TOPIC:

This paper describes the validation of a new method for measuring drinkability without asking consumers to drink large volumes of beer. The technique measures changes in consumer liking and those factors which influence the desire to stay with or swap to another beer or different drink. A consumer study completed in July 2008 was successful in demonstrating significant differences in the drinkability of two beers and provided detailed information on factors influencing consumer liking.

Results: Using this method we were able to show that the technique was successful in measuring differences in the drinkability of the two beers. Analysis of the consumer data showed that there were significant differences in overall liking and flavour between the beers. The method demonstrated that there were significant differences in ratings between glasses of the same beer and in responses due to gender. The technique highlighted which sensory attributes were related to consumer liking. Using the method, we could identify factors which affected the desire to continue drinking a beer or prompted a desire to change to another beer or different drink. In-depth analysis of the data identified a target group which would be useful as a marketing strategy for this brand.

L 33

An enzymatic solution to improve the oxidative stability of wort and beer flavour stability - the role of catalase

Anne Mette Frederiksen¹, Thomas Kunz²

¹Novozymes A/S, Brewing and Alcoholic Beverages, Bagsvaerd, Denmark, ²Technical University of Berlin, Berlin, Germany

DESCRIPTION OF TOPIC:

Oxidative processes with radicals as important intermediates have a significant impact on the quality and stability (shelf life) of beer. The oxidative reactions in beer are well studied, whereas the extent and impact of oxidative reactions, occurring during early stages of brewing, are not fully explored. Mashing has been identified as a critical step of oxidative events during the beer production, which is likely due to the lack of reducing power to quench reactive radicals such as the hydroxyl radical formed by the Fenton reaction:

$\text{Fe}_2^{+} + \text{H}_2\text{O}_2 \rightarrow \text{Fe}_3^{+} + \bullet\text{OH} + \text{OH}^-$ is thus an important intermediate of the oxidative processes initiated during mashing.

Results: In a laboratory scale mashing system, catalase treatment demonstrated a significant decrease of the initial rates of radical formation ($p < 0.05$) of wort, accounting for a 20% reduction. In lager beer pilot scale trials at VLB, Berlin, catalase significantly improved the endogenous antioxidative potential (EAP) and reduced the amount of radicals formed in the resulting beer. Consistently, catalase treatment during mashing resulted in a significantly improved beer flavour stability as evaluated by a professionally trained sensory panel.

L 34

The Brewers of Europe - securing our future

P.W. van Oeveren¹

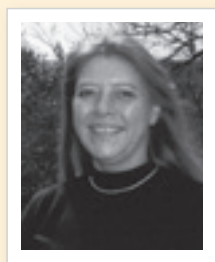
¹Heineken, Zoeterwoude, The Netherlands

DESCRIPTION OF TOPIC:

Currently a lot of EU legislation is being developed or revised under the umbrella of the Sustainable Consumption and Production (SCP) Action Plan and the EU Action Plan for Energy Efficiency. Examples of proposed measures are Ecolabel Regulation and the Ecodesign Directive being part of SCP Action Plan. The CO2 Emission Trading Scheme is an instrument to reduce emissions under the Action Plan for Energy Efficiency. Other relevant legislation is the recast of the Integrated Pollution and Prevention Directive (IPPC), the recently adopted Waste Framework Directive (WFD) with the 5 step waste hierarchy and the REACH Regulation (Registration, Evaluation Assessment and Restriction of Chemicals).

The Brewers of Europe are following developments in this area in order to protect the interests of the brewers. The Issue Management Team (IMT) Environment of the Brewers of Europe works together with the CIAA (Confederation of Food and Drink Industries in Europe), especially by participation in the Environmental Committee of the CIAA. The presentation deals with several issues that have been or are on the agenda. For the future, it is important to stay involved in the legislative processes in Brussels. It is also important to realize that the brewers are part of the supply chain from farmer to consumer. Cooperation with all actors in the chain is important to enable further environmental improvements.

Deborah K Parker



Debbie is a Sensory Scientist with an Honours Degree in Biochemistry and a Doctorate in Brewing Science. Debbie manages and trains the BRI Expert, Technical and QDA panels. Debbie is experienced at combining consumer work with sensory science to provide a complete understanding of brands. This work has included beer, wine, spirits and RTD's. Debbie is an accredited trainer, lecturing at the Siebels Institute, EBC Conventions and she is a member of EBC Analysis Sensory Sub-group committee. A professional beer taster, Debbie has judged at the Great British Beer Festival, has led tutored tastings at the British Embassy in Stockholm and the European Parliament and presented at the Cheltenham Festival of Science and given interviews for BBC Radio 4 Food Programme and World Service.

Anne M. Frederiksen

Pjotr van Oeveren



Pjotr van Oeveren studied Chemical Engineering at the Technical University Delft (The Netherlands). He worked as Process Engineer for an American Engineering / Construction Company and carried out projects for petrochemical and chemical industries in Europe and Saudi Arabia. He joined Heineken in 1983 and worked in various functions in Projects, R&D and Quality Management. Areas of expertise are: project management, utility installations, water and wastewater treatment, quality systems, auxiliary materials, environmental management, energy saving and safety. Since 1999 he holds the function of Environment & Safety Policy Manager at Heineken Supply Chain. He is Chairman of the Issue Management Team Environment of the Brewers of Europe.

L 35

Use of ionized air for reducing odour emissions in brewhouse vapours

Alexander Hofmann¹, Rudolf Michel¹

¹GEA Brewery Systems GmbH, Technology / Research + Development, Kitzingen, Germany

DESCRIPTION OF TOPIC:

Often brewing facilities that were once planned and built on the outskirts of a city have over the years become surrounded by residential buildings. Very often, odour emissions from wort boiling are perceived as unpleasant by many residents, particularly if vapours are emitted through the vapour stack throughout the whole year. When residents are then complaining, the brewery must take action and has to find a remedy.

So far, most measures for the reduction of odour emissions have required extensive upgrades and high maintenance efforts. The aim was to find a simple and cost-effective method for lowering the odour emissions from brewhouse vapours.

Results: With the installation of an ionization system at Vereinsbrauerei Apolda, the original intensity of odour emissions from wort boiling could be reduced by at least 70%. This was confirmed by a TÜV report. Since the installation of the ionization system, the brewery has not received any more odour nuisance complaints from residents.

L 36

Sustainable energy supply in brewing industry

Ludwig Scheller¹, Rudolf Michel¹

¹GEA Brewery Systems GmbH, Technology, R & D, Kitzingen, Germany

DESCRIPTION OF TOPIC:

The price development of fossil fuel has a huge impact on the opinion-making process in the brewing industry regarding the use of renewable energy sources. It is important that breweries are increasingly considering the use of spent grains or other energy rich waste of breweries to replace fossil fuel.

Results: The applied combustion box technique can be used for burning the spent grains of lauter tuns and mash filters. Even the combustion of DDGS, the by-product of bio-ethanol production, is possible without major changes in technique or applied process parameters. In addition other waste like yeast can be burned together with spent grains. Used labels of the bottle cleaning machine or the sludge of the waste water treatment plant should be considered as alternative fuel.

The results showed that standard exhaust gas cleaning systems with flue gas recirculation, electric filters and bag filters are sufficient.

The technique of the combustion box and the applied process technology allow, that emissions of CO, NOx, HCl and SO₂ could be kept within the requested limits of the German Technical Instructions on Air Quality Control.

L 37

Developing a corporate climate strategy

Johnnie Rask Jensen¹

¹Danfoss Solutions A/S, Kolding, Denmark

DESCRIPTION OF TOPIC:

Creating a climate strategy may challenge your company much more than energy efficiency programmes ever did, although they are naturally linked. What are the main differences between energy efficiency and climate strategy? What are the financial costs and benefits of a climate strategy? How do you set up realistic targets and implement them in your climate strategy? These are some of the questions which will be answered in this presentation. Industry can reduce CO₂ emissions by means of strategic climate investments and/or energy efficiency projects. You will get an overview of the challenges and benefits involved with both alternatives, and learn how they can work together. A look into economics will present the cash flow impact involved with various initiatives relating to energy. Performance measurements are important but you will be questioned whether KPI's are sufficient measures?

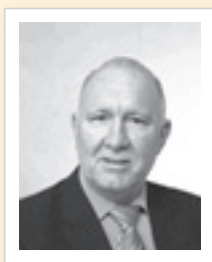
Results: Understanding the difference between climate strategy and energy efficiency, and economics thereof. Learning how energy efficiency programmes can support or even finance a climate strategy. Knowing which challenges will be part of this. Knowing why the most cost-effective CO₂ reduction initiative is to reduce utility consumption at industrial plants.

Alexander Hofmann



Alexander Hofmann received his diploma degree from the Technical University of Berlin at the VLB. Alexander Hofmann started his industrial experience with an apprenticeship as brewer & maltster at Sternquell Brauerei Plauen, then with the Brewery Landsberg as brewmaster and with Sternquell Brauerei on the field of a computer based personnel training system in cooperation with a German automotive manufacturer and on reducing energy costs. He joined Huppmann GmbH in January 2007 as part of the research & development team dealing with improvements of brewing technology and environmental aspects of brewing industry. He is a member of DBMB.

Ludwig Scheller



Curriculum Vitae Born March 30., 1955 at Neustadt an der Aisch, Germany Education Qualified Engineer of Brewing- and Beverage Technology Professional career since April 2007 at GEA Huppmann GmbH, R & D department, technology and energy management 1994 _ 2006 Managing Director of Albadomu Malata Bt. (Szalki Sziget, H - 2400 Dunaujvaros) 1984 _ 1994 at König-Brauerei, Duisburg-Beeck, Germany, final responsibility technical and production manager Studies 1974 - 79 TU München - Weihenstephan professional field technology of brewing and beverages Doctorate March 1981 to December 1983 at the institute of Technologie der Brauerei I, TU München - Weihenstephan, Prof. Dr. Ludwig Narziß

Johnnie Rask Jensen



Educational: Bsc. E.E. (1987) and MBA (1993) from South Denmark University Career: 2004 - present: President, Danfoss Solutions A/S, located in Kolding Denmark 2000 - 2004: Vice President, Danfoss Water & Wastewater _ NA Division, located in Milwaukee, WI., USA 1998 - 2000: Director of Marketing, Danfoss Drives Water & Wastewater Business Area, located in Rockford, Ill., USA 1993 - 1998: Manager, Strategic Business Area, HVAC, Danfoss Drives Division, located in Graasten, Denmark 1987 - 1993: Strategic Buyer, Semiconductors, Danfoss Drives, located in Graasten, Denmark

L 38

Large mash filters - improved results from new generation mash filter systems in practice

Jens Voigt¹, Hans-Joerg Menger²¹Technische Universität München, Weihenstephan, Freising-Weihenstephan, Germany, ²Ziemann Group, Ludwigsburg, Germany

DESCRIPTION OF TOPIC:

Mashfilters are gaining importance in the technology of wort separation with growing brewhouse capacities and unit sizes. In proven technology which has been in place for several decades the unit size was limited to approximately 12 tons of grist charge for many years. High gravity brewing, faster turnaround times and higher utilisation of brewing lines made it necessary to develop mash filter units of larger size. The new generation size of mash filters is beyond 26 tons of grist. They are now in operation for several years. The paper shows new construction details and the differences as well as and process performance compared to previous constructions. Several details lead to improved technical performance. Technologically the new filter generation gives very good results in yield, occupation time and overall capacity. The wort quality compares very well with previous systems. The paper describes technical improvements supported by technological effects. The central rail support system allows fast mechanical movements and a smooth and even mash transfer and distribution. Efficiency provides yields above laboratory values, while solids are low in general accompanied by good turbidity. All quality parameters were measured during commissioning of new full size filters equipped with this technique. Within selected brewhouse designs, the unit is quite flexible regarding the variation of raw material quality.

Results: The results were taken from practical large scale industrial brewhouse installations. The analyses were done by TUM.

L 39

Efficient formation and stripping of DMS during a brewing process without “boiling”

Gert De Rouck¹, Guido Aerts¹¹KaHo St.-Lieven, Industrial Engineering - Biochemistry, Gent, Belgium

DESCRIPTION OF TOPIC:

At the EBC congress in Venice (2007), Aerts presented a new approach of wort production. Classic boiling might be eliminated. Fine milling, mashing-in conditions whereby oxidative reactions are blocked, mashing-off at 95°C to improve an early protein/polyphenol flocculation and degradation of pDMS, can deliver a wort with a high stripping need without boiling need. In this lecture the concentrations of pDMS, DMS, DMSO and aldehydes during innovative wort production are compared with classic brewing.

Results: Classic brewing under the mentioned conditions delivers already a wort with low amounts of aldehydes. pDMS degradation is according to literature. Total process time was 6 hours.

Innovative produced wort had comparable aldehyde profiles. Also the free DMS concentration was very small. Residual amounts of pDMS in pitching wort was slightly lower and the DMSO content is comparable with classic anti-oxidative brewing. Total process time for innovative brewing was 4.5 hours.

L 40

Capacity increase and energy savings with a proline-specific endo protease

Jeroen L van Roon¹, Minh-Tam Nguyen¹¹DSM Food Specialties, Business Unit Enzymes and Dairy Ingredients, Delft, Netherlands

DESCRIPTION OF TOPIC:

Previous studies demonstrated that proline-specific endo protease (PSEP), commercial name Brewers ClarexTM, enables brewers to efficiently stabilize beer by specifically hydrolyzing haze active proteins thereby preventing complex formation with polyphenols. Here, new results demonstrate that PSEP also enables maturation capacity increase, energy costs reduction and lower carbon footprint while maintaining beer quality.

Results: IFBM results demonstrate that with PSEP cold-stabilization time could be shortened from 9 to 3 days without compromising beer shelf life; after 8 months of storage, beers were still visually clear at 0°C. When omitting cold stabilization completely a clear beer was produced with approximately 5 months shelf life.

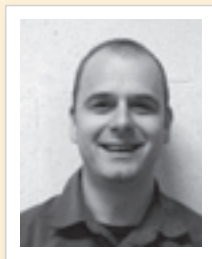
In addition, PSEP treated beers cold stabilized at either 0°C or at 7°C feature same colloidal stability leading to significant energy savings hence reducing CO₂ footprint of beer manufacturing. Moreover no differences were found in other quality attributes such as foam and taste, between PSEP stabilized beers and control. The trials at VLB further demonstrated the excellent flavor stability (based on VLB's 10 indicator chemicals) of PSEP treated beers with short stabilization process at elevated temperature. Since natural antioxidants remained in beer after PSEP stabilization, both endogenous antioxidant potential (EAP) and beverage antioxidant index (BAX) were high.

Jens Voigt



Jens Voigt received degree as Diploma Engineer (MSc) in Brewing and Beverage Technology from TU München-Weihenstephan, Germany in 1985. He held positions with Steinecker as an engineer in brewhouse and fermentation and filtration equipment. He received a PhD in brewing technology from with Prof. Dr. Narziß. In 1997 he joined Huppmann, Kitzingen. Since early 2004 he is a research associate and assistant professor at the Chair for Mechanical Engineering & Process Technology at the Center of Life Science, Weihenstephan. He is member of the MBAA & IBD, member of the editorial board and referee for papers in the Journal of the Institute of Brewing. He lectures at Weihenstephan and regularly selected seminars and international brewing conferences on brewing technology subjects.

Gert De Rouck



Born in 1974. Studies: Academic degree in Industrial Engineering - Biochemistry at the KaHo St.-Lieven, Gent, Belgium (1996). Appointments: 1997- present: responsible for the pilot brewing plants (2-5 hl) of the KaHo St.-Lieven; practical and theoretical courses in malting and brewing science; practical courses in biochemical engineering technics. Assistant Scientist in Malting and Brewing Science. Research topics: flavour stability, mixed fermentation, foam stability, high tech hopping, new milling and mash separation techniques. Since 2008 PhD student at KU Leuven.

Jeroen L van Roon



After finishing an MSc in Bioprocess Engineering, Dr. Jeroen van Roon graduated (honors) in Biocatalysis of Wageningen University, The Netherlands. In 2005, he joined DSM Food Specialties in Delft, The Netherlands, where he worked three years as Scientist Biochemistry and Application for brewing enzymes. He has played a major role in the development of DSM's innovative concept for beer stabilization, Brewers Clarex. Currently, he is Product and Application Development Manager for brewing enzymes, involved in the further development of DSM's brewing enzyme portfolio and of DSM's application knowledge in the field of brewing enzymes.

L 4 1

A new approach to control bottle conveyors

André Sorgatz¹, Tobias Voigt¹, Axel Kather², Horst-Christian Langowski¹

¹TU München, Lehrstuhl für Lebensmittelverpackungstechnik, Freising, Germany, ²Rockwell Automation GmbH, Freising, Germany

DESCRIPTION OF TOPIC:

Conveyors in bottling plants are not only used for the transportation of bottles. To compensate downtimes of single machines they are required as buffers that need to be controlled with reference to their filling level. Nowadays the filling level can only be detected stepwise with inductive or capacitive switches. To calculate the exact filling level, bottles that enter or exit the buffer need to be counted. To this day sensors for this counting task are missing for multi-lane in- or outlets of machines (e. g. bottle washers, packers).

Results: The exact control of the conveyor speed increased the downtime the buffer can compensate. This improves the buffers efficiency and may increase the efficiency of complete plants up to 5 per cent, as simulation studies verified. Additionally the collision speed of the bottles could be reduced. This resulted in reduced bottle scuffing and considerable lower sound emissions. Overall the continuous conveyor control enables a more evenly operation and reduces the mechanical wear of a bottling plant.

L 4 2

Model based diagnosis - a new approach for the downtime analysis in complex bottling plants

Tobias Voigt¹, Axel Kather², Peter Struss³, Horst-Christian Langowski¹

¹TU München, Lehrstuhl für Lebensmittelverpackungstechnik, Freising, Germany, ²Rockwell Automation GmbH, Freising, Germany, ³TU München, Lehrstuhl für Informatik IX, Garching b. München, Germany

DESCRIPTION OF TOPIC:

Bottling plants are complex lines consisting of several linked machines. To increase their today's efficiencies between 50 and 75 percent downtime originating components need to be identified. For this purpose brewers desire automatic systems. Due to interdependencies along the different material flows within the line for this is a difficult task. The presented interdisciplinary research project aspired to a solution, which saves resources by avoiding the establishment of a tailored system for each plant and is cheaply adaptable to changes.

Results: The validation through simulation and its use in analyzing real data from two different plants has provided evidence that the models really capture the essential features of plant behavior. Diagnosis algorithms based on the model components were implemented in a software tool. It allows the automatic localization of plant components, which caused downtimes of the filling machine. Technical downtime reasons could be identified with an accuracy of 89 per cent (status quo of September 2008).

L 4 3

On-site produced disinfectants in the brewery - analytics, monitoring and technological aspects

Christoph Kunzmann¹, Alfons Ahrens¹, Frank Jürgen Methner²

¹VLB Berlin, Research Institute for Water- and Waste Water Technology, Berlin, Germany, ²VLB Berlin / Technical University of Berlin, Berlin, Germany

DESCRIPTION OF TOPIC:

Disinfection processes are basic in drink and food producing industries to guarantee a hygienic and safe production. In times of an increasing cost pressure in breweries and increasing energy costs, the use of efficient and economic disinfectants gets more and more to the fore.

Beside common on-site produced disinfectants like ozone, chlorine dioxide and partly ionized air especially electro chemical activated (ECA) disinfectants based on the membrane cell electrolysis are coming up in a broad range of applications from the classical water disinfection up to CIP processes of tanks, lines and machines as well as rinsing and showering steps of bottles, packaging materials and full packs, replacing cost intensive thermal disinfection steps or converted disinfectants.

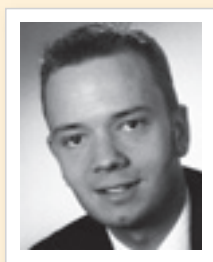
Results: The formation of by-products is strongly dependend to the water quality. The use in different parts of the breweries demands different approaches.

André Sorgatz



André Sorgatz (born 1980), trained as brewer and maltster from 09/2001 till 06/2003 at the Paulaner brewery in Munich. In June 2003 he graduated and became Munich Master of young brewers and Master of the South Bavarian Brewers Championship. After that he studied from 10/2003 till 11/2007 at the Technische Universität München / Weihenstephan. In November 2007 he graduated as an engineer (Dipl.-Ing.) for Brewing Science and Beverage Technology. In 12/2007 he started working as doctoral candidate and research associate at the Chair of Food Packaging Technology, Technische Universität München. His fields of activity at the university are: development of a new sensor to control bottle conveyors, control of conveyors at bottling plants, reduction of noise at bottling plants.

Tobias Voigt



Tobias Voigt (born in 1973) graduated as an engineer for brewing and beverage technology in Weihenstephan in 1999. After practical experiences (Privatbrauerei Gentner, Wolframseschenbach; Spaten-Franziskaner-Bräu GmbH, Munich; Gordon Biersch Brewing Company, San Jose(CA) USA; Syskron GmbH, Freising) he worked as a research associate at the chair of brewery installations and food packaging technology (Prof. Weisser) and earned a PhD in 2004. His current position is assistant professor at the chair of food packaging technology (Univ.-Prof. Horst-Christian Langowski) with activities in data acquisition, simulation and optimisation of bottling plants. He is qualifying for a postdoctoral lecturer in the field of information technology for the food and beverage production.

Christoph Kunzmann



Born 1973 Ruppener Brewery, Konstanz, Germany 1996 - 1997 Graduated as Dipl.- Ing. at TU Berlin 2003 Since 2004 Scientific Assistant VLB Berlin. Since 2007 Division Manager Water & Energy Management, Cleaning and Disinfection at VLB Berlin Working at PhD in the thematic of Disinfection under the direction of Dr. A. Ahrens and Prof.-Dr. F.-J. Methner.

L 44

Procedural aspects for a better lautering performance

Johannes Tippmann¹, Jens Voigt¹, Karl Sommer¹¹TU München, Lehrstuhl für Maschinen- und Apparatekunde, Freising, Germany

DESCRIPTION OF TOPIC:

The lautering process in the lauter tun is still a very time consuming process. But for that all, the procedural knowledge about the exact behaviour of the filter cake is still quite unexplored.

Current investigations on the institute show, that a deeper understanding of the behaviour of the particles, of the filter cake and the behaviour of them on each other bring faster and better lautering results.

Results: The results show the behaviour of the technological factors in dependence on the development of the particle size distribution during the mashing process. The tests in the lauter tun prove a better procedural characterisation of the filtration process and subsequently a basis for better process control of this step.

L 45

Modern process engineering for fermentation and storage cellars

Peter Gattermeyer¹¹Krones AG - Steinecker plant, Freising, Germany

DESCRIPTION OF TOPIC:

From the experiences of numerous finished fermentation and storage cellars, Krones has developed a new cellar concept. In this abstract, the latest findings and the development of this concept are presented.

Results: The new cellar concept is based on an execution in separate filling and discharging blocks with double seat (ds-) valves. Several tanks can be put on one common pipeline. The number of aggregated tanks can be defined individually. The gas side is designed fully automatical with ds-valves or, alternatively, semiautomatic with tilting bends.

The cellar can be extended independent on tank number and pipe length and therefore is more flexible. The clearly arranged and easily accessible construction facilitates the handling and maintenance. Due to the use of ds-valves directly at the tank outlet, the product content in the not-cooled pipes is reduced to a minimum.

With regard to product safety, the product and CIP-lines are separated leak safely. Product related discharging pipes are equipped with a D/A-water supply in order to minimize the oxygen uptake.

L 46

Extending approaches for production planning, process simulation and optimization

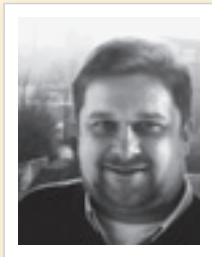
Martin Nagel¹¹Technische Universität München, Informationstechnologie Weihenstephan, Freising, Germany

DESCRIPTION OF TOPIC:

The fast progress in information technologies provides large computing power at low cost ratios. That makes it possible to extend and combine - despite the linked increase in required processing power - current modelling approaches in production planning as well as process simulation and optimization. These extended approaches allow for a new evaluation of optimisation problems in the fields of energy management and capacity planning.

Results: The example simulation environment was applied to a hypothetical brewery in a production planning preliminary test case. Currently it is in use for the optimisation of steam supply in a medium sized brewery. The simulation environment showed full reproductivity and adaption of the targeted problem. A statistical sensitivity analysis suggest (98% confidentiality) full parametric interaction between the modelling modules. Heuristic - tabu and genetic - search algorithms show good convergence and reproductivity. Both tested algorithms find solutions of the best 5% of the complete solution field with a approximate searchtime reduction of 1/40.

Johannes Tippmann



Johannes Tippmann graduated from university in 2004 as a degreed engineer for brewing sciences and beverage technology. In 2005 he started with his doctoral thesis with Prof. Sommer about solid handling in the brew house. He collected many experiences in the procedural knowledge in beer production during his studies, making student research projects and his diploma thesis in this topic.

Peter Gattermeyer



Since 2008 Head of Technology Department, Krones AG Steinecker Plant, Freising 2007 - 2008 Head of hot- and cold area, Krones AG Steinecker Plant, Freising 2003 - 2007 Head of hot area / brewhouse, Krones AG Steinecker Plant, Freising 1996 - 2003 Technologist, Anton Steinecker Maschinenfabrik GmbH, Freising 1991 - 1996 Academic studies at the Technical University Munich/Weihenstephan, graduation as degreed engineer

Martin Nagel



Born in 1979. Is a Research Assistant and Systems Administrator at the Information Technology Weihenstephan (ITW) of the Technische Universität München. His research specialising in process analysis, modelling, simulation and optimisation was funded and supported by several scholarships including the Weihenstephaner Jubiläumsstiftung and the Fleischmann Fonds. Additionally he is managing the IT Rooms for students at the Campus Weihenstephan as well as organising and giving exercise classes in higher mathematics and information technology. He started working at the ITW in November 2004 directly after finishing his studies in brewing science and beverage technologies.

L 47

The rate of uptake and release of Ca, Mg and Zn ions by serially repitched yeast slurry during industrial fermentation process

Aleksander Poreda¹, Piotr Antkiewicz¹

¹University of Agriculture in Krakow, Fermentation Technology and Technical Microbiology, Krakow, Poland

DESCRIPTION OF TOPIC:

The industrial conditions, mainly high hydrostatic pressure, shear forces, etc. may have a great influence on the dynamics of uptake and release of metal ions by yeast. We analysed the ionic content of yeast used many times and also of the relevant worts, during serial repitching into next fermentation cycles performed at industrial scale, comparing the results with those obtained in laboratory scale experiments.

Results: Intracellular level of zinc was relatively high at the beginning of the logarithmic phase, reaching the same level of ca. 0,5 mg/g d.m. regardless of the initial value present in yeast at the beginning of each fermentation. Whereas calcium, being required in flocculation, was absorbed by yeast towards the end of fermentation - but only in the case of industrial fermentations.

L 48

The effect of the timing of wort aeration on ester formation

Taku Irie¹, Yuichi Nakamura²

¹Asahi Breweries, Ltd., Ibaraki R&D Promotion Office, Production Technology Center, Moriya, Japan, ²Asahi Breweries, Ltd., Nishinomiya R&D Promotion Office, Production Technology Center, Nishinomiya, Japan

DESCRIPTION OF TOPIC:

In this study, we investigated the effect of the amount and timing of aeration on ester formation. From test brews under various wort aeration conditions, we found that oxygen has both a positive and negative effect on ester formation, which depended on the timing of wort aeration. We assumed that those conflicting effects reflected the two roles of oxygen for yeast growth. This result could be a clue to control the ester formation with the wort aeration process at a commercial scale.

Results: The TDOC in the brew with a flotation process was higher than the brew without a flotation process, in spite of the flow rate of injected air being the same. The amount of esters had a negative correlation with TDOC, and consequently a smaller amount of acetate esters was produced with a flotation process. Whereas when air was added after the filling of the fermentative tank, ester production significantly increased.

L 49

Feast or famine: how yeast manage amino acid metabolism during the aerobic to anaerobic transition: left to themselves, or with a little help from their friends

Peter John Rogers¹, Victoria Lyons², Vincent Higgins³, Bonny M Tsor⁴, Anthony Beckhouse⁵, Ian Dawes⁴

¹Foster's Group Ltd, Consumer and Category Solutions, Abbotsford, Australia, ²University of Western Sydney, School of Science, Food and Horticulture, Sydney, Australia, ³University of Western Sydney, College of Science, Technology and Environment, Sydney, Australia, ⁴University of New South Wales, School of Biotechnology and Molecular Biosciences, Sydney, Australia, ⁵Griffith University, The Eshtila Institute for Cell and Molecular Therapies, Brisbane, Australia

DESCRIPTION OF TOPIC:

Gene array analyses show aerobically grown yeast switch off amino acid (aa) biosynthesis and rely solely on amino acid uptake. Anaerobically it's opposite; amino acid uptake is switched off and yeast depend on biosynthesis. One-C metabolism (serine, glycine) becomes critical for yeast growth and vitality. It also affects production of flavour actives. But simple wort manipulation can overcome aa exclusion anaerobically which in turn profoundly affects ester production.

Results: Gcn4p is a transcriptional activator of more than 30 amino acid (aa) biosynthetic genes. We have investigated the role of amino acids and Gcn4p in the shift of yeast from aerobic to anaerobic conditions and found that the gcn4 mutant has an extended lag under anaerobic conditions. This delay is rescued by adding serine or glycine to the medium. Most added serine accumulates in the cell wall mannoprotein. Serine and glycine both act as donors for the one-carbon unit in one-carbon metabolism, which is required for biosynthesis of purines, some amino acids, dTMP and some cofactors. Cell wall structure is a critical adaptation for anaerobiosis. The mannoprotein Cwp2p is essential for aerobic cell wall synthesis. It is replaced by a family of mannoproteins including Tir3 anaerobically. Cwp2p has 10% serine, whereas Tir3p has 23%. This may explain the serine requirement. This is relevant to stuck fermentations and a check-point for commitment to flocculation.

Aleksander Poreda



Graduated from The University of Agriculture in Krakow in 2000 - Department of Carbohydrates Technology. PhD in 2006 - The influence of selected metal ions on brewers wort fermentation performance

Taku Irie



Born in 1975. He received a M.S. degree in engineering from the University of Tokyo in 2000 and began working for Asahi Breweries, Ltd.. He worked in the Packaging Section Suita brewery from 2000 to 2001 and Hukushima brewery from 2001 to 2005. Since October 2005, he has been working at the Ibaraki R&D Promotion Office, Production Technology Center, and since 2007, he has been in charge of the technological development of brewing.

Peter John Rogers



Peter studied chemistry then a PhD in yeast genetics (ANU); he worked at the Max Planck Institute Experimental Medicine before a lecturing position at Griffith University. But his early biochemical grounding was from his father a cheese maker in country Victoria. He combined academia with consulting jobs in extractive biochemistry in Queensland. He worked for BHP on new products, even rip-top steel cans. He is past President of the Australian Biotechnology Association; with colleagues he received the ASBC Eric Kneen award from the ASBC, and the Presidential Award MBAA. He is an adjunct professor at RMIT and Griffith Universities. Some of his recent projects: a plant-based beer finings, „age-proof beer“, manipulation of amino acid metabolism, bentonite-free stabilisation of white wine.

L 50

Sulphite production by lager yeast in high gravity glucose rich worts: Clarifying the role of cloudy worts

Eric J Samp¹, Paul Hughes²

¹MillerCoors LLC, Quality Assurance, Golden, United States, ²Heriot-Watt University, International Centre for Brewing and Distilling, Edinburgh, United Kingdom

DESCRIPTION OF TOPIC:

During fermentations with lager yeast in High Gravity Glucose Rich (HGGR) worts, high levels of sulphite production can occur. Cloudy worts, or worts rich in trub solids, have been known to diminish the levels of sulphite produced with these fermentations, even under hypoxic conditions, yet it is still a contentious topic in brewing as to exactly what role solids play in regulating sulphite production.

Results: It was clear from the data that the lipid rich solids influenced sulphite production ($p\text{-val} < 0.05$). It was found that three lipids played a role in reducing sulphite ($p\text{-val} < 0.10$) in this experiment: linoleic acid, lecithin, and campesterol.

L 51

Microbial T-RFLP screening as a solution for premature yeast flocculation (PYF) assurance for malt

Evan Evans¹, Mandeep Kaur¹, Doug Stewart², Megan Sheehy², Alex Speers³, Joseph Lake³, John Bowman¹

¹University of Tasmania, TIAR, Hobart, Australia, ²Joe White Maltings Pty Ltd, Adelaide, Australia, ³Dalhousie University, Dept of Food Science and Technology, Halifax, Canada

DESCRIPTION OF TOPIC:

Premature yeast flocculation (PYF) is an intermittent brewing fermentation problem that results in incomplete wort fermentation, and is a significant problem for some breweries. When PYF occurs it can cause significant losses in out of specification beer (incompletely fermented beer) to the brewer. The occurrence of PYF appears to be related to certain malt batches, however detection of these problem batches by way of a fermentation test that is problematic and time consuming.

Results: We have made a significant breakthrough with the T-RFLP approach and concept. Very striking differences in the microbial DNA finger print patterns, particularly for the fungal PCR primers, between PYF +ve/-ve malts are obvious by using the T-RFLP technique. We are currently screening further confirmed PYF +ve/-ve batches of malt to validate our discovery.

L 52

Towards an understanding of hop resistance in beer spoiling lactobacillus brevis

Rudi F. Vogel¹, Jürgen Behr¹

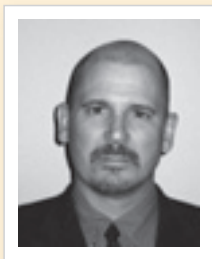
¹Technische Universität München, Technische Mikrobiologie, Freising, Germany

DESCRIPTION OF TOPIC:

Lactobacillus brevis comprises strains with diverse metabolic capabilities. Some specialized strains can grow even in highly hopped pils beers without the need of long term adaptation. Other strains develop tolerance upon prolonged hop exposition or remain sensitive. This work sheds light on the molecular mechanisms behind these differences and provides clues for differentiation of „harmless“ versus „critical“ strains for the brewer.

Results: Beyond previously described transmembrane transport-based hop resistance mechanisms, hop adaptation in *L. brevis* TMW 1.465 is a multifactorial process, which results in changes in metabolism, protein profile, membrane and cell wall composition and intracellular manganese levels. It involves mechanisms to cope with intracellular acidification and divalent cation limitation, redox imbalance and oxidative damage and mechanisms for energy generation and economy, genetic information fidelity and enzyme functionality, and as a result enables beer spoilage.

Eric J Samp



Eric Samp holds a Ph.D. in Applied Statistics from the University of Northern Colorado and is currently completing a M.Sc. in Brewing and Distilling from Heriot Watt University. Eric has held the positions of brewing quality engineer, technical brewer, and brewing quality assurance manager for Coors Brewing Company over the past decade. He is currently serving the role as a corporate statistician for MillerCoors, LLC in the manufacturing quality department. and has published papers in the Journal of the Institute of Brewing, Journal of the American Society of Brewing Chemists, and the MBAA Technical Quarterly. He is a recipient of the Eric Knead Award (2001) and serves on the editorial review board for the Master Brewers Association of the Americas. His main research topics are in sulphur dioxide production by yeast and the role of lipids in brewing.

Evan Evans



Evan Evans graduated with a B. Agr. Sc. (Hons) in 1986, followed by a Ph.D. in 1990, both at the University of Melbourne. In 1992, he joined the University of Adelaide where he developed his interest in malting barley and brewing. Recently he relocated to the University of Tasmania where his brewing research interests continue to be in improving malt quality to improve beer quality and the efficiency of the brewing process. Dr Evans is currently serving on the IBD Awards Committee and is a member of the editorial board for the Journal of the ASBC. In 2005, Evan was made a Fellow of the Institute of Brewing and Distilling.

Rudi F. Vogel



Prof. Dr. Rudi F. Vogel is a biochemist interested in food microbiology and biotechnology. As head of Technische Mikrobiologie at the technische Universität München he conducts research on starter culture development, high pressure in food and biosciences as well as control of unwanted microbes in food. A clear focus is on lactic acid bacteria, their metabolism and genetics, pre- and probiotic functionality and mechanisms of stress response and adaptation. In this context beer spoiling lactobacilli are used as models to understand molecular mechanisms of hop resistance.

L 53

Phenotype MicroArrays - a new method for yeast characterization and measuring yeast metabolism?

Samantha Louise Walker¹, Laura Alonso¹, Stephen Livens¹, Nick J Brain²

¹BRI, Nutfield, United Kingdom, ²Technopath, Limerick, Ireland

DESCRIPTION OF TOPIC:

This paper is to our knowledge the first to use the newly developed Phenotype Microarray (PM) technology to characterize brewery yeasts and to identify nutrient deficiencies. The Phenotype MicroArray platform (PM) that was developed by BIOLOG Inc. was used to study yeast metabolism and sensitivity to stresses. The ability of commercial strains to grow under controlled gas conditions and under hundreds of different metabolic conditions was measured by colorimetric dye chemistry. The rate of growth was measured kinetically in the OmniLog kinetic reader and the resulting data gave detailed information on the metabolic characteristics of the cells as well as their sensitivity to stresses such as salts and pH and chemical inhibitors.

Results: BRI have worked with Biolog to investigate the potential to characterise brewing yeast isolates and to identify phenotypic changes or utilisation of key nutrients that occur during serial re-pitching and storage. We have demonstrated that there are clear changes in yeast phenotype during serial re-pitching. We can characterise individual brewery strains and can identify deficiencies in biochemical pathways for nutrient uptake and utilisation.

L 54

Nutritional changes of barley, rye and buckwheat during malting

Florian Hübner¹, Frithjof Thiele¹, **Elke Arendt**¹

¹University College Cork, Department of Food & Nutritional Science, Cork, Ireland

DESCRIPTION OF TOPIC:

The market of functional food and beverages is fast developing due to the changing lifestyle of the consumer and a growing dietary awareness. Malted cereals and pseudo cereals are becoming more and more interesting as ingredients for these kinds of functional foods. The aim of this study was to determinate the general levels of relevant substances like phenols, antioxidants, beta-glucans etc in various grains and to determine how their levels change during malting. To be able to optimize the content of these substances during malting a statistical design of experiments approach was used.

Results: Compounds with potentially health promoting substances are present in all four investigated grains. However, the impact of malting on the grains differs. Beta-glucan was quickly degraded during malting in barley. In contrast, arabinoxylans in rye were accumulated and became increasingly extractable with longer germination times. The average molecular weight decreased due to enzymatic breakdown. Malting of buckwheat did increase the content of phenolics. For the other two grains, the extracts of the malts contained more phenolics than the unmalted grain. Similar results were found for the antioxidant activity.

L 55

Evaporation of unwanted wort flavour components in the cold section of the brewery

Michael Dillenburger¹, Marcus Hertel¹, Hans Scheuren²

¹HERTEL GmbH, Salzburg, Austria, ²TU München, Lehrstuhl für Maschinen- und Apparatekunde, Freising, Germany

DESCRIPTION OF TOPIC:

Evaporation of unwanted flavours out of wort is only performed in the hot section (brewhouse) of a brewery until today. It is known from many fields of process engineering that an evaporation at lower temperatures can have many advantages. On the one side the thermal stress can drastically be reduced. On the other side it is in some cases possible that the separation factor of components between steam and liquid increases at lower temperatures. Because of these facts it was researched if an evaporation in the cold section of the brewery brings advantages in the field of wort/beer production.

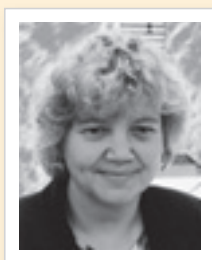
Results: The results show that the separation factor of many unwanted flavour components drastically increases with decreasing temperature. For example, the separation factor of dimethylsulfide is about 75 at atmospheric boiling conditions, while at 30-35°C its value is more than 3000. Thus, it is obvious that clearly less wort has to be evaporated in the cold section of a brewery to reach a desired flavour profile in wort. As also the Henry's law constant is higher at lower temperatures, no high vacuum is needed for an evaporation at low temperatures. This can also be performed by a desorption. The results were proven with an evaporation at a pilot plant in a brewery.

Samantha L. Walker



Samantha holds a degree in Agricultural and Food Sciences from Nottingham University. She was awarded a doctorate from the University of Wales, Cardiff for her work on food microbiology. Samantha subsequently worked as a Higher Scientific Officer in the Molecular Genetics Unit at the Veterinary Laboratories Agency, Weybridge. She joined BRI in 1998 to work on the development of molecular biology methods for the detection of beer spoilage organisms and has been project manager for a number of grant funded research and contract service projects in brewing, molecular biology and microbiology. This work has been published in both peer reviewed academic journals and trade magazines.

Elke Arendt



Dr Elke Arendt is a senior lecturer in the Department of Food and Nutritional Sciences, University College Cork since 1993. She lectures and carries out research in the area cereals, malting and brewing science specific focussing on gluten free foods and beverages, starter cultures, functional beverages, rheology and food structure. Prof. Dr. Arendts research programme at UCC, to date, has resulted in over 120 peer-reviewed research papers, 1 book, 25 book chapters, and approximately 350 additional published articles and abstracts. Her current research group comprises of 26 researchers (post docs and PhD students).

Michael Dillenburger



After his studies he worked in the distilling industry. Since January 2008 Michael Dillenburger became the head of the sales department of HERTEL GmbH / Salzburg.

L 56

Beer shades to match your lipstick and other adventures in new product development

Caroline Walker¹, Laura Alonso¹, Chris Boer¹, Andy Faulkner¹, Debbie Parker¹, Samantha Walker¹

¹BRI, Nutfield, United Kingdom

DESCRIPTION OF TOPIC:

Beer has never been just about barley. Over the history of brewing, many different starch sources have been used to add flavour and character to beer. With the rapid rise in malt prices, the possibility of barley shortages and consumer demands for natural products, we believe that the time is right to explore brewing with some novel adjuncts. With the philosophy that 'anything goes' we selected raw materials to provide natural colour, flavour and potential economical benefits for brewing. This presentation will discuss the successes and failures of these brews, and the lessons learned, while exploring these Alternative raw materials.

Results: Initially, a wide range of raw materials were compared for extract, filtration performance and for flavour on the laboratory scale. Based on these data, we selected 5 raw materials for brewing trials. To produce a red hue, beetroot was added at 5% to the grist. For extract, carrot, butternut squash, chickpeas and cassava were included as 20% adjuncts. These brews gave us surprises in terms of their brewing performance and flavour, and this talk will describe some of the challenges faced using these raw materials.

L 57

Maltose syrup production from barley in an standard brewhouse

Patrick Bahns¹, Rudolf Michel¹

¹GEA Brewery Systems GmbH, Technology, R&D, Kitzingen, Germany

DESCRIPTION OF TOPIC:

Due to cost pressure for purchase of High Liquid Maltose (HLM) a customer wants to modify his existing brewhouse for the production of maltose syrup made from barley. The paper will highlight the planning and the process development based on the use of the existing lauter tun for syrup filtration.

Results: The existing lauter tun defines the milling technique. Under these conditions pilot plant trials were made to work out an infusion mashing regime of less than 4 hours allowing 12 brews/day and reaching the project goals regarding sugar composition and turbidity. We achieved a stable industrial process using a mixture of 85% barley, 15% malt and a taylor made enzyme complex.

The lauter tun delivers wort with final gravity of 13 °P. Based on these findings the falling film evaporation plant was designed for a final concentration of the syrup at 77 °Brix. To standardize the group-wide use of this maltose syrup the variation of the inlet gravity from the brewhouse must be compensated by using a 'finisher' unit after the 4-stage-falling film evaporation.

L 58

Evaluation of the amino acid composition and fermentation performance of barley worts

Stefan Kreis¹, Niels Elvig¹, Hans-Peter Heldt-Hansen¹

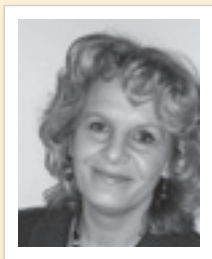
¹Novozymes A/S, Brewing and alcoholic Beverage, Bagsværd, Denmark

DESCRIPTION OF TOPIC:

Yeast fermentation performance is influenced by amino acids. The amount of amino acid of all malt wort is determined by the malting procedure and adjustments at lower mashing temperatures. A tool to influence the amino acid composition is not established. As unmalted barley is used world wide as brewing raw material the aim of this paper was to show which amino acid contribution barley can add to the wort profile. In a system of barley and exogenous enzymes one can imagine that not only the amount but as well the composition can be influenced by the choice of specific enzymes and therefore provides a tool to design a favorable amino acid composition.

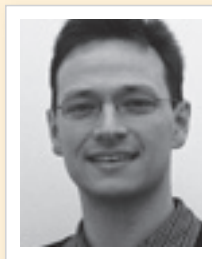
Results: The results show that wort derived from 100% barley has a lower amount of amino acids but also a different amino acid profile. By applying the right exogenous proteases the amount can be enhanced to 80% of all malt wort. According to the absorption ranking from Jones the barley wort profile has 30% more amino acids in group 1 and 2 but only a small content of prolin. It was shown that for the same fermentation performance a lower amount of amino acid was necessary and it was found that the amount of residual amino acids can be reduced within barley wort fermentation significantly. The paper will show the influence of the different profiles on cell growth and ethanol yield. Pilot trials in 10 hl scale with taste panel results will show the effect on flavour stability and the antioxidative potential.

Caroline Walker



Caroline holds a doctorate in Biochemistry and has wide international research experience from her work in the UK, USA and also at the Carlsberg Laboratories. Caroline is the Operations Director at BRI, and her teams are responsible for Membership, information services, training, pilot plant work, flavour & innovation, research and development and microbiology. Caroline is also Manager of the Health Programme. In this role she manages research projects on aspects of beer and health, as well as running an e-mail network alerting breweries to new issues that arise in the medical literature.

Patrick Bahns



BAHNS, Patrick (32): Industrial experience 1996 - 1998 apprenticeship as brewer & maltster at Brauerei Beck&Co, Bremen; 1999 employed brewer at Brauerei Beck&Co, Bremen; since 2004 engineer at Huppmann GmbH, Kitzingen at technical quotations department, later in Project engineering; currently in research & development team. Studies: 1999 - 2004 Brewing and Beverage Technology at Technical University of Munich at Weihenstephan; diploma engineering degree

Stefan Kreis



Dr. Stefan Kreis studied Brewing and Beverage Technology at the TUM-Weihenstephan, Germany. He graduated as engineer 1997. From 1997 until 2002 he completed his Doctoral thesis at the Institute for brewing technology I in Weihenstephan. From 2000 until 2002 he worked as a Scientific Employee and Assistant at the malt laboratory at the Institute for Brewing technology I. From 2002 until 2007 he was an assistant professor and head of the malt laboratory. His main interest of research has been cereals, enzymes, malting technology and beer filtration. He also worked as a consultant for malteries and breweries. Since May 2007 he works as a science manager for Novozymes A/S in the Department for Brewing and alcoholic Beverage in Copenhagen, Denmark.

ABSTRACTS POSTERS:

P 001

A rapid and simple method for analysis of bitterness in beer by FTIR spectroscopy

Helmut Klein¹, Clemens Forster¹, Wolfgang Märzinger², Michael Haberkorn²

¹Brau Union Österreich AG, Quality Assurance & Development, Linz, Austria, ²Upper Austrian Research GmbH, Contactless Sensor Technology, Linz, Austria

DESCRIPTION OF TOPIC:

Many consumer related quality attributes of beer like colour, gravity, alcohol content and turbidity can nowadays be quickly assessed by inline measurement allowing rapid and precise control of these parameters before product release. For bitterness of beer no reliable method exists to date that is suitable for routine inline measurement. The aim of the project was to develop an infrared spectroscopic measurement system for rapid and simple measurement of bitterness in beer.

Results: NIR spectroscopy and mid infrared ATR technology showed too low sensitivity for the determination of bitterness or iso-alpha acids in a precision range which has practical relevance. Mid infrared (MIR) spectroscopic measurements performed with a liquid flow cell with a path length of 25 µm showed the best correlations with iso-alpha acid concentration and photometric determined EBU. By applying multivariate data analysis, the mean deviation of MIR spectroscopic measurement method to HPLC-method is below 1.3 mg/l iso-alpha-acids. The mean deviation of MIR spectroscopic measurement method to the photometric method is below 0.9 EBU.

P 002

Cryoscopy as an analytic tool in lactic acid fermentation

Moritz Krah¹, Katharina Bakic¹, Werner Back¹

¹TU München, Lehrstuhl für Technologie der Brauerei I, Center of Life and Food Sciences Weihenstephan, Freising, Germany

DESCRIPTION OF TOPIC:

Lactic acid is often used in breweries for wort and mash acidification. Natural derived lactic acid is commonly utilized. Especially breweries operating in accordance to the German purity law are only allowed to use the so called „sauergut“ obtained by lactic acid fermentation. To obtain optimum acidification results it is important to know the concentration of lactic acid. The decrease of the pH-value is depended on the buffer capacity of the fermented wort and thus the original gravity. So the pH-measurement is no quantitative analysis. Lactic acid can be measured quantifiable by titration and enzymatic, but also the use of cryoscopy could be a useful approach. Cryoscopy measures the freezing point depression. During lactic acid fermentation one mole of glucose is metabolized to two moles of lactic acid. Due to the resulting increase in solutes per kg of solvent the freezing point in the „sauergut“ is lowered.

Results: The pH-value correlated excellent with the amount of lactic acid produced by the lactobacilli. If the original gravity of the fermented wort changed the pH-value was no good indicator for the produced amount of lactic acid. Only the fermentation progress could be monitored by the pH-value, lactobacilli stopped fermenting at a pH of 3.0. The freezing point depression correlated with the amount of lactic acid measured by titration. This correlation was independent of the original gravity at the beginning of the fermentation process.

P 003

Loop-mediated isothermal amplification to detect and identify beer spoilage *Lactobacillus* sp. bacteria

Hiroyuki Murakami¹, **Nobuyuki Hayashi**²

¹Kirin Holdings Company, Limited, Central Laboratories for Frontier Technology, Center for Food Safety Science, Takasaki, Japan, ²Kirin Brewery Company, Limited, Research Laboratories for Brewing, Yokohama, Japan

DESCRIPTION OF TOPIC:

Contamination of beer by lactic acid bacteria e.g. the genus *Lactobacillus* is a major concern in the brewing industry. However, detection using culturing, conventional taxonomic tests, and existing molecular techniques are time consuming and/or costly. Recently, loop-mediated isothermal amplification (LAMP) has been reported as a simple, rapid, specific and cost-effective nucleic acid amplification method. We applied LAMP to detect and identify the beer spoilage *Lactobacillus* sp bacteria.

Results: The LAMP primers distinguished the target species or beer spoilage strains from other lactic acid bacteria in 40 - 60 min. Moreover, the LAMP method with these primer sets could detect about 1×10^2 cfu of lactic acid bacteria from suspensions in distilled water and beer that contained large amounts of bottom fermenting yeast cells.

Helmut Klein



Corresponding author Helmut Klein is laboratory manager of the centrallaboratory of Brau Union Österreich AG. He worked over 30 years primarily with chromatographic and spectrometric analytical systems. Emphasis of his analytical activity are the development of automatic analyses systems, determination of off-flavours and investigations in taste stability.

Moritz Krah



Moritz Krah was born in 1980 in Schwetzingen/Germany. After attaining the German Abitur (A-level certificate) in 2000, he started studying brewing and beverage technology at the Technische Universität München in Weihenstephan. In 2005 he graduated with a Dipl.-Ing. degree and has since then been working as a Ph.D. student at the Chair for Technology of Brewing 1 in Weihenstephan.

Nobuyuki Hayashi



Nobuyuki Hayashi is a researcher at the Research Laboratories for Brewing, Kirin Brewery Company, Limited. He graduated from Yamanashi University in 1990 with an M.S. in fermentation technology and joined Kirin Brewery. He has been involved with yeast technology and brewery microbiology since 1990. From 2002 to 2004 he had worked on yeast technology as a guest researcher in the Lehrstuhl für Technologie der Brauerei I, at Munich TU. He received his Ph.D. degree (agriculture) from Tokyo University in 2007.

P 004

A rapid non-destructive method for quantification of fungal infection on barley and malt kernels

Sabrina Bodevin¹, Glarborg Larsen Tone¹, Finn Lok¹, Carstensen Jens Michael², Jørgensen Kim³, Skadhauge Birgitte¹

¹Carlsberg A/S, Carlsberg Research Laboratory, Valby, Denmark, ²Videometer A/S, Hørsholm, Denmark, ³Danish Malting Group A/S, Vordingborg, Denmark

DESCRIPTION OF TOPIC:

Barley harvest 2007 in Europe has seen the resurgence of crops highly infected by filamentous fungi. Hence the evaluation of fungal infection on barley and malt kernels by conventional optical measurement methods lacks accuracy and can be tedious. Here we are presenting a new vision system to rapidly perform this task using the VideometerLab®. This system provides a rapid colour, shape and texture measurement, ideal to analyze kernels surfaces. The principle employed is a high-intensity sphere illuminated by light emitting diodes together with a high-resolution black and white camera. The digital image is acquired in less than 10 seconds, over an 18 bands spanning ranging from the ultra-blue (430 nm) to the near-infrared (970 nm) and then analyzed by the VideometerLab® statistical analysis software.

Results: A good correlation between competitive ELISA tests, real-time PCR experiments and VideometerLab® prediction was found ($R^2=0.75$). The results obtained indicate that the videometerlab® equipment can accurately evaluate the percentage of global fungal infection in kernels.

P 005

New oxidation destructive analysis (NODA)

Jan Savel¹, Petr Kosin¹, Adam Broz²

¹Budweiser Budvar, N.C., R&D, Ceske Budejovice, Czech Republic, ²Budweiser Budvar, N.C., Production, Ceske Budejovice, Czech Republic

DESCRIPTION OF TOPIC:

Beer color changes during storage are explained by various mechanisms. Usually, enzymatic as well as non-enzymatic oxidations of polyphenols and/or formation of melanoidin substances are considered. The color is described through beer absorption spectrum in visible region. On the other hand reducing environment is typical for beer but it cannot explain why beer undergoes oxidation under anaerobic condition. The explanation of the paradox is the aim of this poster.

Results: Yellow and brown pigments were formed by air oxidation of single polyphenols as well as by thermal degradation or alkaline decomposition of sugars. The formation of pigments derived from sugars continues at anaerobic ageing while their degradation starts under aerobic condition. The pigments represented typical acid/alkaline indicators that gradually became irreversible by various mechanisms. The natural changes of beer absorption spectra were similar to those obtained by physical and chemical activators.

P 006

Sorghum: An underestimated source of antioxidants and healthy polyphenols for gluten-free beer production

Meike Bröhan¹, Vesna Jerkovic¹, Sonia Collin¹

¹Université catholique de Louvain, Unité de Brasserie et des Industries Alimentaires, Louvain-la-Neuve, Belgium

DESCRIPTION OF TOPIC:

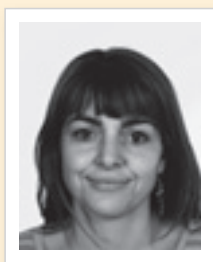
The increasing interest of using sorghum by European brewers is due to its advantage of being gluten-free. For a long time, sorghum is also known to contain very high levels of several polyphenols (1), allowing maintaining low trans-2-nonenal concentrations in aged beers. Moreover, two stilbenes were recently identified in red sorghum in our laboratory (2).

The aim of this work was to investigate various red and white sorghums from different regions of Burkina Faso. In order to select the most promising samples for brewers, we have compared their stilbenes, flavan-3-ols and procyanidins content, as well as their antioxidant activity and their ability to prevent cardboard off-flavour in aged beers.

Results: Red sorghum samples revealed to exhibit 5-15 times higher antioxidant activity than pale malt and only 2-5 times lower antioxidant activity than hop pellets (6).

Some red sorghum samples also revealed exceptional in terms of stilbene concentrations, bringing more resveratrol and piceid to wort than hop.

Sabrina Bodevin



1999 PhD Protein engineering, Paris, France 2000-2003 post-doc Protein catalysis, Stockholm Sweden 2004-2007 post-doc Glycoaminoglycans, Uppsala, Sweden 2008 Research scientist, Carlsberg, Copenhagen, Denmark

Jan Savel



Dr. Jan Savel was born in 1944 in Ceske Budejovice (Budweis), Czech Republic. He studied at the Institute of Chemical Technology, Prague, graduating in 1967 with a Ph.D. degree. Currently, Dr. Savel is an external associate professor at the Institute of Chemical Technology, Prague, as well as head of the Research Department at Budejovický Budvar Brewery, N.C., Czech Republic. Dr. Savel has been a member of the EBC Brewing Science Group since 1994. He has published more than 100 articles in Czech and foreign professional magazines, as well as a monograph dealing with brewing microbiology.

Meike Bröhan



In 2007, she got her diploma as a chemical engineer at the University of Applied Sciences in Lübeck (Germany). After that she started to work as a researcher at the University of Louvain-la-Neuve (Belgium) in the department of Brewery and Industrial Food. Under the supervision of Prof. Sonia Collin, she is analyzing polyphenols in food (e.g. chocolate and sorghum) by using mainly HPLC-MS.

P 007

Characterization of volatile compounds in beer by means of comprehensive 2D-gaschromatography mass spectrometry

Emanuele Boselli¹, Paolo Lucci¹, Giuseppe Di Lecce¹, Andrea Giomo¹, Natale G. Frega¹

¹Università Politecnica delle Marche, SAIFET, Ancona, Italy

DESCRIPTION OF TOPIC:

Comprehensive bidimensional gas-chromatography (2D-GC) coupled on-line with quadrupole mass spectrometry (qMS) is an innovative technique which was applied for the unambiguous characterization of the volatile profile of beers sampled using Dynamic Headspace Solid Phase Microextraction (DH-SPME).

Results: The 2D-GC trace shows a clear distribution of the volatiles due to the non-polar/medium polar phase combination. More polar compounds, such as sulphur, aromatic and heterocyclic compounds, were more retained in the second dimension and were thus located in the upper part of the 2D plot with respect to the less polar compounds (aliphatic esters, alcohols, organic acids, ethers, hydrocarbons). The spelt beers showed higher levels of aliphatic esters (ethyl hexanoate, ethyl octanoate, ethyl decanoate and ethyl dodecanoate) and lower contents of monoterpenes (linalol, terpineol, citronellol and nerol) and damascenone with respect to Pils and double bock beers. This profile was related to the sensory analysis showing that Pils and double bock beers were bitter, while the spelt beers had a fruity and honey flavour. This was presumably due to the typical fruity aroma of the ethyl esters.

P 008

Practical brewer's approach to near infrared spectroscopy

Adam Broz¹, Petr Kosin², Jan Savel², Josef Prokes³

¹Budweiser Budvar, N.C., Production, Ceske Budejovice, Czech Republic, ²Budweiser Budvar, N.C., Research and Development, Ceske Budejovice, Czech Republic, ³Research Institute of Brewing and Malting, Brno, Czech Republic

DESCRIPTION OF TOPIC:

Near infrared spectroscopy (NIRS) is an instrumental method used in agriculture and food industry for many applications. A lot of papers describe also its usage in breweries, mostly for malt analysis. Laboratory of an industrial brewery has been equipped with FT-NIR device, calibration models for malt and hops were built and the method has been used for three years with various crops of barley and hops. Current experience revealed several necessary items to be done for correct work of the calibration models. This paper discusses the appropriate approach to this method to be fully functional.

Results: Experiments showed strong correlation between NIR spectra and many important quality characteristics of malt and hops. Easy handling, low sample preparation requirements and fast quality prediction of raw materials incoming into the industrial brewery made NIRS usable in everyday brewery routine. In spite of lower accuracy when compared to reference methods were the results satisfactory if the calibration models were maintained properly. The maintenance of model was tested in long-term period. Our work revealed a need of continuous update of models, not only in case of new crops, and pointed out the most important rules to reach long-term models efficiency. Several other applications in brewery are shown such as quick monitoring of main fermentation, changes of mash spectrum during mashing.

P 009

New cognitions on the gushing phenomenon

Manuel Christian¹, Vladimír Ilberg¹, Jean Titz¹, Ahmet Alper Aydin², Fritz Jacob¹, Harun Parlar³

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DESCRIPTION OF TOPIC:

As the brewing industry is permanently facing problems with gushing, this research focused on the application of two acknowledged gushing tests (MEBAK) in order to cope with this problem and to better understand gushing as a mechanism in general.

Results: After heating the mash up to ca. 80°C, without boiling but filtration afterwards, one malt sample that according to Weihenstephaner test exhibited a high gushing potential showed no overfoaming of the carbonized wort. Although the wort sample produced thereby was boiled afterwards, gushing was not observed either. When the mash was heated above 80°C, gushing of the produced wort was increasingly induced in dependence of increased heating time. Reduced amounts of ground malt grain down to 10% did not cause gushing any more. After extended boiling applied for this 10%-standard malt, overfoaming amount did also not increase. Therefore a formation of substances relevant for gushing could not be confirmed. Gushing amount reduced significantly by inducing CO₂ bubbles in gushing wort and may be effective to reduce gushing. After bubbling CO₂ through gushing wort and apple spritzer, a lower surface tension of the upper liquid/foam segment than of the middle was observed. A higher number of minimal particles (> 1 nm) were detected in non-alcoholic gushing syrups compared with the non gushing ones. Hydrophobins (from *Fusarium*

Emanuele Boselli



Professor of Enology and Food Industries at the Università Politecnica delle Marche, Ancona, Italy; PhD in Food Biotechnology; Co-author of over 80 publications in the field of food technology and food analysis.

Adam Broz



Adam Broz received Ing. (MSc. equivalent) degree in brewing and malting from Institute of Chemical Technology Prague, Department of Fermentation Chemistry and Bioengineering, Prague, Czech Republic in 1999. He has been employed for Budweiser Budvar N.C. in Ceske Budejovice, Czech Republic since his graduation. He worked as a technician in 1999-2001, then as a chief of brewhouse in 2001-2004, as a plant technologist in 2004-2006 and a deputy brewmaster in 2006-2008. Since 1st January 2009, he has been working as a technical and production director. He has also been studying as a Ph.D. student in biotechnology at Institute of Chemical Technology Prague, Department of Fermentation Chemistry and Bioengineering, Prague, Czech Republic since 2005.

Manuel Christian



Manuel CHRISTIAN finished his study in Brewing Science and Beverage Technology (Dipl.-Ing.) at the Technical University of Munich in 2006 and since then he is doing his PhD at the Research Center Weihenstephan for Brewing and Food Quality under the supervision of Prof. Dr. Dr. Harun Parlar (Chair for the Department for Chemical-Technical Analysis and Chemical Food Technology). His research focuses on the gushing phenomenon as mechanism in general in order to propose counter-measures that help the brewing and beverage industry to cope with this problem.

P 010

Effect of the redox potential modification using gases, on the wort oxidation and quality

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¹AIR LIQUIDE, CRCD - Bioresources Group, Jouy-en-Josas, France, ²IFBM, Vandoeuvre les Nancy, France

DESCRIPTION OF TOPIC:

Gases, such as hydrogen can be used to reduce the redox potential (ORP) of the mash and the wort during brewing. Trials have been carried out with the IFBM to assess their effect on the oxidation degree and the quality of the wort.

Results: In the Teparl test, after the mashing step, the average ORP of the control, N2 and N2/H2 trials were +406 mV, +191 mV and -366 mV respectively. The corresponding average T2N values of the wort after the filtration step were 3.4 µg/L, 2.4 µg/L and 1.7 µg/L. At the semi industrial scale, for the control, N2 and N2/H2 trials, the ORP of the mash before brewing were +81 mV, +18 mV and -403 mV respectively. Whatever the gas condition, dissolved oxygen at 45°C before brewing was approximately the same for all the trials (0.4 to 0.6 ppm). Average T2N values after boiling were 4.9 µg/L for N2/H2 trials instead of 6.8 µg/L and 7 µg/L for the control and the N2 trials. The use of gas didn't alter sensory properties of the beer.

P 011

New method for characterizing high-molecular protein fractions in wort using a charge analyzing system

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¹Technische Universität München, Research Center Weihenstephan for Brewing and Food Quality, Freising-Weihenstephan, Germany, ²Technische Universität München, Department of Chemical-Technical Analysis and Chemical Food Technology, Freising-Weihenstephan, Germany

DESCRIPTION OF TOPIC:

For analyzing coagulable nitrogen in wort, high molecular protein fractions need to be determined. The exact knowledge of the content of coagulable nitrogen is of importance at wort boiling in order to predict the colloidal protein stability. Currently there exist methods for this such as the Kjeldahl which are however time consuming. In this work a new method (charge titration) was developed and applied for the determination and description of coagulable nitrogen in wort.

Results: Different trials for boiling a standardized wort were conducted to describe the precipitation (coagulation) of nitrogen using the charge titration method. The streaming potential as well as the surface net charge of the particles in wort could be reproducibly measured. It was found that a distinct relationship exists between the high molecular protein on one hand and the streaming potential, or the titratable charge, on the other hand. By this new method, the influence of hop on the coagulation could be figured out. As a result, a significant reduction of the high-molecular protein content was observed.

P 012

Multi-parametric sensor (MEMs) for brewing control and quality assessment

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¹Rockwell Automation, Advanced Technology, Mayfield Hts., Ohio, United States, ²Rockwell Automation, Unterschleissheim, Germany, ³Case Western Reserve University, Cleveland, Ohio, United States

DESCRIPTION OF TOPIC:

Complex biochemical processes such as found in the brewing industry are a challenge for traditional control techniques. Linear techniques are limited in their ability to respond to system dynamics and non-linear techniques often lack high fidelity models or real-time state information for adaptive control. A multi-parameter sensor has been developed and tested in the laboratory that can provide unique and useful information for brewing processes. The sensor is small, low cost, and can provide continuous measurement of critical fluid properties.

Results: In general sensed fluid parameters are coupled. For example, some contaminants or chemical changes such as an increased level of oxidation change the fluid dielectric response and cause a change in pH. Combining the response from multiple sensor elements permits obtaining a more accurate estimate of fluid parameters and process reactions. This sensor has also been used to monitor change in food products due to microbial activity. Several laboratory studies are in progress to pursue bio-process control using the fluid sensor such as for a yeast reaction. These efforts are directed at generating real-time state information for use in model-based control.

Dominique Ibarra



Dominique IBARRA is graduated of the University of Technology of Compiègne (France), with a specialization in food and biological products. She started her career working in research and development for Nestlé, in the domains of petfood and fermented dairy products. Then, she joined the Claude and Delorme Research Center of Air Liquide in 2004 where she has handled different projects related to the impact of gases on food quality. She is now in charge of a research project dedicated to the beverages domain. The objective of this project is to improve final products' quality and develop new processes / gas applications in the area of beer, as well as other beverages like soft drinks (plain or fizzy), wine etc.

Jean Titze



Jean Titze studied Technology and Biotechnology of Food at the Technical University of Munich until 2004. From 2005 to 2008, he worked as a scientist at the Research Center Weihenstephan for Brewing and Food Quality, by focusing his research, together with his partner Dr. Vladimir Ilberg, on physical chemistry and particle analysis. In 2006, he took courses at the Academy of Food Law (Philipps-University, Marburg) with specialization on national and European food law. Under the supervision of Prof. Dr. Dr. Harun Parlar, Chair for the Department for Chemical-Technical Analysis and Chemical Food Technology, he is currently completing his PhD in the area of beer analysis. From 2009 onwards he will be working for Deloitte Consulting, Food & Beverage Center of Expertise in Weihenstephan.

Axel Kather



Axel Kather (born 1978) studied from 11/1998 till 06/2003 at the TU München/Weihenstephan. In June 2003, he graduated as an engineer (Dipl.-Ing.) for Brewing Science and Beverage Technology. From 09/2003 till 09/2006 he made additional studies in Practical Informatics and in September 2007 he graduated as a Master of Computer Science at the FernUniversität Hagen. From 07/2003 till 03/2008 he worked as a doctoral candidate at the Chair of Food Packaging Technology, TU München. His fields of activity were: computer-aided production data acquisition and automatic fault diagnosis in bottling plants. His graduation as a Dr.-Ing. is planned in winter 2008. Since April 2008 he works as a Global Industry Technical Consultant in the Competence Centre for Food and Beverage at Rockwell Automation.

A straightforward method for the determination of viscosity-inducing arabinoxylans in wort and beer

Jürg Obrecht¹

¹Novozymes Switzerland AG, Customer Solution Brewing, Dittingen, Switzerland

DESCRIPTION OF TOPIC:

In addition of the known β -glucan influence on wort and beer filtrability, high-molecular Arabinoxylans impart similar negative effects on each, wort and beer filtrability. A method for the measurement of these high-molecular arabinoxylans has been developed to help elucidate filter problems.

Results: A very close correlation of mash filtrability, beer filtrability and arabinoxylan-content could be shown, by using exogenous β -glucanases to eliminate influence by variable β -glucan content.

The standard deviation of the method is 4.3%

Survey of emergent mycotoxins on malting barley

Benjamin Neugnot¹, Patrick Boivin²

¹IFBM, R&D, Vandoeuvre, France, ²IFBM, Vandoeuvre, France

DESCRIPTION OF TOPIC:

Contaminants, particularly mycotoxins are one of the most serious problems in food because consumers want to eat or drink a safe product. Getting a beer with a content of contaminant as low as possible is the greatest challenge facing brewers today.

Malting barley is naturally contaminated by a large number of microorganisms among them toxigenic fungi. OTA and Deoxynivalenol that have been or will be regulated in cereal and malt by European Union have been studied.

Several *Fusarium*-species from barley are capable of producing emerging mycotoxins Beauvericin, Eniatin B and Moniliformin.

We developed an HPLC MS/MS method to determine these emerging mycotoxins on malting barley and malt.

Analytical methods and the occurrence of these emergent field mycotoxins in malting barley will be presented.

Results: A sensitive and reliable analytical HPLC MS/MS methods have been developed to determine Beauvericin, Eniatin B and moniliformin in barley and malt. The natural occurrence of these emerging mycotoxins in malting barley has been studied. Among these mycotoxins, Eniatin B was detected at the highest level. Samples from Harvest 2007 were more contaminated than harvest 2006 and 2007.

Intrinsic antifungal properties of (9S,12S,13S)-9,12,13-trihydroxy-10E-octadecenoic acid (THOE) - formation induced by mechanical stress in barley and malt

Leif A Garbe¹

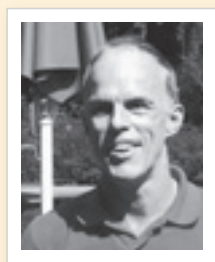
¹TU Berlin / VLB, Analytics, Berlin, Germany

DESCRIPTION OF TOPIC:

Plants are able to defend themselves by different strategies like physical barriers as the cuticle or they release toxic compounds against mechanical damage, pathogens etc. The 9-Lipoxygenase (LOX) pathway leads to the formation of a 9-hydroperoxide of linoleic acid - a precursor of flavor active 2E-nonenal. In addition, LOX pathways lead to the formation of antifungal active agents.

Results: (9S,12S,13S)-Trihydroxy-10-(E)-octadecenoic acid (THOE) inhibited the growth of *Fusarium poae*, *Fusarium tric.* and *Alternaria alternata*. *Cladosporon* sp. was effectively inhibited already at 0.5mM. No inhibition on vegetative growth of *Penicillium* sp. and *Epicoccum* sp. was detectable, THOE shows only weak inhibition on *Trichothezium* sp. The antifungal properties of THOE on *Magnaporthe grisea*, the rice blast fungus was tested by agar-diffusion-test, by inhibition of appressorium formation and germination tests. THOE did neither inhibit the vegetative growth of *M. grisea*, *F. graminearum* and *N. coryli*, nor the germination of *M. grisea* in complete media. Surprisingly, THOE showed an effect on the formation of an infection cell (appressorium) at concentrations as low as 0.075 mM (90%) decreasing with higher concentration.

Jürg Obrecht



1979: Dipl. Chem, Ingenieurschule Burgdorf, 1980-1983: Universität Lausanne, Pheromon-Forschung, 1983-1986: Teaching Assistant, San Diego State University, 1986: Master of Chemistry, San Diego State University, 1986: Practical Training, University of California, San Diego (UCSD), 1986 – 1990: Hoffmann La-Roche Antibiotika und anti-Malaria Forschung, bis 1994: Centre Horticole de Lullier, In-Vitro Pflanzenpropagation / selektion, 1995 bis heute: Novozymes Switzerland AG, Customer Solutions

Benjamin Neugnot



NEUGNOT Benjamin was born in 1976. Studies: 2000: Engineer Degree, European School of Chemistry Polymers and Materials (ECPM, Strasbourg, France). 2005: PhD in Organic Chemistry, University Paris XI-Orsay / Atomic Energy Commission (CEA, Saclay, France). Appointments: 2005: Pharmacokinetic Development Manager (Pierre Fabre Research Institute, Castres, France). Since June 2006: R&D Manager for Analytical Chemistry at IFBM (Institute for Brewing and Malting, Vandoeuvre-lès-Nancy, France).

Leif A Garbe



Leif-Alexander Garbe is Professor and the head of the TU Berlin chair for molecular analysis / bio-analytics and also the head of the VLB research institute for special analyses. Leif graduated at the TU Berlin (TUB), Germany, with a diploma in chemistry in 1996. Then he worked at the "Research and Teaching Institute for Brewing in Berlin" (VLB). From 1997-2002 he performed his Ph.D. thesis and received his Dr. rer. nat. in April 2002 from the Institute of Biotechnology at TUB. His work included the supervision of students of biotechnology and brewery. In 2002 he established a new research group at the TUB focusing on biotransformation, isotope dilution technique and Maillard reaction of peptides / proteins. Since July 2008 he is the head of the TUB chair for molecular analysis / bio-analytics.

P 016

Malting process parameters evaluation by near-infrared spectroscopy in reflectance (NIR)

Valeria Sileoni¹, Rolando Della Sera², Ombretta Marconi², Giuseppe Perretti², Paolo Fantozzi²

¹University of Perugia, Department of Economic and Food Sciences, Perugia, Italy, ²University of Perugia, Italian Brewing Research Center, Perugia, Italy

DESCRIPTION OF TOPIC:

The aim of this study is the development of a rapid method to control on-line several parameters during malting process for the prediction of the moment in which stopping the germination process and therefore the beginning of the kilning. The near-infrared spectroscopy in reflectance (NIR) is a non-destructive and rapid technique applied increasingly for food quality evaluation in recent years. This analytical method is widely used in brewery industry as a quality assurance for raw materials, intermediate and end products.

Results: Various correlations were found between NIR spectra and the corresponding analytical data. The calibration models developed were valued with cross-validation (leave-one-out) and considered satisfactory. In particular, it was possible to evaluate with a low error of prediction (aprox. 5%) moisture, total nitrogen, extract, Kolbach Index, friability, and a-free-amino nitrogen (FAN) in green malt, giving the opportunity to control on-line these important malting parameters.

P 017

Evaluation of malt quality by near-infrared spectroscopy in reflectance

Valeria Sileoni¹, Giuseppe Perretti², Ombretta Marconi², Paolo Fantozzi²

¹University of Perugia, Department of Economic and Food Sciences, Perugia, Italy, ²University of Perugia, Italian Brewing Research Center, Perugia, Italy

DESCRIPTION OF TOPIC:

The purpose of this study is the development of NIR calibrations to allow a rapid and easy evaluation of some important chemical and physical parameters for the evaluation of the malt quality that is useful for breweries. The near-infrared spectroscopy in reflectance (NIR) is a non-destructive, low cost, rapid and effective technology for predicting simultaneously multiple components in food products. This analytical technique is considered suitable to be applied to beer production chain, in particular, for analysis of raw materials, intermediates and end products, and in process control.

Results: The calibration models were verified with cross-validation (leave-one-out) and valued as satisfactory, considering their low values of Root Mean Square Error of Cross Validation (RMSECV). In fact, it is possible to evaluate various parameters on different types of malts with a low error of prediction with these calibrations curves with a low RMSECV, less than 1% for extract, coarse extract and fermentability, and less than 5% for soluble proteins, Hartong extract at 45°C, Kolbach Index, friability, and FAN.

P 018

Correlation study between β -glucans and viscosity during wort production in a pilot-scale brewhouse

Luisa Marte¹, Giuseppe Perretti², Michele Sensidoni¹, Marta Fontana³, Paolo Fantozzi²

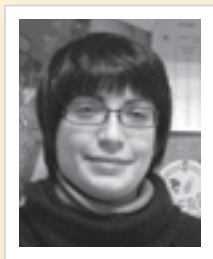
¹University of Perugia, Department of Economic and Food Sciences, Perugia, Italy, ²University of Perugia, Italian Brewing Research Center, Perugia, Italy, ³University of Udine, Department of Agriculture and Environmental Sciences, Udine, Italy

DESCRIPTION OF TOPIC:

The non-starch polysaccharides of barley consist primarily of arabinoxylan, β -glucans, and cellulose. β -glucan polymers originating from barley endosperm cell walls are still present in barley malt used for beer production. β -glucans have been recognized to contribute to wort and beer viscosity, foam stability, body and fullness, haze formation. The presence of β -glucans in malt affects wort and beer viscosity and brewhouse extract yield. Undegraded cell wall polysaccharides have been connected by many authors with lautering and beer filtration problems. These behaviour have been attributed to the ability of these polymers to form viscous solutions and gels.

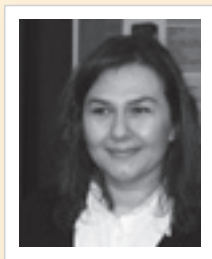
Results: The results obtained shown a wide range of β -glucan concentration, with a range from 78 to 240 mg/l. The highest concentrations were found in the first wort and decreased during the following phases. Viscosity was determined at 20°C, with a range from 1.63 to 1.94. β -glucans content was correlated with viscosity for each wort sample.

Valeria Sileoni



Valeria Sileoni was born in San Severino Marche (MC) in 1983. Degree in Chemical Biotechnologies in 2007. The degree thesis was „Analytical determinations in the beer production chain by NIR spectroscopy (Near Infra-Red)”, carried out at the Italian Brewing Research Centre (CERB). Final Mark: 110/110 with distinction. Since 2008 PhD course in Food Sciences Technology and Biotechnology at the University of Perugia, Department of Economic and Food Sciences and CERB, with Dott. G. Perretti as a tutor, on the following topic “Study of innovative methods of control in the cereal productive chain for the production of beer and spirits”. Main professional interests are Food Science and Technology research, knowledge of industrial food and beverages processes (beer, dairy products, cereals, oils and fats, wine, etc.) and knowledge of analytical approach to quality assessment in food and beverage factories and academic laboratories.

Ombretta Marconi



Ombretta Marconi was born in Perugia (Italy) in 1971. Master-degree in Chemistry (1997) and Doctorate in Food Biotechnology (2005). From 2000 to 2008 Post-graduate Fellowship on “Safeguard of the Nutritional Property and Product Innovation of Fermented Drinks” c/o Faculty of Agriculture, Dept. of Economic and Food Sciences, Div. of Food Technology and Biotechnology. Research Manager of the Italian Brewing Research Centre (CERB). Her main research activities deal with: brewing science and technology; mild technologies; quality control and management systems. She is author of about 30 scientific publications in international and national journals and congress proceedings.

Giuseppe Perretti



Giuseppe Perretti was born in 1968. Degree in Agricultural Sciences (1997) and Doctorate in Food Biotechnology (2003). Experiences c/o University of Perugia (1991-2004): graduate researcher, graduate technician, and fellowships on different topics of food science and technology. Assistant Professor (since 2005) in Food Science and Technology. Experiences c/o Italian Brewers' Association (Rome): freelance researcher for studies on minor components in beers. Author of more than 40 printed publications on international and national journals and congress proceedings. 30 participations for the oral or poster presentation in international or national congresses since 1997. Vice Director and Scientific Responsible of the Italian Brewing Research Centre (CERB) since October 2007.

Predictability and optimization of PVPP-stabilization in beer using anthocyanogenes, polyphenols and total oxygen content figures by means of a neural network

Steffen Hanusch¹, Gerd Bender²,
Mathias Krämer³, Bernd Lindemann³

¹Karlsberg Brauerei GmbH, Technology & Development, Homburg, Germany, ²Karlsberg Brauerei GmbH, Homburg, Germany, ³University of Applied Sciences Wiesbaden, Geisenheim, Germany

DESCRIPTION OF TOPIC:

The optimal utilization of filter runtimes is an important cost factor of beer filtration. A limiting factor of filtration batches is the capacity of the following PVPP-stabilization. The number of cold days out of the forcing test (used at Karlsberg Brewery) determine the minimal dosage of PVPP. The results of these tests last up to 3 weeks, which limits immediate and quick reactions.

The aim was to adapt the PVPP dosage as far and quick as possible using the existing analyses methods. For this purpose a neural network was fed with the analytical data and compared with the results of the forcing test.

Results: The results showed, that the number of anticipated cold days out of the neural network correlates with the measured cold days with a deviation of 9.18% on average. At this step only the anthocyanogenes and the polyphenols content was considered. Looking at the results including the total oxygen content no improvement of the statistical accuracy was cognizable.

Meura's laboratory mash filtration test

Ariane Dewulf¹, Frédérique Harmegnies¹

¹Meura sa, Research and Development, Péruwelz, Belgium

DESCRIPTION OF TOPIC:

Conventional analysis are universally used for malt purchasing specifications, these cover qualitative parameters but do not allow prediction of process ability and real brewhouse performances, especially for mash filtration, which stay a critical step of beer production. The Meura's laboratory mash filtration test allows predicting the industrial mash filterability and calculating the throw for the scale up in industrial 2001 filters.

Results: Years ago, Meura developed its own laboratory method for evaluation of mash filterability on a Meura 2001 mash filter. Many trials demonstrated a good correlation between lab and industrial results.

Use of a copper coil as a faster alternative to traditional conversion of vicinal diketones precursors

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João Grosso Pacheco¹, José Maia Rodrigues¹,
Aquilés Araújo Barros¹

¹Faculty of Sciences, University of Porto, Department of Chemistry, Porto, Portugal

DESCRIPTION OF TOPIC:

The diacetyl content is an important parameter to evaluate wort fermentation. When it lowers to a predetermined value - the „diacetyl rest“ - yeast should be progressively removed starting the clarification process.

During the fermentation of beer, vicinal diketones (mainly diacetyl and pentane-2,3-dione) are essentially in the form of precursors (α -acetolactic and α -acetohydroxybutyric acids). Therefore any analytical methodology aiming all potential vicinal diketones should include a preliminary step of conversion of such precursors. Traditional conversion step consists of an aeration and treatment at 60°C for 90 minutes. We present a faster alternative by means of a Copper (Cu) Coil. Beer passes through the coil while Cu acts as catalyst significantly speeding the conversion process.

Results: Our results show that the conversion with the copper coil has similar results to traditional methodology. Furthermore, obtained results show a signal increase with temperature and the length of the copper coil. Taking this into account is preferable to use a long coil with low temperatures to avoid Maillard reactions. A good choice seems to be is an 1 meter coil at the constant temperature of 60°C.

Steffen Hanusch



Date of Birth: 1973, May 8th

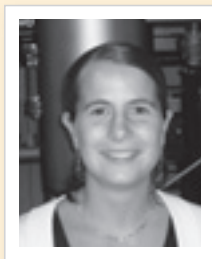
Employment

Since November 2001 Assistant to the Technology and Development Department, Project Management, Karlsberg Brauerei GmbH, Homburg / Saar
May 2000 - October 2001 Technical Trainee, Karlsberg Brauerei GmbH, Homburg / Saar
November 1998 – March 2000 Research Assistant at the Research Institute for Technology of Brewing and Malting, VLB Berlin

Education

1992 – 1998 Studies at the Technical University Berlin / VLB, Graduation: Graduate Engineer for Brewing Technology

Ariane Dewulf



Ariane Dewulf graduated in 2007 as a brewing engineer. In 2007, she joined Meura as engineer in the Research and Development department.

Luís M. Gonçalves



Luís F.M. Gonçalves was born in 1985 near Porto. Has a degree in Chemistry (2003-07) by the Faculty of Sciences, University of Porto (FCUP). Researcher in the “Beervolt” project (2005-07), concerning on flow voltammetric analysis of volatile compounds in beer. Later researcher in the area of dye-sensitized solar cells (2007-08) in the Faculty of Engineering, University of Porto (FEUP) and is currently undergoing PhD studies in Analytical Chemistry at the FCUP. He has won several prizes including the “Eng. António de Almeida” prize in 2008.

P 022

Application of ATP bioluminescence based methods in brewing and beer tapping

Ondrej Koucky¹, Jaromir Fiala², Michal Rouc¹¹Drinks Union (Heineken Czech Rep.), Usti nad Labem, Czech Republic, ²Institute of Chemical Technology Prague, Prague, Czech Republic

DESCRIPTION OF TOPIC:

This work is aimed on application possibilities of an ATP-bioluminescence based method for detection of beer spoilage microorganisms in a brewing process and beer tapping.

Results: Results show a good correlation between classical plates cultivation and this new method. Possibilities of using the ATP bioluminescence for yeast physiological condition assay has been compared to results from a flow-cytometry.

P 023

Particle measurement in beverages - a new tool for a statement on Gushing

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DESCRIPTION OF TOPIC:

Particle measurement can become a new tool in standard quality evaluation of beverages, because it may show a significant correlation to the phenomenon of Gushing. Further improvement of the predictability of Gushing can be considered very desirable for daily praxis. A measurement of particles is highly selective, has a broad spectrum and can be implemented as a close-to-process analysis.

In the future it could allow the production facility to take appropriate countermeasures in early stages of the process (if possible) and/or help to decide on the type of packaging container.

The first aim of the research work should be to verify a significant correlation of Gushing and certain particle sizes and finally to differentiate between Gushing-positive (G-pos) and Gushing-negative (G-neg) samples.

Results: The distribution of the different particle sizes of filtrated beer correlates to G-pos samples. In the particle size measuring area of approx. 5 nm G-pos beer samples show a peak, whereas G-neg beer samples do not show any particles of that size. Furthermore the particle count-analysis method showed distinctive differences between G-pos and G-neg samples of apple juice with mineral water and mineral water in different packaging containers (glass- and PET-bottles).

P 024

Possible use of advanced microscopical techniques to evaluate the ultra structure of grain

Alexander Mauch¹, Frithjof Thiele¹, Christina Klose¹, Martin Zarnkow², Joerg Helbig², Werner Back², Elke K Arendt¹¹University College Cork, Food and Nutritional Sciences, Cork City, Ireland, ²Technische Universität München, Lehrstuhl für Technologie der Brauerei I, Freising-Weihenstephan, Germany

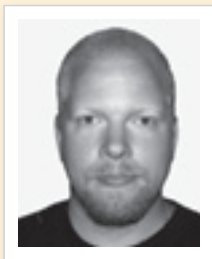
DESCRIPTION OF TOPIC:

Starch, proteins and cell wall material are the main components of grains and they determine the value and the processability of these grains for certain processes and products. In general these components are analyzed using chemical methods and this offers usually sufficient information. But especially if the aim is to understand the modifications in the grain e.g. during malting it is important to visualize this ultra structure and its changes. Scanning electron microscopy (SEM) and Confocal scanning laser microscopy (CLSM) are useful tools to determine these changes.

Results: SEM makes it possible to distinguish between different types of starch granules. Furthermore, certain degradation processes of cell wall material and of starch granules by amylolytic enzymes can be visualized.

With CLSM it is possible to use specific fluorescent dyes which bind to certain components and therefore show their distribution. To a certain extent it is even possible to quantify these substances.

Ondrej Koucky



Born in 1981. Studies: graduated in Malting and Brewing Technology (2005) at Institute of Chemical Technology Prague, actually PhD student at the Department of Fermentation Chemistry and Bioengineering in topic: Application of Rapid Microbiological Methods in Brewing Industry, currently head of technological department in Drinks Union Company (part of Heineken Czech Republic).

Christopher Nüter



Since 2008: Scientific assistant at the VLB Berlin, main activities: brewery consultant (technology, microbiology), development of new applications for laboratory analysis (CTA), teaching 2001-2007: Engineering degree in Biotechnology, specializing in brewing science and technology at the VLB Berlin / TU Berlin 2000-2001: Brewmaster course (Diploma) at the VLB Berlin / TU Berlin 1998-2000: Apprenticeship as a beer brewer and maltster with the Privatbrauerei Moritz Fiege in Bochum, Germany 1997-1998: Compulsory national service 1997: Abitur Date of birth: 05.04.1978

Alexander Mauch



Alexander Mauch completed an apprenticeship as a brewer and maltster in 2000 and worked in a German and Swedish breweries until 2002. He then studied at the Technische Universität München-Weihenstephan and received a M.Sc. degree in brewing- and beverage-technology in 2007. During his master thesis he worked in the field of malting with minor cereals. In June 2007, Alexander began working on his PhD thesis which investigates the impact of different lactobacillus strains as starter cultures in malting in terms of inhibition of rootlet- and mould growth. Furthermore he is jointly responsible for the microbrewery plant of UCC and involved in the brewing research which is carried out there. Alexander is member of the ASBC and Verband ehemaliger Weihenstephaner (VEW).

Contamination of barley with *Fusarium* species related to the occurrence of discoloured kernels, mycotoxin content and consequences for the brewing process

Michael Heß¹, Josef Winkler¹, Dieter Hecht¹, Martina Gastl², Michael Rychlik³

¹Technische Universität München, Phytopathologie, Freising, Germany, ²Technische Universität München, Lehrstuhl für Technologie der Brauerei I, Freising, Germany, ³Technische Universität München, Bioanalytik Weihenstephan, Freising, Germany

DESCRIPTION OF TOPIC:

The contamination of barley with moulds is one of the most critical quality criteria. Fungal metabolites can compromise processing and consumption. Especially the occurrence of *Fusarium* species in the raw material is associated with mycotoxin contamination and the gushing phenomenon. The *Fusarium* contamination is often assessed only by visual inspection for discoloured kernels (red/black). Our investigations relate the occurrence of discoloured kernels to the contamination with *Fusarium* species, mycotoxin content and observations during and after the malting and brewing process.

Results: In our investigation the results from the visual inspection for discoloured kernels could not be related to the contamination with *Fusarium* species, mycotoxin content and the occurrence of gushing.

Analytical profiling of varietal floral and spicy hop essences by SPME in combination with monodimensional and comprehensive two-dimensional GC

Filip Van Opstaele¹, Joeri Vercammen², Guido Aerts¹, Luc De Cooman¹

¹KaHo St.-Lieven Laboratory of Enzyme, Fermentation and Brewing Technology/M25, KUL Association, Leuven Food Science and Nutrition Research Centre (LfoRCe), K.U.Leuven, Gent, Belgium, ²Interscience bvba, Interscience Expert Center, Louvain-la-Neuve, Belgium

DESCRIPTION OF TOPIC:

The objective of the present study is detailed characterisation of the volatile profile of novel varietal floral and spicy hop essences. This research is part of a PhD study focusing on determination of flavour-active compounds in highly enriched hop oil fractions and on evaluation of these essences in brewing.

Results: As demonstrated by SPME-GC-MS floral essences mainly consist of b-myrcene, and further comprise a series of esters and ketones. Spicy essences are mainly composed of sesquiterpene epoxides and alcohols. When compared with commercial floral and spicy hop essences, significantly different and much more specific analytical fingerprints are observed for the in-house essences, due to highly improved fractionation of hop oil. Profound characterisation of the essences was performed by two-dimensional comprehensive GC, revealing previously undetected components in both hop oil fractions.

Characterization of reductones by ¹³C-NMR spectroscopy

Leif A Garbe¹, Alexander Würtz¹

¹TU Berlin / VLB, Special Analysis, Berlin, Germany

DESCRIPTION OF TOPIC:

Norfuraneol (1), glucose reductone (2) and maltol (3) are important Maillard reaction derived reductones. In the past, their formation was investigated from several sugar / amino acid reactions; however, unequivocal pathways leading to 1, 2 and 3 are still not fully understood.

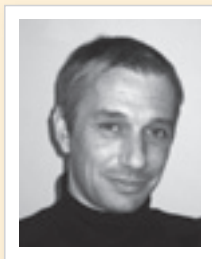
Results: The ¹³C label position of norfuranol (1) and glucose reductone (2) can be estimated by electron impact MS spectra, the position of ¹³C labelling in maltol (3) must be determined by NMR. In addition, the interpretation of EI-MS fragmentations is sometimes difficult and has to be supported by ¹³C-NMR data. The labelling pattern of 1, 2 and 3 dramatically changes with the nature of the amine reaction partners of the sugar. gamma-Aminobutyric acid, a heptapeptide with high lysine content and b-casein led to differently labelled reductones after Maillard reaction with ¹³C sugars (unpublished data). Therefore, formation pathways were elucidated by analyzing isotopomers of reductones 1, 2 and 3 by ¹³C-NMR and EI-GC/MS.

Michael Heß



Plant pathologist, project leader epidemiology, disease survey, development and implementation of integrated pest control systems in cereal production

Filip Van Opstaele



Born in 1970. Studies: Academic degree in Industrial Engineering Biochemistry at the KaHo St.-Lieven, Gent, Belgium (1993). Appointments: 1994-2001: Researcher at the Chemical and Biochemical Research Centre (CBOK) of the KaHo St.-Lieven; 2001-present: Research-assistant at the Biochemistry department of the KaHo St.-Lieven Technical University, practical courses in chemistry and chromatography; theoretical courses in spectroscopic techniques, mass spectrometry; Doctoral researcher on the characterisation of flavour-active compounds in hops; assistant scientist in Malting and Brewing science at the Laboratory of Enzyme, Fermentation and Brewing Technology of KaHo St.-Lieven. Research topics: (beer)flavour, high tech hopping,

Leif A Garbe



Leif-Alexander Garbe is Professor and the head of the TU Berlin chair for molecular analysis / bio-analytics and also the head of the VLB research institute for special analyses. Leif graduated at the TU Berlin (TUB), Germany, with a diploma in chemistry in 1996. Then he worked at the "Research and Teaching Institute for Brewing in Berlin" (VLB). From 1997-2002 he performed his Ph.D. thesis and received his Dr. rer. nat. in April 2002 from the Institute of Biotechnology at TUB. His work included the supervision of students of biotechnology and brewery. In 2002 he established a new research group at the TUB focusing on biotransformation, isotope dilution technique and Maillard reaction of peptides / proteins. Since July 2008 he is the head of the TUB chair for molecular analysis / bio-analytics.

P 028

A novel method for the detection of arabinoxylans

Frank Rath¹, Iris Fechter¹, Christina Quandt²¹VLB Berlin, Research Institute for Raw Materials, Berlin, Germany, ²NovaBiotec Dr. Fechter GmbH, Quality Assurance, Berlin, Germany

DESCRIPTION OF TOPIC:

While the effects of high molecular beta-glucans on the processability of malt have been extensively studied, comparable studies on the impact of arabinoxylans (AX) on the brewing process have yet to be performed. AX are considered a main cause for filtration and other problems in the brewhouse.

Until now, an easy-to-use and reliable detection method for AX was not available. Our project therefore focuses on the development of such a method, making it possible to distinguish between water-soluble and water-insoluble fractions or high and low molecular weight fractions, respectively.

Results: The polyclonal antibodies proved to be specific for AX, showing no cross reaction with other polysaccharides present in wort and beer. The AX were effectively separated from other substances in malt, wort and beer by immunoaffinity chromatography. Cleaned eluates could be quantified using a fluorescent dye whose fluorescence increases linearly with AX concentrations. Quantification of AX was also possible using a refractometer.

P 029

Fuchsin Index (FI)

Josef Dvořák¹, Vladimír Kellner¹, Pavel Čejka¹, Jiří Čulík¹, Tomáš Horák¹, Marie Jurková¹, Pavek Dostálek²¹Research Institute of Brewing and Malting, Plc., Analytical Testing Laboratory, Prague, Czech Republic, ²Institute of Chemical Technology Prague, Department of Fermentation Chemistry and Bioengineering, Prague, Czech Republic

DESCRIPTION OF TOPIC:

The flavour stability of beer is an essential quality characteristic. For prognosis and analytical evaluation of flavour stability various analysis methods have already been established (e.g. thiobarbituric acid index, absorption integral and aniline index). We present our new method.

Results: The FI correlates with ageing-related aroma substances or their precursors, formed as a result of thermal stressing of malt and wort and coming to the fore in beer ageing. For that reason, this index is important for assessment of malt and wort in terms of taste stability of beer.

P 030

Determination of sulphur dioxide by flow-through chronopotentiometry and its importance for brewing practice

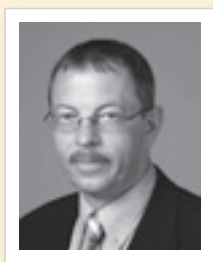
Pavel Dostálek¹, Josef Dvořák¹, Karel Štěrba¹, Pavel Čejka², Vladimír Kellner², Čulík Jiří², Beinrohr Ernest³¹Institute of Chemical Technology Prague, Department of Fermentation Chemistry and Bioengineering, Prague, Czech Republic, ²Research Institute of Brewing and Malting Prague, Prague, Czech Republic, ³Slovak University of Technology, Department of Analytical Chemistry, Bratislava, Slovakia

DESCRIPTION OF TOPIC:

There are many methods for the determination of total sulphur dioxide in beer. The most frequently used are the three methods recommended by the European Brewery Convention (EBC): EBC methods, 9.25.1. - Total Sulphur Dioxide in Beer: Distillation Method, 9.25.2 - Total Sulphur Dioxide in Beer: Enzymatic Method and 9.25.3 - Total Sulphur Dioxide in Beer: p-Rosaniline. Very good alternative to these methods are electrochemical methods and namely flow-through chronopotentiometry.

Results: In order to assess the quality of the proposed method, determination of total SO₂ in a set of 15 beer samples was carried out by the electrochemical method and by the EBC recommended methods mentioned above. The values of the standard deviation and repeatability limit obtained with the electrochemical method were similar to the results measured with distillation method and lower than those obtained by the enzymatic and spectrophotometric methods.

Frank Rath



PROF. RATH, Frank (born in 1957) Studies: 1980-1986: Agricultural Science at the Rheinische Friedrich-Wilhelms-University of Bonn; 1993: PhD. Appointments: 1986: Scientific Collaborator at the Research Department/Plant Production and Physiology, Weissheimer Malzfabrik, Andernach; 1986-1990: Scientific Collaborator at the Research Institut of Raw-Materials within the Research an Teaching Institute of Brewing in Berlin (VLB); 1990-1998: Head of the Research Department/Plant Production and Physiology, Weissheimer Malzfabrik, Andernach; since 1999: Head of the Research Institut of Raw-Materials within the Research an Teaching Institute of Brewing in Berlin (VLB), since 2006: Professor at the TU of Berlin, Member of various national and European panels of experts.

Josef Dvořák



Education/Training/Work: Institute of Chemical Technology in Prague (qualification: Brewing and Malting). Graduation: 2006, Postgraduate study: 2006 present Institute of Chemical Technology in Prague (qualification: Management of food and chemical companies), 2007 present (graduation: 2009) Converse International School of Languages in San Francisco, Jun 2007 Sep 200 The Research Institute of Brewing and Malting in Prague, 2005 - present, research worker Attendance at EBC (The European Brewery Convention) congress in Prague (2005) and in Venice (2007)

Pavel Dostálek



Pavel Dostálek was born in 1963. He studied as a graduate engineer at the Faculty of Food and Biochemical Technology of the Institute of Chemical Technology Prague, Czech Republic (1985). He holds a Ph.D. degree in fermentation chemistry and technology from the same institute (1991). In 1987 he was an assistant scientist in food technology. In 1990 he became an assistant professor for brewing science, and in 1993 he stayed in the Dublin City University. In 1996 he finished postgraduate course on food technology at Hebrew University, Agricultural Faculty, Rehovot, Israel, and in 1997 was became a lecturer in the Department of Fermentation Chemistry and Bioengineering, Institute of Chemical Technology Prague. He is Associated Professor in biotechnology from 2007.

Development of a FMEA (failure mode and effect analysis) as an instrument of weak-point analysis in a brewery; using the example of the keg filling plant at Karlsberg Brewery, Germany

Garlef Tietje¹, Gerd Bender², Sebastian Gutting³, Bernd Linemann³

¹Karlsberg Brauerei GmbH, Homburg/Saar, Germany, ²Karlsberg Brauerei GmbH, Production, Homburg/Saar, Germany, ³University of Applied Sciences Wiesbaden, Geisenheim, Germany

DESCRIPTION OF TOPIC:

New plant components have been installed in an existing keg filling plant.

The standard tool FMEA was adapted to the brewery requirements. The interaction between the units were examined and possible weak-points were detected. Target was to optimize the filling process and to improve the productivity by minimizing unexpected breaks.

Results: The execution of the FMEA led to a detailed documentation of the keg filling plant and the filling process.

Based on the risk priority figures a catalogue of necessary measures were determined, separated into four categories:

- Easy and fast implementations
- Urgent implementations with costs
- Difficult implementations
- Unrealistic solutions

Even the realization of the easy and fast implementations led to a significant improvement of key process indicators.

Modified Gushing Test - Reproducible gushing analysis through optimised and harmonised analytical conditions

Frank Rath¹, Frank Homann²

¹VLB Berlin, Research Institute for Raw Materials, Berlin, Germany, ²Warsteiner Brauerei Haus Cramer KG, Quality Assurance, Warstein, Germany

DESCRIPTION OF TOPIC:

The gushing problems, which arose after the 2007 harvest and are still ongoing, have led to animated discussions about suitable methods to determine the risk potential of the raw materials. Generally speaking, the "Modified Carlsberg Test", on the basis of mineral water, has proven its usefulness as a tool for risk assessment and handling of malts in this critical situation. However, the insufficient reproducibility of results from different laboratories gave cause for criticism.

Results: The results of gushing analysis of malts with a very different risk potential showed a good repeatability within a laboratory. However, in the inter-laboratory tests, the results were sometimes contradictory. The insufficient reproducibility of the results between laboratories was attributed to variations in the sample preparation, the water-matrix used and, above all, the way and the intensity of the shaking during the incubation. After an alignment of the laboratory equipment and a rigorous adherence to the detailed modified analysis procedure, significant improvements were achieved in the reproducibility of the results from further round-robin tests.

Novel proteomic studies performed with UPLC chromatography and nano ESI-QTOF-MS/SMSMS: Comparison of the protein content in unhopped wort, cold wort and bright beer

Fabienne Decker¹, Sascha Robbert¹, Stefan Loch-Ahring¹, Fabian Schulte²

¹Brauerei C & A. Veltns, Meschede, Germany, ²Universität Bielefeld, Bielefeld, Germany

DESCRIPTION OF TOPIC:

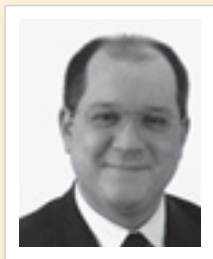
During the brewing process the protein content dramatically changes: wort boiling, the addition of hop, fermentation, filtration procedure and in some cases flash pasteurization exert influences, which configure the protein pattern in the bottled beer.

The protein diversity strongly decreases till the end product. Major proteins discussed with topics like foam stability, gushing or haze formation are LTP and protein Z. Tracing them throughout the brewing process and elucidation of modifications are of great interest.

In generell proteomic studies are performed with gel electrophoresis and additional MALDI-analysis. Here we present a new way to do proteomic analysis irrespectively operating from gel separations.

Results: The results of this study present proteins identified in unhopped wort, cold wort and beer.

Garlef Tietje



Date of birth: 1973, February 26th

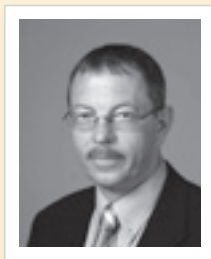
Employment

since December 2002 Department Manager Brewhouse, Fermentation and Keg-Filling, Karlsberg Brauerei GmbH, Homburg / Saar · June 2000 – November 2002 Assistant to the Technology and Development Department, Project Management, Karlsberg Brauerei GmbH, Homburg / Saar · November 1998 – May 2000 Technical Trainee, Karlsberg Brauerei GmbH, Homburg / Saar · June 1998 – October 1998 Research Assistant at the Research Institute for Technology of Brewing and Malting, VLB Berlin · April 1998 – May 1998 Training at Beverage Consulting Hamburg GmbH & Co. (BCI), Hamburg

Education

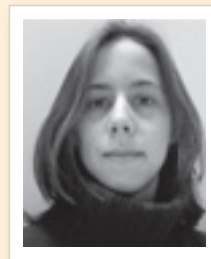
October 1999 – June 2002 Night School (beside the job), Graduation: Business Economist (VWA) · October 1995 – March 1998 Studies at the VLB Berlin, Graduation: Diploma Brewmaster · September 1993 – May 1995 Apprenticeship as Brewer and Maltster, Privatbrauerei Wittingen & Mälzerei Heine, Peine

Frank Rath



PROF. RATH, Frank (born in 1957) Studies: 1980-1986: Agricultural Science at the Rheinische Friedrich-Wilhelms-University of Bonn; 1993: PhD. Appointments: 1986: Scientific Collaborator at the Research Department/Plant Production and Physiology, Weissheimer Malzfabrik, Andernach; 1986-1990: Scientific Collaborator at the Research Institut of Raw-Materials within the Research an Teaching Institute of Brewing in Berlin (VLB); 1990-1998: Head of the Research Department/Plant Production and Physiology, Weissheimer Malzfabrik, Andernach; since 1999: Head of the Research Institut of Raw-Materials within the Research an Teaching Institute of Brewing in Berlin (VLB), since 2006: Professor at the TU of Berlin, Member of various national and European panels of experts.

Fabienne Decker



2006: Diplom. Molekulare Biotechnologie, Technische Fakultät der Universität Bielefeld Diplomarbeit bei der Brauerei Veltns im Bereich Proteomics mit Massenspektrometrie Seit 2007 Diplomarbeit im Bereich der Instrumentellen Analytik der Brauerei Veltns: Schwerpunkt Proteomics mit HPLC/UPLC MS und SMSMS

P 034

A new method of sensory evaluation

Hans Scheuren¹, Jens Voigt¹,
Benjamin Haeffner¹, Karl Sommer¹

¹Technische Universität München (TUM); Lehrstuhl Maschinen- u. Apparatekunde (MAK), Freising, Germany

DESCRIPTION OF TOPIC:

Flavor is the significant criterion of evaluation in beer tasting, which depends on many primary and secondary causes. This includes desirable and undesirable aromatic compounds, but also haptic and physical issues like viscosity CO₂-level and color. Taste as a subjective matter is valued individually quite different. Influences of process changes are difficult to evaluate. In order to get representative and fast results, a new sensory test was developed, which can be realized with reasonable resources, and takes statistical methods into account. The relative number of test persons, who can detect a difference in change, remains almost constant in a group and more or less independent from external influences. Individual errors follow statistic behavior and can be assessed if the number of tasters is big enough. The significance of results from a smaller group of experienced tasters in a sensory panel can be improved by increasing the number of test persons even if they are less experienced. The results of this work are based on differentiation trials with beer of different concentrations of Benzaldehyde as a typical off-flavor aroma compound. In a group of inexperienced tasters, mainly young food technology students, qualified differentiation showed high conformance and significance.

Results: The results are very good. It can be seen that the results describe a probability distribution and that the number of correctly tasting persons for every concentration can be calculated.

P 035

Improvement of the evaluation of the mashing conversion yield and the sparging efficiency

Jan Schneider¹, Geatan Schmid¹

¹University of Applied Sciences Ostwestfalen-Lippe, Beverage Technology, Lemgo, Germany

DESCRIPTION OF TOPIC:

Conventional methods of the determination of extract losses in the form of spent grain extraction are not suitable in many cases. Both (percental) numbers are related to the absolute amount of spent grains, which is not known in practice. The mass of the spent grains can differ considerably. The new method determines the spent grain amount by a mass balance of the extract. Laboratory mashing equipment simulates the large scale process. A model describes the fate of the extract during mashing and lautering. Herewith it is possible to determine the conversion yield of mashing and the mass of the spent grains. The model was verified by gravimetric measurement of the spent grains amount. With the knowledge of the spent grains mass the soluble and convertible spent grain extract can be converted into the actual absolute losses of extract.

Results:

- Depending on the process parameters (malt, grist, mashing) remarkable differences in the conversion yield, justified by convertible spent grain extract.
- Improvement of conventional spent grain extract analyses can be improved with the knowledge of the spent grains mass.
- With the new method the spent grain mass can be estimated quite precise.
- Conversion yield is a new size to distinguish conversion yield from sparging efficiency and it correlates with the convertible spent grain extract.

P 036

Spoilage yeasts in breweries and their detection by realtime multiplex PCR

Jutta Schönling¹, Henning Kötke²,
Mareike Wenning³, Mathias Hutzler⁴

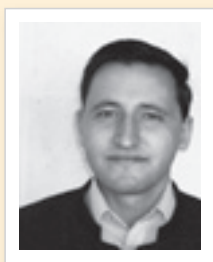
¹GEN-IAL GmbH, Troisdorf, Germany, ²Lehrstuhl für Technologie der Brauerei II der TU München in Weihenstephan, Freising, Weihenstephan, Germany, ³Lehrstuhl für Mikrobielle Ökologie, Freising, Germany, ⁴Forschungszentrum Weihenstephan für Brau- und Lebensmittelqualität (BLQ) TU München, Germany

DESCRIPTION OF TOPIC:

Spoilage yeasts are a everlasting danger for beer and beer mixed beverages and the hygiene of their production surroundings. Saccharomyces belong to the most dangerous spoilage yeasts e.g. *S. diastaticus*. Most non-Saccharomyces spoilage show lower fermentation capacity. Most of them are only able to grow if fermentable sugars and oxygen are available in the beer or beer mixed beverage. A recent study shows that the non-Saccharomyces species *Pichia anomala* is a dominating contaminant in the filling area and is biofilm forming. In this study the yeast distribution in 106 contaminated beer samples was observed with a focus on Saccharomyces spp. and *Pichia anomala* and a specific multiplex realtime PCR kit was used for the analysis.

Results: In this study 106 yeasts strains were isolated from beer and identified on species level by 26S rDNA-sequencing. The percentage of the Saccharomyces sp. was 14,2% and the percentage of *Pichia anomala* was 17,9%. The strains of Saccharomyces sp. and *Pichia anomala* were inoculated in beer and alcohol-free beer and incubated for 14 days at 28°. All strains showed beer spoilage potential after 14 days. All strains of Saccharomyces sp. grew within 4 days. On genetic level the yeasts are detected and differentiated by multiplex realtime PCR.

Hans Scheuren



Hans Scheuren graduated from university in 2006 as a degree engineer for brewing sciences and beverage technology. In 2006 he started with his doctoral thesis with Prof. Sommer about kinetic processes of mashing procedure. The aim consists in designing a mathematical model for predicting the success of mashing according to the content of important aromatic components and the enzymatic activity.

Jan Schneider



1991-1996 Studies in Weihenstephan
1991-1995 Internships and jobs (Euler Brauerei, Licher Privatbrauerei, Staatsbrauerei Weihenstephan, Mälzerei Sulzbach-Rosenberg, Gordon Biersch Brewing Company)
1997 TU München-Weihenstephan ph.d. student
1997-2001 TU München-Weihenstephan, chair of brewery plants, Scientific Assistant
2001-2002 Pall Corporation, Dreieich (Germany), Sales, key account
2002-2003 Sandoz GmbH (Novartis), Kundl (Austria), project manager plant erection
2003-2006 VLB, Berlin (Germany), head of the institute of brewery equipment and packaging technology
2006 University of applied sciences Ostwestfalen-Lippe, Professor for beverage technology, head of laboratories

Jutta Schönling



Education:
1990 Diploma thesis at Institute of Medical Microbiology of RWTH Aachen
1995 Dissertation at Institute of Human Genetics of University Bonn
1995-1998 Postdoc at Institute of Human Genetics of University Bonn
1998 Foundation of the company GEN-IAL GmbH
2000 Winner of the innovation price of NRW
2005-2007 Patents in DNA-detection and microbial capturing methods

Carrageenan - an effective tool for wort clarification in the brewhouse (laboratory vs industrial trials)

Piotr Antkiewicz¹, Aleksander Poreda¹, Mateusz Liszka², Marcin Smaza²

¹University of Agriculture in Krakow, Fermentation Technology and Technical Microbiology, Krakow, Poland, ²University of Agriculture in Krakow, Scientific Circle of Fermentation Technology (MSc 2007), Krakow, Poland

DESCRIPTION OF TOPIC:

Carrageenan makes an effective tool allowing to obtain a clear wort in the brewhouse. It enhances natural sedimentation of haze particles present in wort. Its addition causes a rapid clarification of wort on cooling, giving a better start to stabilize beer right at the beginning of the production process.

Results: The clarity of wort significantly increased, proportionally to the amount of carr. added, as well as the amount of precipitate (photos presented). The optimal value seems to be 50 ppm of carr. (minimum amount of precipitate with a satisfactory level of haze). Protein content dropped by ca. 25% when 100 ppm carr. was added, while further increase of its addition did not influence the protein content. The use of carr. does not influence the analysed microelements concentration in wort. The influence of carr. addition on wort clarity is wort density dependent - for the weak wort (9P) the highest value of carr. (200 ppm) caused an increase of haze as compared to the control. Whereas in the case of stronger wort (18P) such influence was not noted.

Haze-related phenolic structures generated through beer aging. Proposal of a sensitive colloidal instability assay using microwells

Julie Laille¹, Vesna Jerkovic¹, Meike Brohan¹, Sonia Collin¹

¹Université catholique de Louvain, Unité de Brasserie et des Industries Alimentaires, Louvain-la-neuve, Belgium

DESCRIPTION OF TOPIC:

Beer composition (flavour, colour, haze...) changes through storage, thereby altering the quality of the product. Beer flavour is known to be deteriorated due to the release of compounds like T2N (1), DMTS (2) or 4-VG (3). Recently Dehydrodicatichin A with a yellow brown colour has been identified as responsible for beer colour modification through aging (4). Very little accurate information is available regarding the phenolic structures involved in haze formation. Yet these data are required to propose new colloidal stability assays giving better prediction for brewers.

Results: Various model media of catechin and pro-cyanidins were monitored in order to mimic beer storage. After isolation of the degradation products and identification by RP-HPLC-ESI(-)-MS/MS, their haze potential was measured. New compounds derived from dimmer oxidation revealed very potent to interact with proline-rich proteins. A new assay using microwells is therefore proposed to accurately quantify the haze polyphenolic fraction of a beer.

Relationship of temperature, particle size and clarification - an investigation in haze stability of wheat beer

Cem Schwarz¹, Martin Zarnkow¹, Werner Back¹

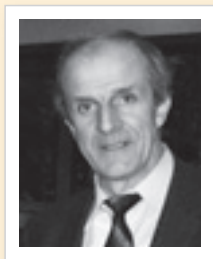
¹Lehrstuhl für Technologie der Brauerei I, TU München-Weihenstephan, Freising, Germany

DESCRIPTION OF TOPIC:

Stable haze is an important quality aspect of German "Hefe-Weizenbier" (top fermented wheat malt beer). Haze in this beer is caused primarily by yeast and colloids. The progress of haze according to different storage temperatures (4°C and 20°C) were monitored nephelometrically and by detecting the particle size distribution in the supernatant of 0.5 L bottles at a measurement temperature of 12°C over 8 weeks.

Results: The results show a high sedimentation rate of yeast in cold and warm stored samples, due to its diameter $x > 3 \mu\text{m}$ over the time of 8 weeks. The availability of colloids as haze effecting particles (at 12°C) was strongly influenced by the storage temperature and the resulting physical phase due to the temperature. Both samples showed a bimodal distribution. The cold stored samples show a high amount of precipitated colloids, accompanying a sedimentation characteristic like solid particles, the residual particles have had a diameter of $1 \mu\text{m}$. Samples stored at 20°C showed almost no precipitation and have had a similar intensity of turbidity and particle size distribution ($x < 4 \mu\text{m}$) at the point of measurement as initial.

Piotr Antkiewicz



A lecturer at the Department of Fermentation Technology and Technical Microbiology, University of Agriculture in Krakow, Poland. For over 30 years he has been involved in the education and scientific research regarding brewing technology, working close with polish brewing industry. Dr Antkiewicz has taken part in many research projects, conducted in cooperation with industrial sites, regarding both malting as well as brewing technology. He is one of the initiators of a very famous conference of polish brewers called School of Fermentation Technology – which gathers the representatives of the breweries, malthouses, universities, and supporting companies every year.

Julie Laille



She is postgraduated in analytical chemistry from France. She obtained her analytical knowledge thanks to 6 years of learning and several training periods. For example, she worked in the national institute of agronomical research (INRA) and in the veterinary national school of Nantes, especially in 'LABERCA' which is the national reference laboratory of steroids analyses. Since November 2007, she started a PhD thesis at UCL under the supervision of Prof. S. Collin. She will present you the work done in the department of brewery and industrial food (INBR) about the polyphenols responsible for the beer colour instability.

Cem Schwarz



1998-2004: Studies of Brewing and Beverage Technology at TU München-Weihenstephan. Since 2005: Ph.D. student and scientific worker at the chair of Brewing Technology (Prof. Back) in Weihenstephan, with focus on haze stability of wheat beer and cross flow membrane filtration. Since 2008 head of the beer lab.

P 040

Gushing malt leads it to gushing beer?**Mbaka Malanda**¹, Patrick Boivin¹, Erwan Troalen¹¹IFBM, Vandoeuvre, France**DESCRIPTION OF TOPIC:**

Gushing is one of the most serious beer faults. Gushing tests have been carried out directly on malt by extracting gushing factors from malt followed by introducing the factors to a beer or sparkling water. An ELISA method to detect Hydrophobins, a small surface active proteins produced by filamentous, was also developed to predict the gushing risk of malt. The importance of these methods on malt to predict the gushing risk of beer is controversially. The aim of this investigation was to study at the 20 hl brewing scale, the impact of gushing malt to gushing beer.

Results: The present study at 20 hl brewing scale showed that gushing positively malt have no led to gushing beer. Gushing inducers were followed during brewing process to know at what steps, these were loosed.

P 041

Upstream beer stabilisation during wort boiling by addition of gallotannins and/or PVPP**Hannes Withouck**¹, Annick Boeykens¹, Gert De Rouck¹¹KaHo St.-Lieven Laboratory of Enzyme, Fermentation and Brewing Technology/M2S, KUL Association, Leuven Food Science and Nutrition Research Centre (LfoRCe), K.U.Leuven, Ghent, Belgium**DESCRIPTION OF TOPIC:**

Haze development in beer during the shelf life is a persistent problem in the brewing industry. Pilot-scale brewing trials (12°P) were conducted to study the effect of gallotannins and PVPP addition in the boiling kettle on colloidal and flavour stability, this in combination with pH control.

Results: Brewing trials in the presence of gallotannins showed an efficient removal of sensitive proteins with only a small increase of the gallic acid content and a positive influence on taste and reducing capacity of the fresh beer. The evolution of chill haze related to the aging process showed that beers stabilised with 10 g/hL gallotannins in combination with pH correction gave the best results. The addition of 10 g/hL PVPP has an explicit effect on the amounts of polyphenols, which results in an improvement of the colloidal stability. The use of both stabilisation agents during wort boiling showed a decrease of the sensitive proteins and the haze-forming polyphenols. This in combination with an increase of the reducing capacity.

P 042

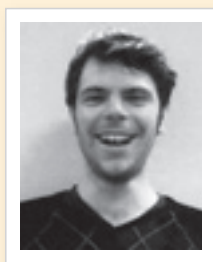
Effect of surfactants on beer foam stability and collapse**Martin Baszczyński**¹, Pavel Novák¹, Tomas Branyik², Maria Zednikova³, Marek C. Ruzicka³, Jiri Drahos³¹Institute of Chemical Technology, Department of Fermentation Chemistry and Bioengineering and, Institute of Chemical Process Fundamentals ASCR, Department of Multiphase Reactors, Prague, Czech Republic, ²Institute of Chemical Technology, Department of Fermentation Chemistry and Bioengineering, Prague, Czech Republic, ³Institute of Chemical Process Fundamentals ASCR, Department of Multiphase Reactors, Prague, Czech Republic**DESCRIPTION OF TOPIC:**

Beers of different composition were tested experimentally, as for the effect of organic compounds with surface activity on the dynamics of beer foam stability and collapse. The high-speed imaging system was used to monitor the foam behaviour, at high resolution.

Results: The temporal pattern of the beer foam behaviour was obtained in terms of the kinetic parameters and their relation to the character of the surface active compound.

Mbaka Malanda

Dr Mbaka MALANDA is Master in sciences and techniques of food industries from Brest University. He has a PhD in Nutrition, food sciences and Applied biochemistry at Nancy University: Study of beer colloidal stability (Prof CHAPON). He has worked for 5 years in the industrial brewery (UNIBRA – Kinshasa – Congo). Since 1991, he is at the French Institute of Brewing and Malting (I.F.B.M.) as Pilot Plant Manager and teacher.

Hannes Withouck

Finished my Bachelor in Biochemistry in 2005 at KaHo Sint Lieven. Career: 2005 - present: responsible for the pico brewing plant (50 L) of the KaHo Sint Lieven; practical courses in analytical chemistry; reasearch in brewing science. Research topic: colloidal stability

Martin Baszczyński

Baszczyński Martin holds a MSc degree in Fermentation Chemistry and Bioengineering from the Institute of Chemical Technology (ICT) in Prague. Currently he is involved in Postgraduate (PhD) studies at the Department of Fermentation Chemistry and Bioengineering (ICT) and also working at the Department of Multiphase Reactors of the Institute of Chemical Process Fundamentals, Academy of Sciences of the Czech Republic. He is mainly interested in the area of beer foam research with emphasis on the stability and structure.

P 043

High-speed imaging of beer foam formation: Effect of surfactants

Pavel Novák¹, Martin Baszczyński¹,
Tomas Branyik², Maria Zednikova³,
Marek C. Ruzicka³, Jiri Drahos³

¹Institute of Chemical Process Fundamentals of the ASCR, v. v. i., Department of Multiphase Reactors and, Institute of Chemical Technology Prague, Department of Fermentation Chemistry and Bioengineering, Prague, Czech Republic, ²Institute of Chemical Technology Prague, Department of Fermentation Chemistry and Bioengineering, Prague, Czech Republic, ³Institute of Chemical Process Fundamentals of the ASCR, v. v. i., Department of Multiphase Reactors, Prague, Czech Republic

DESCRIPTION OF TOPIC:

In this experimental study we developed a visualization method based on the high-speed imaging technique. The method consists of application of high-speed digital camera and image analyzing software. The method is suitable for investigating the mechanism of bubble formation (heterogeneous nucleation) and collision of bubbles with liquid surface. The suppression of bubble coalescence, whence foam formation, was tested on different samples of model liquids and beers differing in surfactant content.

Results: We obtained interesting relations between the flexibility of the liquid film surrounding the gas bubbles and the composition of the liquid phase. The influence of surfactants on mechanism of bubble formation and their collision with gas-liquid interface was studied.

P 044

Expression of the hydrophobin FcHyd5p from *Fusarium culmorum* in *Pichia pastoris* and evaluation of its contribution to gushing

Georg Lutterschmid¹, Matthias Stübner¹,
Rudi F. Vogel¹, Ludwig Niessen¹

¹TU-München - Lehrstuhl für Technische Mikrobiologie, Freising, Germany

DESCRIPTION OF TOPIC:

Hydrophobins are small proteins of about 10 kDa produced by filamentous fungi with a remarkable surface activity promoting the formation of self-assembled structures known as rodlets. They are important for fungal growth and the interaction of fungi with their environment. Recent studies suggested, that hydrophobins act as factors inducing gushing for beer, the uncontrolled burst out when a beer bottle is opened. Problems of primary (biologically caused) gushing correlate with the quality of barley used in malting and occur in particular in those years when barley has been infected by fungal pathogens such as *Fusarium*.

Results: It could be shown that amounts > 0,5 mg of lyophilisate induced gushing, whereas lyophilisate of the *P. pastoris* wild type strain X33 caused no gushing. The gushing inducing property could also be observed in non-alcoholic carbonated beverages. The addition of lyophilisate to the brewing process at the beginning of mashing was also demonstrated to result in gushing beer.

P 045

New best practise approach to traditional stabilisation

Mika Unting¹, Sonya Broderick²

¹ISP, Cologne, Germany, ²ISP, Warrington, United Kingdom

DESCRIPTION OF TOPIC:

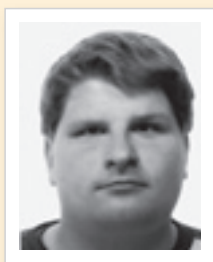
Colloidal instability in beer is caused by the interaction of haze sensitive proteins and haze active polyphenols (tannoids) present in the beer. Haze formation can be controlled through the management of these haze precursors. Process aids such as PVPP and silica are employed in the brewing process to achieve the desired haze precursor levels and allow the beer to attain its predicted shelf-life.

Inefficient practises in stabilisation can result in unjustified cost waste through over stabilisation of the beer.

Implementation of Best Practise through achieving the correct dosage rate and accurate dosing can deliver optimum stabilisation while reducing the cost base to the brewery. This is a possibility with the use of the right equipment, namely the Haze Tester and the ISO-mix system.

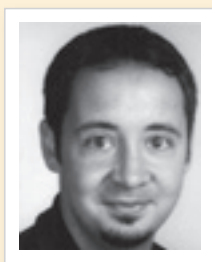
Results: Results demonstrate that the combination of targetted dosing and accurate, even distribution allow lower dose rates of Polyclar 10 to be employed in the stabilisation regime without compromising quality.

Pavel Novák



Pavel Novák holds an MSc degree in Fermentation Chemistry and Bioengineering from the Institute of Chemical Technology (ICT) in Prague. Currently he is involved in Postgraduate (PhD) studies at the Department of Fermentation Chemistry and Bioengineering (ICT) and also at the Department of Multiphase Reactors of the Institute of Chemical Process Fundamentals, Academy of Sciences of the Czech Republic. His research interests are in the area of foams with emphasis on the beer foam formation and interaction with solid phase.

Georg Lutterschmid



1999-2004 Study of Foodtechnology (Dipl.-Ing. (FH)) at TU München, Diploma thesis Influence of different pre-treatments on the crosslinking of casein by transglutaminase; 2004-2006 Study of Technology and Biotechnology of Food (M. Sc.) at TU München, Master thesis Identification of new alcoholdehydrogenases from *Lactobacilli*; since 2006 PhD student at the Lehrstuhl für Technische Mikrobiologie at TU München.

Mika Unting



2 years with Diessel, Brewing Engineer VLB, last 10 years with ISP, today head of beverage department Europe

P 046

Gushing suppressing effects of hop constituents

Stefan Hanke¹, Markus Herrmann¹,
Werner Back¹

¹TU München, Lehrstuhl für Technologie der Brauerei I, Freising, Germany

DESCRIPTION OF TOPIC:

Gushing is one of the most unsolved problems in brewing. This phenomenon of bottled beer has been known for a long time and spontaneous foaming is caused by an imbalance of gushing promoting and preventing factors contained in beer. Despite the high diversity of gushing factors reported it is widely accepted that barley and malt contaminated by moulds represent the most significant inducing factor. They are designated as primary gushing factors and nearly all research in the last years focused on these malt and microorganism derived factors. An influence of hop is often neglected. Older reports say that hops can have an influence on the gushing tendency of beer. Beside polyphenols and bitter acids hops contain oils that give a pleasant hoppy flavour when added at late stage of wort boiling.

Results: These experiments showed that a concentration of 50 µg/l Linalool reduced the gushing volume by 25%. With increasing linalool content the gushing volume decreased even more. Also hop oil significantly reduced the gushing tendency of beer. Activated carbon induced gushing which could be reduced by by linalool and alpha acids. Our results were comparable with the gushing reduction obtained with a commercial hop based gushing inhibitor.

P 047

Updated research results on the flavour stability of beer in plastic packagings

Roland Folz¹

¹VLB-Berlin, Research Institute for engineering and packaging, Berlin, Germany

DESCRIPTION OF TOPIC:

Plastic containers and closures have taken on an important role as packaging materials for the brewing industry. Alongside the many well-known advantages there is the problem of plastic's inherent permeability to gases (O₂ and CO₂). To enhance the barrier properties of plastic material different bottle systems for example Multilayer, internal coatings and blends were developed. The quality of these various systems can be evaluated through the measurement of permeation. Since the demand of permeation measurement has reached the market novel methods for measurement are proposed and offered. The diversity of systems led to a situation in which measurement results from different sources can not be compared which each other. The lecture contains a comparison of existing methods with novel methods and at the same time an evaluation of the latest development in barrier enhanced plastic bottles and closures.

Results: Deviations in the results of different permeation measurement methods that are not working with the real kinetic exist and must be an essential part of discussion about barrier effects.

P 048

Assuring the microbiology of draught beer

David Quain¹, Abhishek Banik¹, Paul Hughes¹

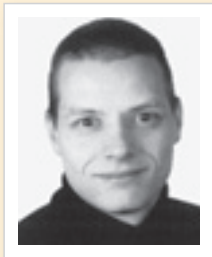
¹Heriot-Watt University, International Centre for Brewing and Distilling, Edinburgh, United Kingdom

DESCRIPTION OF TOPIC:

A number of factors influence the quality of draught beers. Notably, hygiene standards impact on the microbiological loading of beer. Elevated levels of microorganisms distort product quality and have a deleterious effect on attributes such as taste, aroma and clarity. Key to the assurance of good hygiene is regular and effective line cleaning that manages the regrowth of attached microorganisms (biofilm) within dispense tubing. We report here the implications on product microbiology of weekly line cleaning and what happens when this stops. Also a novel 'magnetic field' technology that reportedly allows the relaxation of weekly line cleaning was evaluated in terms of microbial loading in the beer.

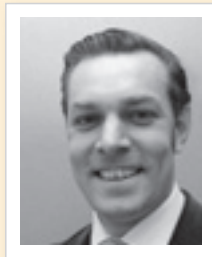
Results: Weekly line cleaning supported beers of excellent product quality with microbial loadings of 958 colony forming units (cfu)/ml (aerobes) and 665 cfu/ml (anaerobes) (average for three brands monitored weekly for 12 weeks). Stopping line cleaning for four weeks increased the average counts ca. 5-fold (aerobes) and ca.7-fold (anaerobes). The 'magnetic field' technology - on lines which were not cleaned for 9 weeks - delivered average microbial counts which were 52% (aerobes) and 32% (anaerobes) of the control beers.

Stefan Hanke



I was born in 1980. From November 1999 to July 2004 I studied brewing science and beverage technology at Technische Universität München (Weihenstephan), graduating as an engineer with a Dipl.-Ing. degree. During my studies I worked for and received practical training at different German brewing and malting companies. Since September 2004 I have been a scientific employee at the Lehrstuhl für Technologie der Brauerei I, Freising-Weihenstephan, Germany (Prof. Back). From December 2006 until May 2007 I headed the institutes Small Scale and Pilot Scale Brewery Department. Since May 2007 I'm responsible for the HPLC and GC Laboratory of the institute. My main research topics are the influence of hops on beer drinkability, as well as the influence of beer matrix on bitter taste.

Roland Folz



Roland Folz attended an apprenticeship as a brewer and maltster at the Beck's Brewery in Bremen, Germany. After working another year for the Beck's brewery, he started his studies in Berlin and received a diploma engineer degree in brewing technology from the Technical University, Berlin. After the graduation, he was head of the technical department/production at the Preussen Pils brewery in Pritzwalk, Germany for two years. In October 2006, he returned to the VLB-Berlin as a global consultant for brewing technology and now works for the Engineering and Packaging Department as the specialist for the filling department and PET topics. Furthermore to his consulting practice, he is involved in teaching and in research projects and manages the internationalisation of the VLB.

David Quain



After 24 years at Bass/Coors, David is part-time Professor in Brewing at ICBT and also founder/Director of red-ts Ltd, a technical consultancy.

Decomposition of the iso- α -acids in bottle conditioned and pasteurised beers

Nerina Sebastianutto¹, Stefano Buiatti¹,
Andrea Pavslar¹

¹University of Udine, Department of Food Science, Udine, Italy

DESCRIPTION OF TOPIC:

Decomposition of iso- α -acids (IAA) was evaluated comparing bottle conditioned with pasteurised beers. In addition, the influence of the yeast strain used in the conditioning step was studied.

Results: The pasteurised beer was analysed before and after pasteurization. Both the IBUs and the IAA content did not change. During the refermentation step, the IAA showed an average decrease of 13%, the trans-isomers decreased more than the cis-isomers and the yeast strains did not prove different. During ageing the pasteurised beer showed a decrease in IAA by 17% and the other beers by 18% on average. The yeast strains did not prove different during ageing even if the highest pitching rate showed a strongest decrease in IAA. The T/C ratio decreased by 33% and 37% for pasteurised and conditioned beers respectively. The isochumulone, isohumulone and isoadhumulone showed a decrease during ageing by 17, 20 and 16% for pasteurised beer and 14, 18 and 19% for the other beers.

Should brazen-equipment still be used in beer dispensing systems these days?

Heinz Dauth¹, Johannes Tippmann¹,
Klaus Dörsam²

¹TU München, Lehrstuhl für Maschinen- und Apparatekunde, Freising-Weihenstephan, Germany, ²Berufsgenossenschaft Nahrungsmittel und Gaststätten BGN, Mannheim, Germany

DESCRIPTION OF TOPIC:

For more than ten years different committees and boards are discussing the usage of brazen-equipment in beer dispensing systems very controversial. The repeated efforts of the "Arbeitskreis Getränke-schankanlagen des Deutschen Brauer-Bundes" to use solely equipment of stainless steel have not yet penetrated into the awareness of all persons in charge. Due to the need for scientific action investigations have been carried out to determine the release of lead from brazen-equipment which stands in contact with beer.

Results: During the whole investigation period one could measure different lead concentrations released from the nozzles due to longer contact time with beer. The lead concentration appeared non-systematic and independent from age and condition of the nozzles.

A novel method for measuring total package oxygen

Frank Verkoelen¹

¹Haffmans BV, Sales, Venlo, Netherlands

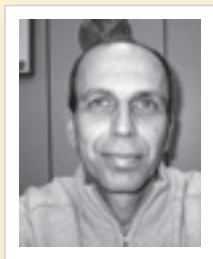
DESCRIPTION OF TOPIC:

When it comes to product life and flavor stability of beer and beverages, oxygen remains detrimental. Preventing (even low) oxygen pick-ups during the entire production and packaging process is of paramount importance to brewers and beverage manufacturers. As a result, beer and beverages are produced with very low dissolved oxygen (DO) levels, achieving consistent quality and high flavor stability during their complete shelf life. Through a TPO measurement the brewery is able to determine the critical parameter for the sustainability of beer quality.

Directly after filling, packages are prepared for TPO measurement that should be performed as quickly as possible to avoid product oxidation and consumption of oxygen. A quick determination, without sample preparation, requires separate measurement of the O₂ content in the headspace and dissolved oxygen. This results in the total package oxygen and enables to determine whether the O₂ is coming from the headspace or from the liquid.

Results: A new measuring method for calculating Total Package Oxygen (TPO) out of the oxygen content in the headspace and the dissolved oxygen. The total oxygen is equal to the total oxygen calculated with the traditional z-method of Uhlir.

Stefano Buiatti



He got a degree in Agricultural Science at University of Bologna, Italy. He is researcher at University of Udine 1985 present. He worked as Quality Control Technician at Moretti Brewery in Udine, Italy in 1985. Research secondment to Brewing Research International, Nutfield (UK) in 1997 and 1998 (6 months) and in 1999 (3 months). Expert as project evaluator for EU since 1999. In charge of the pilot brewery at the University of Udine, Italy. Professor at University of Udine on Brewing science and Cleaning and Disinfection of Food Plants: He has been teaching Brewing Science since 1994 and Cleaning and Disinfection of Food Plants since 1999. He works on optimization of analytical methods, chemical and microbiological quality assessment of craft and industrial beers.

Heinz Dauth



Graduated as an Engineer for Food Technology and Biotechnology at the TU München - Weihenstephan in 1993. Afterwards appointed as a Scientific Researcher at the Chair of Process Engineering (Prof. Sommer) in Weihenstephan. Doctoral thesis completed in 1999 in the field of mechanical process engineering. Since 2003, Scientific Assistant and University Lecturer at the Chair of Process Engineering, TU München. His main interests of research are bulk solids technology, dispensing technology, process engineering for specific problems in the food and beverage industry. He is also responsible for the industrial cooperation programme of the institute. Furthermore he is working as an Assistant Professor at the Weihenstephan University of Applied Sciences lecturing about process engineering.

Frank Verkoelen



Studied Mechanical Engineer at HTS Venlo and finished in 1982 Since 1984 working for Haffmans B.V. - Started as a project engineer for CO₂ recovery. - After Project Management changed to R&D in 1987 - Became the R&D manager - Since approx. 2001 changed to Product Manager QC, - Became Sr. PM responsible for sales of QC equipment and in-line equipment

P 052

Beer categorization: A new way to understand beer expertise

Maud Lelièvre¹, Sylvie Chollet¹,
Dominique Valentin²

¹ISA, Lille, France, ²Université de Bourgogne - CESC, Dijon, France

DESCRIPTION OF TOPIC:

A beer sensory panel is a very useful tool to describe and compare beers. But training beer experts require important investments. So expertise is an important field of research in sensory analysis. Whereas effect of expertise on discrimination and description of food products has been widely studied, little is known about how sensory experts categorize their perceptions and their knowledge. By understanding how sensory experts organize their perceptions, we could develop new sensory training methods. The objective of this study was to understand how people categorize beers depending on their expertise level.

Results: Globally, there is no difference in discriminative performance but it seems that discrimination criteria are not the same for the two groups of experts. We found that sensory beer experts and brewers globally categorize beers in the same way, when they taste beers or when they see beer pictures.

P 052 a

The influences of membrane filtration on taste stability and haze formation

Dick Meijer¹

¹Norit Process Technology BV, Enschede, Netherlands

DESCRIPTION OF TOPIC:

An independent study has shown that Norit Process Technology's Beer Membrane Filtration has a positive effect to the taste and colloidal stability of the filtered beer. In this test – a modern Cross Flow Membrane Filter has been compared with a state-of-the-art Kieselguhr Filter. The Kieselguhr that has been used as a filter aid had an extremely low FE-content and as research methods EPA/ ESR/ EPR and standard chemical analysis of aging components have been used. One of the tests has been executed in a brewery with a full-scale Beer Membrane Filter. The test results indicated a higher FE-level in Kieselguhr filtered beer, implicating a higher oxidative level of the beer.

P 053

Beer bioflavouring by refermentation: a sensorial comparison between bottle conditioned and industrial beers

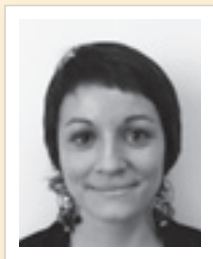
Andrea Pavsler¹, **Stefano Buiatti¹**,
Stefano Micolini¹

¹University of Udine, Food Science, Udine, Italy

DESCRIPTION OF TOPIC:

Sensorial comparison between bottle conditioning and isobaric bottling methods. Evaluation of the effects on the final quality product using alternative extracts for refermentation process in lager beer style.

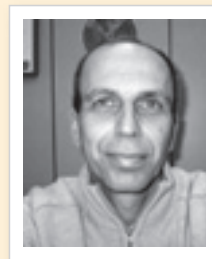
Results: Bottling conditioning can be a suitable method to obtain good quality products, even for lager beers like American lager, classic American Pilsner and German or Bohemian Pilsner beers style.

Maud Lelièvre

Master's degree in Sensory Analysis PhD project: „Effect of expertise on representation and categorization of beers.”

Dick Meijer

A Brewer with 17 years experience in different positions at the Grolsch Breweries in the Netherlands. In 1997 started as Technical Director within the Norit organization. The last 4 years responsible for marketing and sales of turn-key breweries and membrane applications in breweries. Target is to implement kieselguhr-free beer membrane filtration and Membrane Bioreactors, where effluent of the treated waste water will be re-used as Process water, as the standard applications.

Stefano Buiatti

Date of Birth: 24.4.58, single Degree in Agricultural Science, University of Bologna, 1984. Lecturer/Researcher University of Udine 1985 present Quality Control Technician Moretti Brewery, 1985 Research secondment to Brewing Research International, Nutfield (UK) September 1997 to March 1998 and July 1999 to October 1999 Expert as project evaluator for EU since 1999 (in FP 5,6 and 7) In charge of the experimental microbrewery at the University of Udine Preparation and delivery of lecture course at University of Udine on Brewing science and Cleaning and Disinfection of Food Plants Optimization of analytical methods, chemical and microbiological quality assessment of craft beers.

Occurrence of thiols in beer: Impact of bottle refermentation

Sabrina Nizet¹, Jacques Gros¹, Laurent Mélotte¹,
Sonia Collin¹

¹Université catholique de Louvain, Unité de Brasserie et des
Industries Alimentaires, Louvain-la-Neuve, Belgium

DESCRIPTION OF TOPIC:

Thiols are known to have a strong impact on the overall aroma of fermented beverages. For fresh beers, twelve polyfunctional thiols were detected (1). All of them were absent from wort, suggesting a key role of fermentation (1). Thiols can be also generated through ageing, inducing roasted/burned (2-mercaptoethyl acetate and 3-mercaptopropyl acetate) or onion-like (2-mercapto-3-methylbutanol) off-flavours (2). In some breweries, a cold storage is applied just after fermentation to avoid milk-like defects, most probably brought by polyfunctional thiols.

As no scientific data were available on the impact of bottle refermentation on these compounds, this was the aim of the present work.

Results: XAD extractions were performed on bottle refermented and unfermented beers. Some fruity esters and acids revealed detected with a higher dilution factor after refermentation. However, the biggest differences between both beers were their thiol profile. Eight polyfunctional thiols emerged as specific of the refermented beer. Their chemical structure and synthesis pathway will be discussed.

Quantitative analysis of the content of aromatic alcohols in Czech beer using SPE and GC-MS

Jiří Čulík¹, Tomáš Horák¹, Vladimír Kellner¹,
Jurková Marie¹, Pavel Čejka¹, Josef Dvořák¹

¹Research Institute of Brewing and Malting, AZL, Praha, Czech
Republic

DESCRIPTION OF TOPIC:

The content of aromatic alcohols o-phenylethanol, eugenol, guaiacol, 4-ethyl and 4-vinylguaiacol, tyrosol and tryptofol considerably influence the sensoric profile of beer. As literature data concerning their content in beer in many cases differ significantly, our aim was to develop an accurate, sensitive and reproducible method for the analysis of aromatic alcohols in beer.

Results: The extraction conditions were optimized and the proposed method was validated on real samples of beer. The recovery of aromatic alcohols ranged from 78% to 98% and the coefficient of variation ranged from 1,22% to 10,96%. The limit of detection (LOD) varied from 0,001 to 0,01 mg/l.

Impact of organic practices on organoleptic properties of beer

Laurent Mélotte¹, Sabrina Nizet¹,
Etienne Bodart¹, Sonia Collin¹

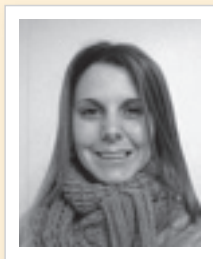
¹Université catholique de Louvain, Unité de Brasserie et des
Industries Alimentaires, Louvain-la-Neuve, Belgium

DESCRIPTION OF TOPIC:

Consumers are more and more sensitive to the presence of pesticide residues in their products as to the negative impact of conventional agriculture on the environment. Some brewers are currently proposing organic versions of their beer to fulfill this increasing demand. However, even when an identical process is applied, organic and conventional versions of the same beer always taste differently. The aim of the present work was to point out these differences and start tracing their origin in the raw materials (hops and malt).

Results: Differences were evidenced between the two beers. The former, already more coloured, displayed a more complex profile, with more spicy, grainy and malty aromas, whereas the conventional one contained more sulphur and stale flavours. XAD extraction was performed on both samples. Significant variations were recorded among acids, esters, volatile phenols and sulphur compounds, partially explaining tasting profile differences. Sulphur composition was tentatively linked to organic practices in hop culture, especially the use of copper sulphate.

Sabrina Nizet



Sabrina Nizet received her bachelor in food in chemistry in 2004 from the Institut Paul Lambin (Bruxelles, Belgium). Since then, she joined the team of Professor Sonia Collin (Université catholique de Louvain, Brewery and industrial food department) where she is involved in researches focused on hop and beer aroma. She is also specialized in organic chemistry and involved in beer quality control.

Jiří Čulík



Čulík, Jiří was born in 1952. Studies: MSc, Institute of Chemical Technology - Prague, CZ, Faculty of Food Preservation and Meat Technology (1975); PhD, Institute of Chemical Technology - Prague, Faculty of Fermentation Chemistry and Bioengineering (1987). Appointments: 1975-1980, technologists and research and development worker (fermentation and beverages technology); since 1980: Research worker at the Research Institute of Brewing and Malting Prague (RIBM); since 2001: Technical Head of Accredited Analytical Testing Laboratory; since 1997: Member of the MEBAK Committee. Research topics: gas and liquid chromatography, trace analysis of cancerogenic and sensoric-active compounds in beer and related raw materials, flavour stability of beer.

Laurent Mélotte



Laurent is graduated in agronomy and in brewing from UCL (Belgium). After working in a Gueuze Brewery, he started extensive research on sorghum malting and brewing for 4 years. In 1993 he joined Inbev as Raw Material Specialist, then Analytical and Sensory Services Manager, Senior Malting Scientist, and recently Global Brewing Chemistry Manager. Laurent is now visiting lecturer (biochemistry of malting and brewing) at the UCL and active in research in the laboratory of Professor Collin. His research focuses mainly on the aroma characteristics of special beers and their fate along ageing, and the quality of raw materials.

P 057

Development of light beers with improved fullness and prolonged flavour stability

Koen Goiris¹, Sofie Malfliet¹, Jan De Cock¹, Gert De Rouck¹, Guido Aerts¹, Luc De Cooman¹

¹KaHo St.-Lieven Laboratory of Enzyme, Fermentation and Brewing Technology/M2S, KUL Association, Leuven Food Science and Nutrition Research Centre (LForCe), K.U.Leuven, Ghent, Belgium

DESCRIPTION OF TOPIC:

Compared to the US, consumption of light beers in Europe is marginal. Although cultural and health-related aspects may largely explain this differential consumer behaviour, in this work we aimed at unravelling potential flavour deficiencies of light beers and to develop a fully-flavoured product with prolonged flavour stability.

Results: The fresh commercial beers could be differentiated based on their origin (US or European) and beer style (light or pilsner). A lack of bitterness, too much sweetness, and especially low fullness were identified as potential flavour deficiencies of fresh light beers. Upon ageing, light beers were generally less flavour stable than their pilsner counterparts, mainly due to increased sensory perception of cardboard and ribes staling flavours.

P 058

Screening of different enzymes able to hydrolyse cystein adducts, a new source of hop flavours

Jacques Gros¹, Sabrina Nizet¹, Vesna Jerkovic¹, Laurent Mélotte¹, Sonia Collin¹

¹Université Catholique de Louvain, Unité de Brasserie et des Industries Alimentaires, Louvain-la-Neuve, Belgium

DESCRIPTION OF TOPIC:

4-Sulfanyl-4-methylpentan-2-one (4SMP) and 3-sulfanyhexanol (3SH), two Sauvignon-like flavours (1), have been detected in various lager beers and in some hop varieties (2,3,4). In wine, these polyfunctional thiols are released from S-cysteine conjugates, thanks to yeast β -lyase activity (5). The aim of the present work was to investigate how brewing enzymes could increase the hydrolysis of such conjugates, most probably present in hop.

Results: Sensorial analyses evidenced strong differences before and after hop enzymatic digestions. GC-O, GC-PFPD and GC-MS allowed us to identify the main polyfunctional thiols derived from S-cysteine conjugates. The most efficient enzymes were selected. pH and temperature were optimized in order to increase the polyfunctional thiols recovery.

P 059

Identification of a new off-flavour in "light stable" beers

Jacques Gros¹, Sabrina Nizet¹, Laurent Mélotte¹, Sonia Collin¹

¹Université Catholique de Louvain, Unité de Brasserie et des Industries Alimentaires, Louvain-la-Neuve, Belgium

DESCRIPTION OF TOPIC:

MBT (3-methyl-2-butenethiol) is responsible of the famous lightstruck off-flavour in beer (1). Reduced hop extracts can be used to avoid iso α -acid photo-degradation (2). If it clearly improves the taste of fresh beer bottled in clear glass, some off-flavours are still detected after ageing. The aim of the present work was to investigate the pathways leading to these compounds.

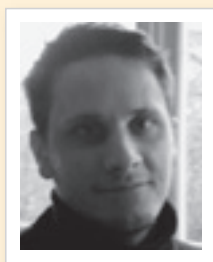
Results: Whereas no MBT flavour was detected by the panel, comparative sensorial analysis evidenced a strong "onion-like" off-flavour in "light stable" beer exposed to light. GC-O and GC-MS applied on the aroma extracts allowed to identify 2-sulfanyl-3-methylbutanol (2S3MB) as the key-compound (AEDA Dilution Factor = 32-1024 for 2S3MB while only 8-16 for MBT). 2S3MB revealed to be synthesized from 3-methyl-2-butenol (3MBOH) found in hop extracts. The involved radical mechanism is strongly enhanced by light.

Koen Goiris



Goiris, Koen Born in 1976. Studies: Academic degree in Industrial Engineering Biochemistry at the KaHo St.- Lieven, Ghent, Belgium (2000). Appointments: 2000-present: Assistant Scientist in Malting and Brewing Science at the Laboratory of Enzyme, Fermentation and Brewing Technology of KaHo St.-Lieven. Research topics: high tech hopping: advanced bittering, novel hop aroma technology and hop polyphenols; beer flavour and flavour stability; mixed fermentation and light beers.

Jacques Gros



EDUCATION: 10/2007 PhD Student in Agronomy and Biological Engineering carried out in the Brewery and Food Industries laboratory, Catholic University of Louvain-la-Neuve (Belgium). (Advisor Prof S. Collin) 06/2007: Research Master in Microbiologie Immunologie - University of Bordeaux II (France). EXPERIENCE - INTERNSHIPS 2007: Research project leader in Mycology and Alimentary Security (MYCSA) INRA Bordeaux (France) (7 months) 2006: Research project assistant in Laboratoire de Functional genomics of Trypanosomatides, University Bordeaux II (2 months) 2004: Research project assistant in Oenology Faculty, UMR nologie-Ampélogie, University of Bordeaux II (2 months)

Jacques Gros



EDUCATION: 10/2007 PhD Student in Agronomy and Biological Engineering carried out in the Brewery and Food Industries laboratory, Catholic University of Louvain-la-Neuve (Belgium). (Advisor Prof S. Collin) 06/2007: Research Master in Microbiologie Immunologie - University of Bordeaux II (France). EXPERIENCE - INTERNSHIPS 2007: Research project leader in Mycology and Alimentary Security (MYCSA) INRA Bordeaux (France) (7 months) 2006: Research project assistant in Laboratoire de Functional genomics of Trypanosomatides, University Bordeaux II (2 months) 2004: Research project assistant in Oenology Faculty, UMR nologie-Ampélogie, University of Bordeaux II (2 months)

The sorting task: Another method to obtain beer sensory descriptions

Sylvie Chollet¹, Maud Lelièvre¹, Hervé Abdi², Dominique Valentin³

¹Institut Supérieur d'Agriculture, Food Department, Lille, France, ²University of Texas, Dallas, United States, ³Université de Bourgogne, UMR CSG 5170 CNRS, INRA, Dijon, France

DESCRIPTION OF TOPIC:

In sensory evaluation, the method commonly used to characterise and describe beers is the conventional profile. This method is very efficient but requires a lot of time to train subjects and to teach them to quantify all the relevant sensory characteristics. Recently, new faster and less restricting methods have been developed, such as free choice profiles or profile flash. In both these methods, subjects are free to choose their own vocabulary to describe beers. More recently, the sorting task (which is a method based on similarity between products) has been studied in food and non-food fields. The aim of the present study is to see whether the sorting task can be useful to obtain relevant sensory information about beers.

Results: Results showed that sensory maps obtained with sorting tasks are close to those obtained with the conventional profile. Moreover, sorting tasks could be used with trained as well as untrained subjects. Using of a list of terms helped, whereas providing the number of beer groups did not. Finally, to obtain relevant results, the number of beers to classify should not be more than twenty.

Relevance of non-thermal process steps on Strecker aldehyde formation after wort boiling

Andreas Stephan¹, Andreas Brandl¹, Georg Stettner¹

¹Bitburger Braugruppe GmbH, Bitburg, Germany

DESCRIPTION OF TOPIC:

In previous publications we pointed out the correlation between high soluble nitrogen contents in malt and wort and the increased susceptibility of the resulting beers towards beer aging. The aging process is closely linked to the Strecker degradation of the precursor amino acids. Apart from the wort boiling we elucidated further formation origins throughout the following non-thermal process steps.

Results: In accordance to our previous results we found an increase in methional for the BoB-beer. Surprisingly this increase was also evident for the BoF-beer. This indicated that there is a non-thermal pathway to Strecker aldehydes (SA) during fermentation that is dependent on the level of the corresponding precursor amino acid. More interestingly we also saw an increased formation of SA in the BB-beer. Having an identical amount of SA in fresh condition compared to the standard the addition of amino acids intensified the amount of SA and consequently the stale flavour after 3 and 6 months significantly.

Thermal influence on Strecker aldehyde formation during wort boiling

Andreas Brandl¹, Andreas Stephan¹, Georg Stettner¹

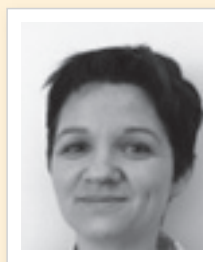
¹Bitburger Braugruppe GmbH, Bitburg, Germany

DESCRIPTION OF TOPIC:

In previous publications we pointed out the correlation between high soluble nitrogen contents in malt and wort and the increased susceptibility of the resulting beers towards beer aging. The aging process is closely linked to the Strecker degradation of the precursor amino acids. Currently mainly thermal processes (e.g. wort boiling) are said to be responsible for the development of Strecker aldehydes (SA). Different wort boiling times and intensities were examined to check the influences on beer aging intensity during storage.

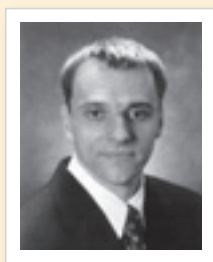
Results: Worts 1-5 showed a slightly increased level of SA for the brew with 120 min boiling time whereas the amount of SA was equal for all fresh beers and after 3 months. Hence the tasting panel could not point out a significant difference in aging flavour for these beers. Interestingly the brew without boiling (BwB) showed a slightly higher level of SA in the fresh beer than the standard beer (SB; 70 min boiling). It became obvious that the levels of SA for BwB and SB vary significantly throughout wort production. However the final beers show a nearly identical SA amount.

Sylvie Chollet



Professor in Food department of Institut Supérieur d'Agriculture de Lille-France (Since 2000) - PhD in Food Sciences (2000)

Andreas Stephan



Since 2007: Head of central laboratory of the Bitburger Braugruppe GmbH, Bitburg, Germany. 2000-2006: Head of the laboratory of the Bitburger Brauerei Th. Simon GmbH. 1999: PhD in Food Chemistry at the University of Hamburg (Thesis: development and manoeuvrability of the flavor of soybean lecithins). 1997-1999: Scientific collaborator at the Institute of Food Chemistry, Hamburg. Appointments: 1996: Hygiene Institut Hamburg; 1995: GBA Gesellschaft für Bioanalytik Hamburg mbH. 1990-1995: Studies of Food Chemistry at the University of Hamburg

Andreas Brandl



Born in 1973. 1993-1995: Technical graduation as a brewer at the brewery Aldersbach. 1995-2001: study of Brewing and Beverage Technology at the TU Munich-Weihenstephan. 2001-2005: PhD thesis in Weihenstephan on the development and the implementation of PCR-based methods into brewery quality assurance. 2005-2007: Project engineer for aseptic filling lines at Krones AG in Neutraubling. Since 2007: Head of the Bitburg brewery pilot plant. Responsible for the organisation and documentation of brewing technology trials.

P 063

Contribution of staling compounds to various types of aged flavours occurring in lager beer by studying their concentration evolutions and flavour thresholds

Daan Saison¹, David P. De Schutter¹, Sem M. Vandecan¹, Bregt Uyttenhove¹, Filip Delvaux¹, Freddy R. Delvaux¹

¹Centre for Malting and Brewing Science, Microbial and Molecular Systems - KU Leuven, Heverlee, Belgium

DESCRIPTION OF TOPIC:

Beer flavour is the result of a complex interaction between hundreds of compounds and even more taste and olfactory receptors. During storage, various chemical reactions occur in beer which result in the deterioration of the fresh flavour. It is however unclear which compounds are responsible for the aged flavour. Additionally, aged flavour formation (cardboard, ribes, caramel, madeira,...) appears to be dependent on storage conditions. This study gives an overview of the flavour contribution of compounds that were already linked with beer ageing and gives a clearer insight in the effect of storage conditions on the progress of ageing reactions.

Results: The effect of 26 staling compounds on the aged flavour of a Belgian lager beer was studied. Strikingly, thresholds were regularly found to be substantially lower than previously reported. In addition, a masking effects and various interactions were observed between flavour compounds. Finally, the progress of staling reactions was clearly dependent on storage conditions and gave rise to different staling compound concentrations and consequently different types of aged flavours.

P 064

Sensory properties of iso- α -acids and their derivatives

Nicole Schulze¹, Ines Böker², Berthold Weber², Christa Runge², Andreas Degenhardt², Gerhard Krammer², Peter Winterhalter¹

¹TU Braunschweig, Institute of Food Chemistry, Braunschweig, Germany, ²Symrise GmbH & Co KG, Holzminden, Germany

DESCRIPTION OF TOPIC:

The bitterness plays an important role as hop-derived beer flavour attribute and is caused by the iso- α -acids which result from isomerisation process of the α -acids during the wort boiling process. Also tetrahydro-iso- α -acids, hexahydro-iso- α -acids and rho-iso- α -acids are widely used as post fermentation bittering products, due to their foam enhancing and light stable properties. There is only little scientific data about the sensory characteristics of these different iso- α -acid isomers and their chemically modified variants.

Results: For the sensory characterisation a panel of 12 - 20 persons (male, female) had been trained to evaluate taste thresholds and time-intensity measurements.

P 065

LC-MS/MS studies on the influence of the pH value on the formation of novel iso- α -acid degradation products in beer

Annika Brock¹, Andreas Stephan¹, Daniel Intelmann², Thomas Hofmann², Georg Stettner¹

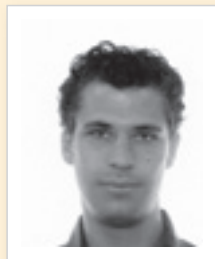
¹Bitburger Braugruppe GmbH, Bitburg, Germany, ²Lehrstuhl für Lebensmittelchemie und Molekulare Sensorik, Freising, Germany

DESCRIPTION OF TOPIC:

The flavour of beer is heavily dependent on time of storage. The typical bitterness of fresh beer is well-known to slightly decrease in intensity and to change in quality with increasing age of the beverage. Non-volatile bitter compounds of beer have been investigated in the last decades, and it is agreed that the typical beer bitterness is caused by adding hop products during wort boiling. A number of isomerization processes during the wort boiling process have been reported to be of major importance for bitter taste development in the final beer product. Moreover, the iso- α -acids have been identified as the major bitter contributors in beer and were demonstrated to be generated upon a re-arrangement reaction of their hop-derived precursors, namely the α -acids. Already De Cooman et al. 2000 pointed out that particularly the trans-iso- α -acids are prone to degradation. In contradiction to previous findings, Intelmann and Hofmann revealed an acid-catalytic decomposition pathway for trans-iso- α -acids to tri- and tetra-cyclic degradation products. In the present study, we investigated the influence of the pH value of beer on the formation of these degradation products by means of quantitative HPLC-MS/MS experiments.

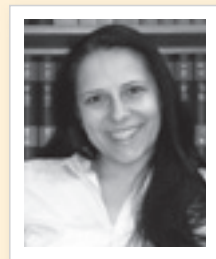
Results: The results exhibited a negative correlation between the pH value, the instability of iso- α -acids, and the formation of their tri- and tetra-cyclic degradation products.

Daan Saison



Daan Saison graduated as bio-engineer in food chemistry and technology at the K.U.Leuven. He carried out his masters thesis at the Centre for Malting and Brewing Science (CMBS) at the K.U.Leuven on the subject 'Characterisation of Glycoside Hydrolase in Brewers' Yeast and the Influence on Hop Glycosides.' After graduation, he started a Ph.D. program at the CMBS. In August 2008, he gave a lecture at the 'World Brewing Congress' on the subject: 'Effect of the fermentation process on staling indicators in order to influence the flavor stability of beer'.

Nicole Schulze



2000 - 2005 study of food science, TU Braunschweig
2005 - 2006 practical training at LAVES within 2nd state examination
2006 - 2007 project work at Institute of Food Chemistry TU Braunschweig
2007 start of Ph.D. studies

Annika Brock



Personal information: Annika Brock Im Graben 20 54634 Bitburg, Germany 05.09.1978 Experience: Flavour scientist, Bitburger Braugruppe GmbH, Bitburg, Germany (September 2008 to present) Scientific assistant, Chair of Food Chemistry and Molecular Sensory Science, TUM, Freising, Germany (October 2007 to July 2008) Scientific assistant, Institute of Food Chemistry, WWU, Münster, Germany (May 2005 to September 2007) Internship, Iglo, Reken, Germany (April 2004 to June 2004) Education: 2004-2005 year of practical training at CVUA Münster (2. state examination) 1998-2003 study of Food Chemistry at the University of Bonn (1. state examination)

Interactions in beer flavour release and perception

Rebecca Clark¹, David Cook¹, Robert Linforth¹, Francis Bealin-Kelly², Joanne Hort¹

¹Division of Food Sciences, University of Nottingham, Sutton Bonington, Loughborough, Leicester, United Kingdom
²SABMiller plc, SABMiller House, Church Street West, Woking, Surrey, United Kingdom

DESCRIPTION OF TOPIC:

Much is known about the role of individual ingredients and of key process parameters in determining beer flavour quality. However, relatively little is known about the sensory and physicochemical interactions between key flavour components - for example the impact of carbonation on perceived bitterness, sweetness or aroma of beers. The aim of this investigation was to evaluate interactions between selected primary flavour determinants in beer (carbonation level, alcohol content, bitterness).

Results: Ethanol significantly increases the release of ethyl acetate, phenethyl alcohol and isoamyl alcohol ($p < 0.05$). Carbonation significantly increases the release of ethyl acetate and isoamyl alcohol ($p < 0.05$). Hop acids did not affect volatile release.

Determination of flavour active monophenols in beer using liquid-liquid extraction with pH adjustment and GC-MS

Femke L. Sterckx¹, Sem M.G. Vandecastel¹, Freddy R. Delvaux¹

¹KULeuven, Centre for Malting and Brewing Science, Heverlee, Belgium

DESCRIPTION OF TOPIC:

The volatile phenols are a group of flavour compounds that have been extensively studied in wine and other alcoholic beverages, where they are often held responsible for certain vanilla like, spicy and woody aromas. In beer however, the research on phenolic compounds was mostly focussed on phenolic acids and anti-oxidants and not so much on the flavour active monophenols. Therefore, a method was developed to investigate these simple phenols in beer.

Results: After extraction with KOH-solution the pH was adjusted to different values, ranging from pH 9 to pH 6. This influenced the amount of extracted phenols, dependent on the functional groups present. Various monophenols could be identified when analysing different commercial beer samples with the improved method, including vanillin, acetovanillon, methyl vanillate, 4-hydroxybenzaldehyde, thymol and syringaldehyde. Many of the identified phenols haven't been reported as beer compounds previously.

Identification of novel unique flavor compounds derived from Nelson Sauvin hop and synergy of these compounds

Kiyoshi Takoi¹, Marie Degueil², Svitlana Shinkaruk³, Cécile Thibon⁴, Toshio Kurihara¹, Koichi Toyoshima¹, Kazutoshi Ito¹, Bernard Bennetau², Denis Dubourdieu⁴, Takatoshi Tominaga⁴

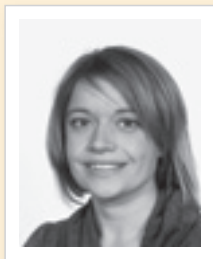
¹Sapporo Breweries Ltd., Frontier Laboratories of Value Creation, Yaizu, Japan, ²Université de Bordeaux, Talence, France, ³ENITA de Bordeaux, Talence, France, ⁴Université de Bordeaux, Faculté d'Enologie, Talence, France

DESCRIPTION OF TOPIC:

Nelson Sauvin(NS) is a unique hop variety that was bred and grown in New Zealand. This hop belongs to the high alpha-type hop, but it gives a specific floral flavor like Sauvignon Blanc wine to finished beers. We have already identified isobutyric esters and a new volatile thiol, 3-sulfanyl-4-methylpentan-1-ol, derived from NS. This result has been reported at EBC 2007. Now, we studied how these compounds contribute to the characteristic flavor of the beer made from NS (NS Product).

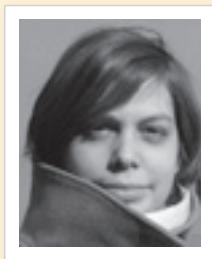
Results: We have already reported that isobutyric esters (isobutyl isobutyrate (IBIB), isoamyl isobutyrate (IAIB) and 2-methylbutyl isobutyrate (2MIB)) and a new volatile thiol, 3-sulfanyl-4-methylpentan-1-ol (3S4MP) were found in the NS hop and the NS product. Isobutyric esters had a floral flavor like green apple and/or apricot. 3S4MP had a grapefruit-like and/or rhubarb-like odor, similar to that of Sauvignon Blanc. Now, we newly identified another volatile thiol, 3-sulfanyl-4-methylpentyl acetate (3S4MPA), in the NS product. This compound had a grapefruit-like odor, similar to that of 3S4MP.

Rebecca Clark



Rebecca Clark BSc. PhD research topic - Multimodal flavour perception, the effect of key flavour components in beer on flavour perception.

Femke L. Sterckx



Master in Bioscience Engineering: Food Technology at Catholic University of Leuven, Belgium (2002-2007) PhD Research Fellow at Centre for Malting and Brewing Science, KULeuven, Belgium (2007-present)

Kiyoshi Takoi



KIYOSHI TAKOI is senior research brewer in the Frontier Laboratories of Value Creation of SAPPORO BREWERIES LTD. and studies the flavor compounds of beer.

P 069

Masking solution for off-flavours In alcoholic beverages: The Olfactoscan®

Catrienus de Jong¹, Kerstin Burseg¹,
Heleen Goorissen¹, Damien Lemaire¹

¹NIZO Food Research, Flavour, Ede, Netherlands

DESCRIPTION OF TOPIC:

The formation and presence of volatile off-flavours in foods and beverages is a widespread and costly problem for the food and beverage industry. If the removal of an off-flavour is not feasible other volatiles can be used that mask or suppress the perception of the off-flavour [1,2]. The concept of off-flavour masking is of great interest for the food and beverage industry. Fermentation and hop selection in combination with brewing optimization could lead to a considerable product improvement once knowing which aroma-aroma or aroma-taste interaction have masking or enhancing properties [3]. However, predicting which odorants mask or suppress the perception of a selected off-flavour is difficult and often the result of time-consuming trial-and-error methods. In this poster examples are given for the masking of potato-like off-flavours in alcoholic beverages with the help of an unique in-vivo screening technique called the Olfactoscan®. The Olfactoscan® allows a rapid sensorial determination of masking and/or suppressing odour interactions (4). Besides aroma-aroma interaction also aroma-taste interaction can be studied. As this method is based on the sensorial evaluation of odour interactions, it includes masking as well as suppressing effects at all levels, namely at receptors, olfactory bulb as well as olfactory cortex.

1. Luckow, T., Sheehan, V., Fitzgerald, G. & Delahunty, C. (2006) *Appetite* 47:315-23
2. Burgering, M., de Jong, C., Goorissen, H.P. and Pepin, L. (2009) Submitted to *Revue d'Oenologie*.
3. Goorissen, H.P., de Jong C. and Pepin, L. (2009) poster at 32nd EBC2009 Hamburg.
4. Burseg K.M.M. & de Jong C. (2008). Olfactoscan®: In-Vivo Screening with the for Off-Flavor Solutions. In Proceedings 12th Weurman Symposium, Interlaken Switzerland.

Catrienus de Jong



After finishing a study for analytical chemist, Catrienus de Jong was involved with the foundation of the flavour research department at NIZO food research. Now 30 years later he is still active as senior scientist and project manager at NIZO food research and manages flavour related research projects for customers all around the world. He is also responsible for many scientific publications and contributions at symposia.

P 070

Improving flavour stability of the final beer through the use of innovative natural antioxidant

Nicolas Declercq¹, Tiago Prol², Moises Perez³,
Mustapha Nedjma⁴, Cesare Bianco⁵

¹AEB GROUP, R&D Beverage Division, San Polo, Italy, ²AEB Bioquímica Latino America, Manager Beverage Division Brazil, Sao José Dos Pinhais, Brazil, ³AEB Argentina, General Direction, Maipu Mendoza, Argentina, ⁴Spindal AEB Group, R&D Biotechnology, Gretz Armainvilliers, France, ⁵AEB Group, CEO, San Polo, Italy

DESCRIPTION OF TOPIC:

Flavour stability is very significant to evaluate beer quality. The beer occurs during the all production many problems of oxidation. Glutathione (GSH) is one of the most abundant low-molecular-weight thiols found in living cells. This study presents industrial results about the use of a natural and innovative yeast extract with high level content of GSH. The objective of this study is to stabilise the organoleptic profile of the final beer by inhibiting the oxidation of the lipids, proteins and reductones in further aldehydes and free radicals compounds leading to the stealing agents, introducing this selected yeast extract peptides such as GSH during maturation, in order to bring a new alternative in regards to the latest legislation on antioxidants. Through a limit of 10 ppm of sulphites in the final product, the brewers start to reduce the oxidation acting directly on precursors from the brewhouse (Lox). However it remains necessary to insure a protection during bottling.

Results: A large panel of treatments and analysis from several pasteurised lager and speciality beers has been carried, through a comparative test between traditional antioxidants and the innovative yeast extract GSH, from the maturation tank or the bottling line. The beer shelf life from 9 to 15 months is quantified by measuring ITT and RSV-TBARS. Aldehydes, sulphur compounds, amino acids, fatty acids are quantified by GC-MS. More traditional analysis are mentioned, such as the effect of the turbidity, colour, consequence on foam, impact on protein and polyphenols, heavy metals and total sulphites before and after treatment.

Nicolas Declercq



Nicolas Declercq received a Diploma of Brewing Engineer of the University of Louvain. Since 2005 he forms part of the Beverage Team of AEB GROUP as responsible for the Western Europe Market and Global Technical Support. He is directly implicated in several R&D projects for AEB GROUP treating the optimisation of the organoleptic profile of the beer. He published together with well-know universities several papers and lectures on this subject at the ASBC, WBC and the AETCM.

P 071

Laboratory- and pilot plant- scale study on the creation of carbonyl compound-sulphur dioxide adducts

Marcel Karabin¹, Tereza Ehlová¹, Pavel Dostálek¹

¹Institute of Chemical Technology Prague, Department of Fermentation Chemistry and Bioengineering, Prague, Czech Republic

DESCRIPTION OF TOPIC:

Delaying flavour staling, in order to prolong shelf life of beer, is one of greatest challenges that the brewing industry is facing today. While the influence of free carbonyl compounds on beer quality is more or less solved, the role of carbonyls bound in adducts with sulphur dioxide formed during the fermentation process is still quite underestimated. Reverse degradation of these compounds can totally change the flavour of beer, especially after long storage under improper storage conditions.

Results: Intensity of the creation of adducts is basically pH independent under common conditions of the brewing technology (pH 4-7). The critical parameter for stability of adducts is temperature. Temperature increase from 0°C to 50°C results in 50% decrease of the adducts content. The next relevant parameter is the structure of applied carbonyls. As expected, short linear carbonyl compounds provided higher yield ratio than the other carbonyls. The reaction yield was also affected by molar ratio of reactants. From the technological point of view, the critical part of technology for creation of adducts was secondary fermentation, during which adducts content increases more than twice.

Marcel Karabin



Born in 1975 Studies: Institute of Chemical Technology Prague (ICT Prague): MSc. degree -1999, Ph.D. degree 2007 Appointments: 2002-2005: Research worker at Department of Fermentation chemistry and Bioengineering (ICT Prague) for EURO project Rheolyse, 2000-2008: Research worker and since 2008 Assistant professor at Department of Fermentation chemistry and Bioengineering (ICT Prague). Field of Work: Analytical methods (HPLC, GC) and isolation and sample preparation techniques applied on hop, malt and beer.

Quantification of flavour active cis- and trans-(4,5)-epoxy-2E-decenals in beer by GC-NCI MS with isotope standards

Konrad Neumann¹, Leif A Garbe¹

¹TU Berlin / VLB, Special Analysis, Berlin, Germany

DESCRIPTION OF TOPIC:

cis- and trans-4,5-epoxy-2E-decenals are highly flavour active compounds. They are resulting from the peroxidation of linolenic acid. Epoxydecenals are very reactive compounds; therefore, their accurate analysis requires isotope standards.

Results: A simple way for the synthesis of high reactive cis- and trans-4,5-epoxy-2E-decenals was used to achieve isotope standards. Beer work up procedure was optimized and GC-MS Analysis with NCI mode enabled limits of detection for epoxydecenals with 10 ng/l (0.01 ppb) in beer. The content of Epoxydecenals in beer (fresh) varied from 0.02 ppb (fresh beer) to 0.4 ppb (40°C, 3 days). The flavour of the cis-epoxy-2E-decenal was confirmed to be metallic, while the trans-epoxide was classified as malt-like.

Comprehensive chemical-analytical profiling and characterisation of Belgian 'kriek' beers

Jessika De Clippeleer¹, Filip Van Opstaele¹, Marjan De Ridder¹, Guido Aerts¹

¹KaHo St.-Lieven Laboratory of Enzyme, Fermentation and Brewing Technology/M2S, KUL Association, Leuven Food Science and Nutrition Research Centre (LForCe), K.U.Leuven, Gent, Belgium

DESCRIPTION OF TOPIC:

Fruit beers, appreciated worldwide, represent a small but rising segment in the Belgian beer export, amounting to a volume which should not be underestimated. The fruit beer 'kriek' is in origin made by addition of fresh sour cherries to mid-young lambic beer. The traditional kriek beer is less fruity and more acid. As fresh sour cherries are limited available, and due to a trend towards sweeter beers, commercial kriek beers are nowadays often sweetened and prepared by use of cherry juice and aroma, which can be entirely or partly substituted by colourings and flavourings, resulting in a wide variety of beers. Forced by the international trade and increasing competition with other beers, this study is the first to aim at a detailed characterisation of a number of kriek beers to bear mutual comparison or comparison with other beverages.

Results: An analytical HS-SPME-GC-MS method has been developed for reproducible flavour profiling. In the complex volatile fraction of all beers, 103 compounds were identified. The selected marker aldehydes, ethyl and acetate esters, higher alcohols, organic acids and sugar profiles varied between all beers. Many hop degradation products were noticed due to the use of aged hops. After 1 year of spontaneous ageing, minimal deterioration is observed.

The effect of CO₂ extracted malt on flavour and foam stability

Ralf Mezger¹, Mathias Schäfer², Nadine Igl¹, Werner Back², Martina Gastl²

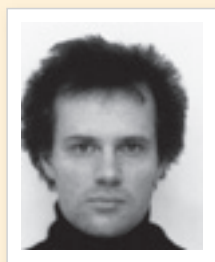
¹NATECO2 GmbH & Co. KG, Wolnzach, Germany, ²Institute of Brewing Technologie I, Freising, Germany

DESCRIPTION OF TOPIC:

CO₂ can be used as a solvent for the extraction of mainly non polar substances with moderate thermal stress for the raw material. Consequently pale malt was extracted with supercritical CO₂. Fatty acids like palmitic acid, oleic acid, linolic acid and linolenic acid act as a source for ageing active aroma compounds and foam destroying substances in beer. By decreasing those substances with supercritical CO₂ as a solvent, positive effects on taste and foam stability occurred.

Results: The trials have been executed with different additions of defatted malt. By using pure defatted malt for the brewing trials an improvement of foam and an increase of taste stability could be achieved. Furthermore the augmentation of aging indicating substances in beer like 3-methyl-butanol, 2-acetyl-furan or gamma-nonolacton was considerably less compared to the trials with standard malt. Hence not only analytical but also sensory analyses indicated a better beer quality.

Konrad Neumann



Konrad Neumann is research student at the TU Berlin / VLB chair for molecular analysis / bio-analytics. Konrad graduated at the TU Berlin, Germany, with a diploma in Biotechnology (Dipl.-Ing.) in 2005. Afterwards, he worked at the 'Research and Teaching Institute for Brewing in Berlin' (VLB) on the preparation of his Ph.D. (Dr.-Ing.) thesis. His work is focussed on the chemical synthesis of isotopically labelled aroma active compounds as standards for GC-MS analysis.

Jessika De Clippeleer



Born in 1977. Studies: MSc degree as Engineer in Food Technology - Food Chemistry at Wageningen Universiteit (WU) (2003); MSc theses at the Laboratory of Food Chemistry, WU, and at the Research Group Food Chemistry and Human Nutrition, Universiteit Gent. Academic degree in Industrial Engineering - Biochemistry at KaHo St.-Lieven, Gent (2000); thesis at Universidade Católica Portuguesa, Porto. Appointments: 2005-present: Research Assistant working on beer flavour stability towards a PhD degree at KaHo St.-Lieven, Laboratory of Enzyme, Fermentation and Brewing Technology (EFBT)/M2S, K.U.Leuven Association, Leuven Food Science and Nutrition Research Centre (LForCe). 2003-2005: Research Assistant at KaHo St.-Lieven, Laboratory of EFBT, and Laboratory of Food Chemistry and Meat Technology.

Ralf Mezger



1995-2000: Study of Brewing and Beverage Technologies at TU München/Weihenstephan 2000-2005: Scientific assistant at the Lehrstuhl für Technologie der Brauerei I (TU München/Weihenstephan), PhD (field of wort boiling). 2005-2007: Engineer at Krones AG Steinecker Plant for reasearch and development. Since 2007: Assistant of the plant manager.

P 075

Decision maker tool for evaluation of T2 and HT2 toxins contaminated malting barley

Julie Toussaint¹, Régis Fournier¹

¹IFBM, Molecular Biology, Vandoeuvre-les-Nancy, France

DESCRIPTION OF TOPIC:

The aim of this study is to better characterise consequences of barley kernel infection by *Fusarium langsethiae* in order to help maltsters from using TCT A highly contaminated barley samples. We have acquired data concerning the infection symptoms on barley ear by using molecular tools and tried to determine best method for TCT A highly contaminated grains elimination.

Results: Before malting, barley kernel calibration drives to the elimination of small grains. The analysis of 4 calibration subsamples shows that the smallest grains sample displays a very high amount of T2 and HT2 toxins correlated with a high content of *Fusarium langsethiae* DNA, whereas the other fractions are less contaminated. In addition, barley ears displaying various symptoms were analysed in the same way by real time PCR. The DNA amount of *Fusarium* spp. and *Fusarium langsethiae* was determined for each grain of these ears. This study revealed that *Fusarium langsethiae* infection can be associated with apparition of small and fit black (or not) grains.

P 076

Rapid detection of yeast in brewery rinse water

Chris D Powell¹, Annick Mercier¹, Felix Schnarwiler¹, Fred Strachan²

¹Lallemand Inc, Genetic Identification Laboratory, Montreal, Canada, ²Sierra Nevada Brewing Co, Chico, United States

DESCRIPTION OF TOPIC:

Vessels utilized within the brewing industry are sterilized or sanitized after use to prevent contamination from unwanted particulate matter, chemicals or microbes. While the efficiency of cleaning agents is typically good, it is common practice to perform tests on rinse water to ensure that hygiene standards are met. Recently there has been a growing trend towards the implementation of quick and reliable PCR-based methods for the detection/identification of bacteria or wild yeast contaminants in brewery samples. However, in many instances pre-enrichment for 16-72h is required prior to analysis and the level of differentiation provided is excessive for basic hygiene assessment. Here we describe a simple method to detect yeast as a means of assessing vessel hygiene.

Results: Elutrasep filtration allowed a similar number of cells to be recovered to standard membrane filtration (> 80%). However the ability to recover cells to be used directly for Q-PCR analysis resulted in an extremely low detection limit of approximately 1 cell/2ml of brewery rinse water, irrespective of the Q-PCR system employed. Further analysis of brewery samples using Q-PCR revealed that yeast could be reliably detected at this level while no false positives or negatives were observed.

P 077

Moulds presence management for a better Gushing risk control

Carol Verheecke¹, Eric Verheecke²

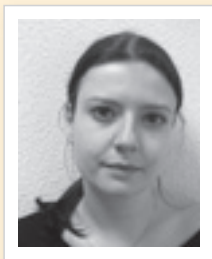
¹ECCLOR, Research & Development, Betheny, France, ²ECCLOR, Research & Development, Reims, France

DESCRIPTION OF TOPIC:

For several years, the mould presence on grains after storage and its impact on quality have been studied. An Innovant Tool has been developed to manage the presence of moulds on cereals. For brewing, the topic is to focus on the moulds which can provide Hydrophobins. Those Hydrophobins are small fungal proteins isolated in *Fusarium*, *Aspergillus*, *Nigrospora* and other isolated strains.

Results: This approach of the storage decreases the quantity of mould present on the grains after the storage period. Consequently, it also reduces the Hydrophobin presence. Based on correlations observed between the Hydrophobin level and the gushing potential of barley and malt, the result is a better gushing risk management.

Julie Toussaint



Toussaint Julie was born in 1983. Degree and Honour in Genetics and Molecular Biology, University Henri Poincaré (Nancy, France), 2005. Master's degree of Biotechnological engineering at the French engineering school Polytech'Clermont-Ferrand (Clermont-Ferrand, France), 2007. Since October 2007: PhD position in the Molecular Biology Division at the Institut Français des Boissons, de la Brasserie et de la Malterie (French Institute for Beverage, Brewery and Maltery, Vandoeuvre-les-Nancy, France). Study of *Fusarium langsethiae*, from barley field to final product (beer) and co-products.

Chris D Powell



Chris Powell obtained a BSc in Biology and Environmental Biology in 1996 and in 1997 Chris moved to Bass Brewers (now Coors) to work as part of the Research and Development team. Chris began his Ph.D. later in the same year at Oxford Brookes University, in conjunction with Bass, and received his doctorate in 2001 on the subject of yeast cellular ageing and fermentation performance. Subsequently, Chris became involved in a project funded by the European Commission, exploring mechanisms for the rapid detection of microbial contaminants within breweries. Chris joined Lallemand in 2004 and is currently in charge of genetic R&D for the identification and characterization of micro-organisms utilized within the food and beverage industry, in addition to research focused on brewing yeast.

Carol Verheecke



Our competence is to solve issues linked to Bacterial, Yeast, Fungal. We work on the effect of this phenomenon as fermentation, mycotoxins production and Gushing effect. This concerns cereals and oilseed at field, during storage and process, base on a new thermodynamic approach. My Tutor is Mr. VERHEECKE Eric (Specialist in Thermodynamics - Bacterial, Yeast, Fungal, Mycotoxins development). Concerning my training, I'm graduated in a Biology License and I'm following a Master of Microbiology course.

Anti-bacterial activity of lysozyme in pitching yeast and effect of lysozyme on yeast fermentation

Maarten de Groot¹, Anita Van Landschoot²

¹FORDRAS S.A., Lugano, Switzerland, ²CTL University of Gent, Biochemistry and Brewery, Gent, Belgium

DESCRIPTION OF TOPIC:

Lysozyme has anti-bacterial activity against Gram-positive bacteria and has no activity against yeast. As such, lysozyme can be used for the specific inhibition of beer spoilage bacteria. After all, the most frequently identified beer spoilage bacteria are Gram-positive lactic acid bacteria, and brewers' yeast is the culture used for brewery fermentations. Hen egg white lysozyme (300mg/L) is tested for the antibacterial activity against four described lactic acid bacteria in industrial pitching yeast and in industrial beer with refermentation in the bottle. The four studied lactic acid bacteria strains are sensitive to the antibacterial effect of lysozyme. The sensitivity is species dependent and probably influenced by the characteristics of the yeast slurry. The influence of industrial pitching yeast treated with lysozyme on the fermentation performance is also studied. No negative effect is observed on the yeast fermentation performance in any of the tests carried out.

Results: Part I; The four studied lactic acid bacteria strains are sensitive to the antibacterial effect of lysozyme. The sensitivity is more pronounced when the yeast suspension is incubated at 22°C.

Part II; After one day incubation of yeast slurry with lysozyme at 22°C, no negative effect of lysozyme addition on the fermentation performance was observed.

Part II; The lysozyme had no negative effect on the refermentation properties of the yeast. The four studied lactic acid bacteria strains are sensitive to the antibacterial effect of lysozyme.

A new method to determine yeast viability by phase contrast microscopy

Alexandre Godoy¹, Henrique Vianna Amorim¹, Mario Lucio Lopes¹, Silene Cristina de Lima Paulillo¹, Paul Hughes²

¹Fermentec, Piracicaba, Brazil, ²ICBD - International Centre for Brewing and Distilling, Edinburgh, United Kingdom

DESCRIPTION OF TOPIC:

A yeast viability method based on phase contrast microscopy without the use of dyes is reported, with the aim to develop a fast, simple and accurate methodology to be used in a routine basis in every alcoholic fermentation processes.

Results: Phase-contrast microscopy analysis revealed that the living cells presented dense and dark, and dead cells were shown to be bright, oval and slightly smaller than living cells. The combination of these characteristics made easier the identification of cells that were actually dead in the studied populations. This represents an advantage compared to the staining methods and fluorimetry to determine the viability.

Culture-independent PCR-DH-PLC technique for profiling of microbial communities in malting and brewing process

Riikka Juvonen¹, Outi Priha¹, Arja Laitila¹

¹VTT Technical Research Centre of Finland, Biotechnology, Espoo, Finland

DESCRIPTION OF TOPIC:

Complex microbial communities are an integral part of cereal ecosystems. Microbes greatly influence performance of the processes and the safety, technological, nutritional and organoleptic properties of the final products. Therefore, understanding and routine monitoring of microbial population dynamics in the processing is important. In our previous study, the polymerase chain reaction-denaturing gradient gel electrophoresis (PCR-DGGE) was shown to be a useful tool to explore dynamics of predominant bacterial populations in the malting ecosystem. Moreover it revealed previously unidentified species. However, this technique is rather time-consuming and therefore not optimal for analysis of large amounts of samples. The present study was undertaken to evaluate the potential of automated denaturing high performance liquid chromatography (DHPLC) for microbial community profiling which allows PCR-amplified fragments with different sequence to be separated without a gel.

Results: DHPLC allowed separation of the polymorphic PCR-amplified fragments from reference strains and their mixtures. The analysis of cereal samples at various process stages showed that the technique has potential to study microbial diversity and dynamics in the malting and brewing. Fraction collection and DNA sequencing from well-separated profile peaks allowed identification.

Maarten de Groot



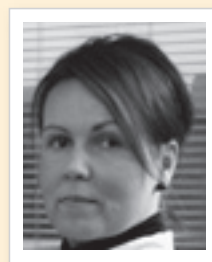
Director Sales & Marketing of Fordras S.A. in Lugano Switzerland, responsible for the beer market. With many years experience in, international sales and business development of ingredients, expanding several multinational companies across Europe. With a Bachelors degree in Business & International Agriculture, he earned his Master's in Business & Organizations at the University of Amsterdam, Netherlands. Several research in anti-microbials in beer and dairy products.

Alexandre Godoy



Graduated in Agricultural Science 1992. In 2009 will complete the Master of Science at the ICBD (International Centre for Brewing and Distilling, Heriot Watt University, Edinburgh, Scotland). Has been working for more than 16 years as a coordinator of the division of Microbiology of Fermentec Ltd, a Brazilian consulting company specialized in alcoholic fermentation and laboratory control in all steps of sugar and alcohol production, developing and spreading out new technologies for the sugar and ethanol sectors for the Brazilian mills and distilleries around the world.

Riikka Juvonen



Riikka Juvonen has a MSc degree in Food Microbiology. Currently, she is working as a research scientist at VTT Biotechnology. Her current research interests include the molecular detection and taxonomy of beer-spoilage bacteria, especially Pectinatus and Megaspheera, and sourdough microbiology.

P 081

The survival of pathogens in wort and beer - the ethanol and pH hurdles

Garry Menz¹, Peter Aldred¹, Frank Vriesekoop¹¹University of Ballarat, Institute of Food and Crop Science, School of Science & Engineering, Ballarat, Australia

DESCRIPTION OF TOPIC:

Beer is typically free from pathogenic microorganisms due to combined effects of a series of antimicrobial hurdles. These inhibitory factors include the presence of a low pH, ethanol, hop iso- α -acids and carbon dioxide, and reduced levels of oxygen and available nutrients. However, beers with reduced levels of these hurdles are more susceptible to the growth and/or survival of pathogenic bacteria. In this study we show the effect of ethanol and pH on the survival of four foodborne pathogens (*Escherichia coli* O157:H7, *Listeria monocytogenes*, *Salmonella* Typhimurium and *Staphylococcus aureus*) in wort and beer.

Results: No growth was observed at pH values below 4.0, or at ethanol levels above 4%. However, growth and survival were enhanced as pH levels were raised and ethanol levels were lowered in both the worts and beers.

P 082

The antifungal protein from *Aspergillus giganteus* fights filamentous fungi on barleyAnja Spielvogel¹, Hassan Barakat Mohamed¹, Vera Meyer¹, Ulf Stahl²¹University of Technology Berlin, Microbiology and Genetics, Berlin, Germany, ²Research and Teaching Institute for Brewing Berlin (VLB) e.V., Research Institute for Microbiology, Berlin, Germany

DESCRIPTION OF TOPIC:

Contamination and destruction of crop, plants and biomaterials by filamentous fungi is responsible for enormous economic losses worldwide. Head blight caused by *Fusarium* species is mainly accountable for crop loss throughout the world. However, crop loss is not the only threat; also mycotoxin formation and fungus specific metabolites reduce barley based product quality.

The filamentous fungus *Aspergillus giganteus* produces a selective antifungal protein that has fungicidal properties at a micro molar concentration. It has been demonstrated that the *Fusarium* species, in particular, is very sensitive towards the so called "Antifungal Protein" (AFP). Remarkably, the growth of bacteria, yeasts, plant- and human cells is not affected.

Results: First results indicate that indeed AFP application during malting is able to inhibit the growth of *Fusarium* species on barley, whereas malt quality was not affected. Current investigations are focusing on the course of mycotoxin concentration, gushing potential of the treated malt and influence of AFP on the end product beer.

P 083

Polymer pipelines for beer and softdrink - an economic alternative to stainless steel

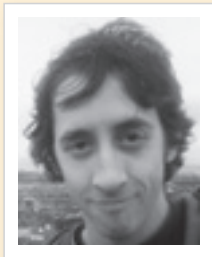
Stefan Buchner¹, Peter Rasmussen², Leif Andersen²¹Polymer Consult Buchner GmbH, Hamburg, Germany, ²Carlsberg, Fredericia, Denmark

DESCRIPTION OF TOPIC:

In 2006 Carlsberg evaluated economic alternatives to stainless steel pipelines for transport of beer. Two different pipe systems have since been developed and qualified, which were not commercially available. In 2008 continuous polymer pipelines have been installed at the Carlsberg brewery in Fredericia (Denmark) to connect the brewery with the neighbouring filling lines at a distance of 1.200 m.

Results: Continuous polymer pipelines have been qualified which are very economic compared to stainless steel pipes.

Garry Menz



I am a PhD student at the University of Ballarat, investigating factors affecting bacterial growth in beer. I have a B. App. Sci. (Food Science & Technology) (Hons) and a B. Man (Marketing).

Anja Spielvogel



Anja Spielvogel is a scientific assistant and lecturer at the University of Technology in Berlin (TU Berlin). She studied biotechnology and graduated with a diploma (Dipl.-Ing.) in 2003. In 2008, she finished her Ph. D thesis at the department of Microbiology and Genetics at the TU Berlin. During her Ph. D she was a visiting researcher at the CSIC in Madrid and could establish a close research cooperation. At the department of Microbiology and Genetics at the TU Berlin, she is now head of the research group "Filamentous Fungi". Her research focuses on the molecular biology of filamentous fungi, especially on stress adaptation and influence on signal transduction pathways. The regulation of the expression of the antifungal protein of *A. giganteus* is one example. This protein with its selective antifungal properties is tested for application together with the "Institute of Raw Material" of the "Research and Teaching Institute for Brewing in Berlin" (VLB).

Stefan Buchner



Stefan Buchner took his Masters Degree on PEN (a polymer used for low permeation beer bottles) and his PhD at the Institute of Macromolecular Chemistry in Hamburg in polymer physics. In 1991 he joined Shell in the Netherlands and worked in Arnhem and Amsterdam in the non-metals group. His work concentrated on the performance of polymers in the oil and gas industry. In 1997 Wellstream hired him as a consultant when the Newcastle pipe factory was built. In 2000 he founded Polymer Consult Buchner GmbH, a German limited company with customers in the engineering-, chemical-, food- and oil- & gas- industry. Stefan is member of VDI (The Association of German Engineers).

Fluxcalcination of Kieselguhr - influence of the fluxing agent on formation of crystalline phases, permeability, colour and suitability as filter aid

Thomas Schleicher¹, Winfried Russ¹,
Quido Smejkal²

¹Technische Universität München, Institute of Resource and Energy Technology, Freising, Germany, ²Leibniz Institute for Catalysis, Berlin, Germany

DESCRIPTION OF TOPIC:

Kieselguhr is a sedimentary rock mainly composed of opallike, amorphous silica, which is worldwide used for deep bed filtration processes. Prior to using kieselguhr as a filter aid, the raw material has to undergo a conditioning process. Fluxcalcined kieselguhr is manufactured by treating the kieselguhr in a kiln at 900°C - 1200°C after adding an alkaline flux, generally sodium carbonate. Most of the amorphous SiO₂ is transformed into a crystalline phase of SiO₂ called cristobalite which can cause silicosis and is suspected to cause cancer. Therefore the influence of fluxing agents on the formation of cristobalite during the fluxcalcination of kieselguhr was investigated.

Results: Kieselguhr fluxcalcined with fluxing agents containing sodium showed the tendency to form crystalline material. Using these fluxing agents the highest permeability and best colour values could be achieved. Fluxing agents containing potassium ions showed a significant lower tendency to form crystalline material. Permeability was lower compared to fluxing agents containing sodium. Colour measurement showed considerable red values.

Fluxing agents containing magnesium or calcium did almost suppress formation of crystalline phases. On the other hand permeabilities of these samples were significantly lower. Colour values were also insufficient.

Technological and economical reconsideration of depth filtration - Becopad

Alfons Witte¹

¹Begerow, E: GmbH & Co., Langenlonsheim, Germany

DESCRIPTION OF TOPIC:

Factors within the brewing process that can affect the quality of the beer have been present since the first „mead“ was made around 1700 BC and the first depth filter was engineered. For decades, minerals found in the depth filters were unavoidable. Using depth filtration, brewers have had to contend with and control issues affecting the brewing process such as mold, introduction of heavy metals like iron, and inorganic materials, all of which can affect beer flavors. By eliminating these factors one can „purify“ the brewing process, reduce the cost of filtration, participate in „being Green“ and ultimately produce a better beer. Due to new technology we will demonstrate how eliminating minerals can make the brewer's job easier. And we will show results from industrial scale to prove that by re-designing depth filtration the brewers can take advantage of ecological and economical savings.

Results: First results show, that due to several savings (water, energy, labour), filtration cost come down by at least 30%, compared to conventional depth filter sheets.

Simultaneous filtration and stabilisation of the beer: Potentiality of Oxidised High Density Polyethylene (PEox) as filter aid

Maxime Libouton¹, Daniel Daoust²,
Michel Sclavons², Jean-Jacques Biebuyck²,
Laurence Van Nedervelde³

¹Institut Meurice, Brussels, Belgium, ²Université Catholique de Louvain, Physics and Chemistry of High Polymers, Louvain La Neuve, Belgium, ³Institut Meurice, Brewing Sciences, Brussels, Belgium

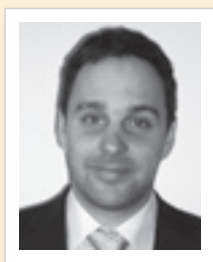
DESCRIPTION OF TOPIC:

Nowadays, beer filtration should be performed regarding to economics and be friendly towards environment. The objective of this study was to evaluate the potential of PEox particles as a filter aid media coupled to PVPP and Brewtan® for a simultaneous filtration and stabilisation of the beer.

Results: The filter aid PEox has an average particles size distribution of 37 µm and a shape like „pop corn“. The porosity of the media made of PEox is 0.6 compared to 0.85 for kieselguhr. This still allows the material to retain a good amount of haze and yeast cells without clogging, but the expected haze was reached only when using Brewtan®. The use of PVPP mixed to the PEox filter aid (25/75%) showed best results for filtration due to the shape of PVPP particles and the slight compressibility of the material itself, but its use still could not allow us to reach the expected haze unless Brewtan® was used also during the filtration trials.

Regeneration with oxidative detergent was tested within the tank used for precoating follow by separation on the candle. Although the filter aid mixture wasn't as clean as expected, filtration trials carried out after such an operation showed expected results. Enzymatic treatment was also investigated and is under optimisation.

Thomas Schleicher



Thomas Schleicher received his Diploma-Engineer degree in technology and biotechnology of food from the Technische Universität München in 2005. From December 2005 to March 2007 he was employed at the Chair of Energy and Environmental Technology of the Food Industry and worked in the field of renewable fuels. Since the retirement of Prof. Meyer-Pittroff in March 2007, he works in the field of beverage filtration at the Institute of Resource and Energy Technology from the Technische Universität München. In filtration, he specializes in processing diatomaceous earth.

Alfons Witte



Born 12.10.1966

1993 Dipl. Ing. Getränketechnologie (FH Wiesbaden / Geisenheim)
1994 – 1997 Exportleiter Korkindustrie Trier GmbH, Trier
1997 – today E. Begerow GmbH & Co, Langenlonsheim
Position:
– Head of Sales Beer & Mineral Water since 01.01.2008
– Export Manager Food&Beverage North America since 01.01.2006
– with Begerow (Export Manager Eastern Europe) since 01.01.1997

Laurence Van Nedervelde

Laurence Van Nedervelde is lecturer and researcher at the Institut Meurice. In 1991, she received her diploma as engineer in chemistry and agro-food technology from the University of Brussels. Since 2003, she is Head of the department of Brewing Sciences. Her main research areas include selection of industrial yeasts (brewing purpose, bioethanol production...) and improvement of brewing yeast (ester production, carbonyl compound reduction) or development of new fermentation technologies (immobilisation technique, fed batch propagation, on-line measure). Besides these activities, she is also expert in agro-food sector for the Walloon Region and active member of several associations in brewing field (ASBC, EBC, ARFB).

P 087

Using microalgae for breweries for CO₂ mitigation and biomass production

Laurenz Thomsen¹, Michael M Sanguineti²

¹Jacobs University Bremen, Geoscience, Bremen, Germany,
²Phytolutions GmbH, Bremen, Germany

DESCRIPTION OF TOPIC:

Biological carbon mitigation, in particular engineered closed photosynthesis systems, offer advantages as a viable near-to-intermediate term solution for reduced carbon emissions in the industry sector. Photosynthetic (or "natural" sequestration) systems produce usable byproducts (biomass, biofuels).

Results: The objective of microalgae biofixation of CO₂ from breweries is to operate large-scale systems that are able to convert a significant fraction of the CO₂ outputs (flue gas and/or CO₂ from the fermentation process) into biofuels, feed, (bio)chemicals and building materials. For the production of energy, algae can be mixed with brewery sludge and spent grains and converted.

P 088

Beer stabilisation by polyamide sorbents

Zbyněk Černý², Pavel Dostálek¹, Lucie Širíšťová¹, Bohuslav Časenský², Jiří Mikulka³

¹Institute of Chemical Technology Prague, Department of Fermentation Chemistry and Bioengineering, Prague, Czech Republic,
²Katchem Ltd., Prague, Czech Republic, ³ATYPO Ltd., Prague, Czech Republic

DESCRIPTION OF TOPIC:

Insoluble polyamides were first used by Harriss and Ricketts in the late 1950s for beer stabilisation. These investigators showed that Nylon 66 effectively removes anthocyanidins from beer. However, practical use of nylons as a colloidal stability treatment agent has essentially been eliminated, because they cost too much. Therefore in 1960s nylon was replaced by cheaper PVPP. PVPP, which is an insoluble crosslinked form of PVP, represents the most frequently used stabiliser for removal of polyphenols nowadays. In 1980s the research of polyamides for brewing application was done at the Institute of Chemical Technology Prague, where several polyamide sorbents with excellent sorption activity were developed. Nowadays a new polyamide sorbent was developed. This sorbent is kieselguhr covered by a thin layer of poly-6-caprolactame. The sorbent is prepared by in solution polymerisation in the presence of kieselguhr.

Results: Characterisation of the product in dependence on ratio PA/kieselguhr: specific surface 2 - 8 m² · g⁻¹, mean particle diameter < 120 µm, pore volume 1 - 7 · 10⁻² · cm³ · g⁻¹. This sorbent has the same sorptive effectiveness against beer haze polyphenols (calculated on the base of polymer amount) as the equal PVPP dosage. Sorbent has also some sorption activity for proteins, an excellent flow characteristic and a low filter resistance. Moreover this sorbent is absolutely insoluble in beer. It represents a new generation of very effective polyamide sorbent for beer stabilization.

P 089

Reduction of beer value chain's environmental impact with the use of proline specific endo-protease (PSEP) demonstrated by a comparative Life Cycle Analysis (LCA) screening of PSEP in beer production

Minh-Tam Nguyen¹, Ron Duszanskyj¹, Francois Strozky, Francois², Carmen Alvarado Ascencio³, Patrice Pellerin⁴

¹DSM Food Specialties, Delft, Netherlands, ²DSM Food Specialties, Seclin, France, ³PRé Consultants BV, Amersfoort, Netherlands, ⁴DSM Food Specialties, Montpellier, France

DESCRIPTION OF TOPIC:

Results of new studies have demonstrated that addition of PSEP (commercial name Brewers ClaretTM) also enables shorter cold maturation at elevated temperature while ensuring efficient colloidal stability and maintaining beer quality. PSEP enables brewers to significantly lessen their CO₂ footprint by reducing energy cost, water consumption and raw materials usage in beer production.

Results: 1/ Environment profile of stabilizers production: the environmental impact for producing PSEP is about 10 times lower compared to current synthetic stabilizers.

2/ Comparison of environmental cost of producing PSEP against the savings in environmental impact due to the change in beer process: the impact of brewer's beer manufacturing stage is reduced by 5-8% when PSEP is used. The use of regenerated PVPP also could mean savings for the environment however the beer losses involved end up ruling out these savings.

3/ Environmental impact of beer value chain: the total environmental impact represented by 1 million hectoliters beer produced is high. The use of PSEP compared to current synthetic stabilizers reduces by 2% the total environmental impact of beer value chain.

Laurenz Thomsen



Doctor of Sciences (Dr. rer. nat.) at University of Kiel, 1992 Research Associate in the Department of Environmental Geology, GEOMAR, 1992-98 Guest scientist at the NIVA Institute, Oslo, Norway, 1995 Guest scientist at the NIOZ Institute, Texel, Netherlands, 1997 Habilitation at University of Kiel, 1998 Heisenberg fellow of the DFG at the School of Oceanography (University of Washington), 1999-2001 Jacobs University faculty, 9 / 2001- Affiliate associate Professor at the School of Oceanography, University of Washington, Seattle, 5 / 2002-

Zbyněk Černý



Educated at Institute of Chemical Technology, Prague, (finished 1978), with specialization on Department of polymers. PhD received on hydrides of complex aluminates used for catalytic systems for anionic polymerization 6-caprolactam. From 1991 he is engaged in KATCHEM Ltd. Praha, in technology of polymerization of polyamides and polyamide powders.

Ron Duszanskyj



Graduated as an Applied Chemist I started my career with Bass Brewers UK and became Technical and Production Manager in North England. I passed the Associate and Diploma Memberships Examinations with the Institute of Brewing to become a qualified Master Brewer. 14 years later I joined the Vaux Group as Senior Brewer at the Sheaf Brewery in 1991. In 1996 I joined AB Vickers as Business Development Manager for whole range of brewing process aids responsible for UK, APAC and CEE/ Russia regions. In 2001 I joined DSM as Technical Sales Manager supplying beverage enzymes in Europe and Russia. For the last two years I provided Brewing Technical Support in Europe, Russia and Africa and have recently been appointed as Product Application Specialist Brewing.

Change from a pilot plant brewery to a competence center of brewing and environment technology

Hans-Joerg Menger¹, Tobias Becher², Oliver Wüst³, Maximilian Härtl³, Karl Zobel³

¹Ziemann Group, Ludwigsburg, Germany, ²Ziemann Group, Innovation Management, Ludwigsburg, Germany, ³Ziemann Group, Ziemann Energy, Ludwigsburg, Germany

DESCRIPTION OF TOPIC:

The new challenge in the brewing industry is a process technology, which is able to operate with low investment and low life-cycle costs by producing high quality beers. For the supplier this represents a change of the previous standard Research & Development activity. The previous main research was located in the production plant. The new, but very important field of activity of R&D, is an exact analysis of the necessary energy and raw material consumptions as well as the analysis and implementation of an energy and resource concept for the brewhouse and the complete brewery, which allows to link all consumers in the brewing plant as well as to optimize operational aspects and the corresponding costs.

In view of this situation, the ZIEMANN pilot brewery, built in 2005, has been designed in a completely new way. The area of the pilot plant has been doubled in order to have sufficient space for the equipment and to develop an environmental technology, in addition to the brewhouse technology especially the no waste concept. This presentation shall give an overview of the new design of the plant, strategic adjustments of the new centre of competence and the first scientific results.

Results: New process technology and energy saving technology all over the global steps of the complete brewery plant which are coming out of the development activity of the new pilot center

Microbial and enzymatic hydrolysis of brewer's spent grains

Thomas Herfellner¹, Winfried Ruß¹

¹TU München, Institute of Resource and Energy Technology, Freising, Germany

DESCRIPTION OF TOPIC:

Rising energy costs and limited options for waste disposal organic breweries residues offer an interesting way of energy recovery. Due to the inhomogeneous chemical waste composition and the various solid, pasty and liquid compounds the anaerobic digestion represents an advantageous technology and is in case of wastewater treatment already state of the art. Concerning the chemical composition of spent grains there are still problems in hydrolysing the lingo-cellulose fraction. The performance of hydrolytic bacteria without any pre-treatment is not enough to achieve economically advantageous dwell times. Therefore enzymatic pre-treatment was investigated during a research project which was supported by the Association for the Promotion of Science of the German Brewing Industry (wifoe). Another aim of research was to intensify the microbial activity during hydrolysis.

Results: By the application of substrate specific enzymes it was possible to force the liquidation-time of the complete protein and fat fraction of spent grains. The additional added enzymes quickened also the microbial hydrolysis of the lingo-cellulose fraction. By the variation of different fermentation parameters it was possible to define optimal temperature values and optimal space loading.

Marketing co-products to the feed industry

Michael B Spandern¹

¹Spandern Agribusiness Consulting, Bordesholm, Germany

DESCRIPTION OF TOPIC:

The management of waste and co-products emissions is moving into the spotlight. Energy efficiency, protection of resources and consumer perception determine the overall strategy of beverage production. To many brewers the incapability of marketing co-products correctly has led to failure of the financial planning. Others put more efforts into this side-business and became successful players in the market.

Results:

Just as for branding of beers the marketing activities for co-products must follow the same pattern:

- 1) understanding customers needs,
- 2) consistency and,
- 3) differentiation.

The feed industry has faced some massive changes within the last decade. Feed is now regarded as a part of the food chain. Quality and safety standards do not differ between feed and food today. In consequence all suppliers to the feed industry must understand themselves as feed producers. Animal feeds are designed and calculated based on the specific requirements of livestock and poultry species in each age and stage of production. Variation causes losses in animal performance and is an unacceptable weakness in the highly competitive business environment of feed production. Feed manufacturers tend to limit the use of variable components in animal feed formulation in order to comply with the guaranteed nutrient composition of the finished feeds. The variations in quality are significantly influenced by (1) the enzymatic degradation during mash preparation, (2) fermentation management and (3) phenomena such as maldigestion reactions in the drying process.

Hans-Joerg Menger



Hans-Jörg Menger received the doctor's title for natural science in April 2003 from the University of Stuttgart-Hohenheim, Germany. He began an apprenticeship as brewer and maltster 1985. In 1990 he started to study food technology at the University of Stuttgart-Hohenheim, Germany. He began employment with Ziemann Ludwigsburg GmbH, Germany; in January 1998 in the technology department. Since April 2000 he is responsible for the patent resort and since July 2003 he is head of R & D and technology department from Ziemann Ludwigsburg GmbH, Germany.

Thomas Herfellner



Thomas Herfellner received a diploma and M.Sc. degree in Food Technology from Technische Universität München, Germany. Since 2006 he is working as Ph.D student at the Institute of Energy and Environmental Technology of the Food Industry which was renamed into Institute of Resource and Energy Technology in 2007. His scientific work is anaerobic fermentation of organic breweries residues.

Michael B Spandern



Mike graduated as Diplom-Ingenieur in agricultural sciences at the University of Kiel. He started his industry career in animal nutrition for GETREIDE AG in Northern Germany. He then joined the feed additive and ethanol business as a sales manager for ALLTECH, Hamburg and later relocated to Seattle. Parallel he earned a postgraduate degree in brewing and distilling at Heriot-Watt in Edinburgh. In 2006 Mike founded an business consultancy for suppliers to the alcohol and animal feed industry. He is columnist at the weekly magazine FeedStuffs and author of several ag-industry publications. His wife runs a rural veterinary clinic. Together they have three children.

P 093

Protect the environment, safe energy and work towards a sustainable future!

Michel Brueren¹

¹Haffmans BV, Sales Department, Venlo, Netherlands

DESCRIPTION OF TOPIC:

With increased environmental awareness and desire to further reduce costs breweries are focussing on compact possibilities to protect the environment & reduce energy consumption.

Protect the environment: CO₂ as refrigerant
To liquefy fermentation CO₂ gas, a CO₂ recovery plant requires a cooling unit. These units nowadays use typical NH₃ or Freon as coolant. Due to the environmental disadvantages of these cooling agents (NH₃ is toxic and Freon is a moderate greenhouse gas), an alternative, CO₂, is available. CO₂ itself is a refrigerant that has the advantage of being non-corrosive, non-toxic, non-flammable etc., all features which create a safer environment. Compared to NH₃, the great thermodynamic properties of CO₂ enable up to 30% CAPEX and OPEX savings. Safe Energy by up to 60% A CO₂ recovery plant consists of several units, of which CO₂ liquefaction and evaporation units account for a large portion of the plant's energy consumption. With a new energy recovery system, the required energy can be reduced by up to 60%. The two "neglected" energy streams: "heat" released when liquefying CO₂ gas and "cold" released when evaporating liquid CO₂ are optimally applied. Effectively, the new system simultaneously facilitates the Liquefaction of incoming CO₂ gas (from the fermenters) and Vaporization of incoming liquid CO₂ (from the storage tanks). Breweries that expanded their CO₂ recovery system experienced a lower initial investment when applying this energy recovering system. It gives them the opportunity to invest in a plant with a compact, energy efficient and cost effective system rather than large, traditional, energy consuming liquefaction and vaporization units.

Results:

2 products: - CO₂ as refrigerant, - LiquiVap

P 094

The cis-resveratrol/cis-piceid ratio is proposed as a new indicator of the hop freshness

Vesna Jerkovic¹, Sonia Collin¹

¹Université catholique de Louvain, Laboratoire de brasserie et des industries alimentaires, Louvain-la-neuve, Belgium

DESCRIPTION OF TOPIC:

Callemien et al. (1) mentioned the presence of trans-resveratrol, trans-piceid and cis-piceid in hop pellets. Total stilbene concentrations range from 5 to 16 ppm (1-3). Jerkovic and Collin (3) evidenced the huge impact of the harvest year. No stilbenes were detected in supercritical hop extracts (4). The aim of the present work was to assess the impact of conditioning and storage on hop stilbenes concentrations. American varieties were analyzed through storage in 2 differently conditioned forms (cones and derived pellets) all under protected atmosphere. The stability of trans-piceid and its aglycon was monitored for 1 year under six different model conditions.

Results: Stilbenes concentrations of 6 leaf hop varieties and derived pellets were monitored over 12 months of storage. Pelletization induced strong stilbene degradation in some cultivars. Yet pellets emerged as more stable than leaf hop during the first four months of storage. The presence of a new peak identified as cis-resveratrol (up to 1.2 mg/kg in trans-resveratrol equivalents) in all chromatograms of > 4 months-stored samples indicates a release from cis-piceid (confirmed in model media). cis-Resveratrol revealed very interesting for assessing hop freshness.

P 095

Origin of hops - determination by isotope ratio mass spectrometry (IRMS)

Roland Schmidt¹, Anke Kutsch¹,
Andreas Rossmann²

¹NATECO2 GmbH & Co. KG, Wolnzach, Germany, ²Isolab GmbH, Schweitenkirchen, Germany

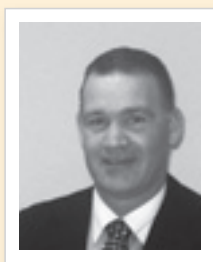
DESCRIPTION OF TOPIC:

The isotope ratio mass spectrometry (IRMS) is a suitable method to determine the origin and the authenticity of agricultural products, foods and beverages. Examples for the application of this technique are asparagus, fruit juice, wine and ham. So the question came up if the IRMS method can be used for hops, too.

By means of the IRMS technique the ratios of the stable isotopes are analysed. The growing regions with their climatic distinctions influence the stable isotope ratios of chemical elements in the biomass of plants. The environmental conditions have also an effect as well as the use of agricultural methods (e.g. fertilization). At work with hops the ratios of the following stable isotopes were investigated: hydrogen, carbon, nitrogen and sulfur.

Results: Over the ratio of 13C/12C and 2H/1H a differentiation in Hallertau hops is doubtful. But when additionally the ratios of 15N/14N and 34S/32S are taken into account the samples can be discriminated according to the growing region. The influences of variety and crop year are little but nevertheless they must be regarded. The examination of all four stable isotope ratios allows to discriminate between each individual growing area.

Michel Brueren



Studied Mechanical Engineer at Technical school and finished in 1986

Since 1988 working for Haffmans BV

- Started as a project engineer for CO₂ recovery plants.
- Product manager CO₂ recovery systems since 1999;
- Responsible for advice and sales CO₂ recovery systems.
- Area responsible Europe, North Africa, Latin America.

Vesna Jerkovic



She completed her PhD, sponsored by the Inbev-Baillet-Latour foundation, in 2007 under the supervision of Professor S. Collin. Previously, she completed a university degree as Engineer in Chemistry and Biotechnology at the Université catholique de Louvain (Belgium) and a MSc in viticulture and enology from the Ecole Nationale Supérieure Agronomique de Montpellier (France). Her researches focused on the study of stilbenes in the brewing process and beer health benefits.

Roland Schmidt



Roland Schmidt was born in 1956. After the studies of Brewing and Beverages Sciences at the Technical University Munich-Weihenstephan (1978-1984) he started his working life 1984 as head of laboratory at the Hopfenextraktion HVG Barth, Raiser & Co. in Wolnzach, after a change of name now known as NATECO2 GmbH & Co. KG Wolnzach (Germany). As Manager of Quality Assurance he is responsible for the laboratory and for the R&D section. He is author or coauthor of more than 30 scientific papers and he is member of several scientific commissions and boards.

A new approach to the production of isomerized hop extracts

Martin Biendl¹, Timo Lambertsen¹, Willi Mitter²

¹Hopsteiner HHV GmbH, Mainburg, Germany, ²Simon H. Steiner, Hopfen GmbH, Mainburg, Germany

DESCRIPTION OF TOPIC:

The present paper relates to a new method for the production of iso-alpha-acids by the isomerisation of alpha-acids in the form of a hop extract.

Results: An efficient isomerization of alpha-acids was achieved after mixing pure resin ethanol-extract with magnesium oxide, filling the mixture into a container, closing the container and heating it up gently, e.g. for 5-10 days at 50°C. Under these conditions all other ingredients of the starting material remained unchanged.

Radical scavenging capacity of hop-derived products in view of health and brewing applications

Arne Heyerick¹, Laura Van Hoyweghen¹, Martin Biendl²

¹Ghent University, Laboratory of Pharmacognosy and Phytochemistry, Ghent, Belgium, ²Hopsteiner, Mainburg, Germany

DESCRIPTION OF TOPIC:

Dietary antioxidants are believed to be effective in the prevention of oxidative stress related diseases (eg. cancer and cardiovascular diseases). Polyphenols are widely recognized as potent antioxidants as they can scavenge reactive oxygen species (ROS). The hop plant (*Humulus lupulus* L.), used in a variety of health applications and indispensable as a beer ingredient, is an interesting source of polyphenolic antioxidants including tannins, flavonol glycosides and prenylated flavonoids. In addition, also hop oil and hop acids (including downstream products) have been reported as potent antioxidants.

Results: Peroxyl radical scavenging capacities of prenylated flavonoids were highly analogous to quercetin and OPC equaling 5-10 Trolox equivalents. The hydroxyl radical scavenging capacities of xanthoflav products was highly correlated with the concentration of xanthohumol. The hydroxyl radical scavenging capacity of pure xanthohumol (> 95%) was about 60 Trolox equivalents which is 10-20 times higher than that of quercetin and OPC. Ethanol extract consistently showed a higher radical scavenging activity than CO₂-extract. Tannin extract proved an efficient peroxyl radical scavenger.

Effect of Bordeaux mixture (copper sulfate) on 4-Mercapto-4-methylpentan-2-one content in hop cones

Masahito Morimoto¹

¹Asahi Breweries, Department of Flavor and Chemical Analysis Research Laboratories of Brewing Technology, Moriya, Japan

DESCRIPTION OF TOPIC:

4-Mercapto-4-methylpentan-2-one (4MMP), 3-mercaptohexan-1-ol (3MH), and 3-mercaptohexyl acetate (3MHA), which belong to thiols, contribute to black-currant/muscat-like aroma of beers using some USA cultivars such as Cascade cultivar. 4MMP has particularly low threshold value and strongly influences beer aroma. In our previous study, 4MMP existed in the hop pellets cultivated in USA, Australian and New Zealand, but did not in Europe. Then we assumed that the decrease of 4MMP concentration in European hops may be caused by Bordeaux mixture (copper sulfate) which is used in only Europe for protection against downy mildew. Therefore, we conducted the field tests for investigating effects of Bordeaux mixture on 4MMP content. In this paper, we describe the results of the field test.

Results: We observed 4MMP content of hop cones and beers treated with Bordeaux mixture decreased by approximate 25% compared to untreated samples. The copper ion content of treated hop cones was only that of 1/3 to 1/5 of general European cultivars, in contrast that of untreated hop cones was below detection limits. The level of other substances in hop cones and beers were hardly different between treated and untreated samples.

Martin Biendl



In 1990 conferring of a doctorate on the field of chemistry of natural substances. Since then employed as head of Research and Development at the German hop processing company Hallertauer Hopfenveredelungsgesellschaft m.b.H. (HHV), part of the international hop trading company Hopsteiner. Since 1996 manager of the R&D/Analytical Department of this company. Representative of the International Hop Industry Cooperation (IHIC) in the EBC Analysis Committee and chairman of the Hops Subcommittee. EBC representative and vice-chairman of the International Subcommittee for Isomerised Hop Alpha-Acids Standards. Board member of the German Hop Trade Association.

Arne Heyerick



Born in Belgium in 1974 - Graduated in Biochemistry with a thesis on the phytoestrogenic activity of hops (1996) - PhD in Biochemistry from Ghent University (2001) on lightstruck flavor in beer - Senior Scientific Collaborator at Ghent University (2001-2006) working on industrial projects related to the valorization of health-beneficial properties of hop-derived phytochemicals - Since 2006: Appointed Technology Developer at Ghent University leading a valorization consortium consisting of 10 laboratories that are actively collaborating on evidence-based development of natural therapeutics (c-EviDeNT) - Author of more than 30 publications in international scientific peer-reviewed journals and inventor of 2 patents.

Masahito Morimoto



STUDIES: Masters degree (2006) from the Graduate School of Agriculture, Kyoto University, Japan, with a Major in Food Engineering. EMPLOYMENT: In 2006, joined the Brewing Research and Development Laboratory of Asahi Breweries, Ltd. and worked on basic research for aspergillus. Since 2008, has carried out specific research into the hop aromas of beer.

P 099

Scanning electron microscope (SEM) examination of lupulin glands of different hop varieties

Frithjof Thiele¹, Christina Schönberger², Elke Arendt¹

¹University College Cork, Department of Food & Nutritional Science, Cork, Ireland, ²Joh. Barth & Sohn GmbH & Co. KG, Nuernberg, Germany

DESCRIPTION OF TOPIC:

The flavour active components of hops are the hop resins and the essential oils, which are produced in the lupulin glands. The sizes of the glands are suspected to show a relationship with the content resins and oils as well as with the storage stability of alpha acids. The aim of this study was to investigate the lupulin glands of different hop varieties on one hand to show how they differ in appearance and structure and how homogeneous the glands are within one variety. On the other hand if the size and the structure are in any relationship with the valuable components of hops. Therefore 10 different hop varieties from the USA, Great Britain and Germany were investigated with a scanning electron microscope.

Results: In general the lupulin glands vary extensively in size and structure within one variety. The diameter of the glands varies between 50 µm up to 400 µm. And the average diameter of the individual varieties differs extensively as well. A direct correlation between the average size and the alpha acids was not found. For most varieties the glands were found to be completely filled some varieties showed a large percentage of flat and almost empty glands.

P 100

Contribution of free phenolic acids and flavanols to antioxidant activity in malting process of barley

Marta Fontana¹, Franco Tubaro², Stefano Buiatti³

¹University of Udine, Department of Agriculture and Environmental Sciences, Udine, Italy, ²University of Udine, Department of Chemical Science and Technology, Udine, Italy, ³University of Udine, Department of Food Science, Udine, Italy

DESCRIPTION OF TOPIC:

Polyphenols (PF) influence beer quality and sensory stability being involved in beer hazing. The aim of this study is to evaluate the antioxidant activity (AA) of some PF during malting process of three varieties of barley and, in particular, the effect of different steeping conditions on PF extraction. Moreover the correlation between PF and antioxidant activity during each step of malting has been evaluated.

Results: After the first steeping, PF content decreases more at pHs 7 and 8 (22-51%) compared to pH 5 (3-13%): o-hydroxycinnamic acid and (+)-catechin are the main PF involved. From steeping to germination the PF content increases for all conditions while, during kilning, the levels of PF decreases. The PF content in malt is influenced by variety and pH used during steeping. In addition, testing the capacity to quench free radicals as an index of AA, PF show a low activity.

P 101

T2 and HT2 toxins elimination by GRAS micro-organisms in steeping waters

Emmanuel Jean Rondags¹, Michel Fick¹, Patrick Boivin², Régis Fournier²

¹Chemical Engineering Sciences Laboratory, National Center for Scientific Research, Biotechnological Processes Engineering, Vandoeuvre lès Nancy, France, ²IFBM, Vandoeuvre lès Nancy, France

DESCRIPTION OF TOPIC:

T2 and HT2 toxins increasingly recovered in terms of frequency and concentration on barley in the fields. Even if these toxic molecules are washed out from barley during the steeping phase, worrying amounts are susceptible to be released under the form of steeping waters, raising environmental and safety concerns. In this context, this work presents an efficient, cheap and robust toxin decontamination approach based on the use of the common enzymatic potential of GRAS microorganisms such as yeasts and lactic acid bacteria.

Results: This work has first allowed the selection of highly T2 and HT2 resistant GRAS strains with toxicity thresholds of up to several thousands ppb of T2 for *Geotrichum candidum* for example. These resistant strains have then been evaluated for their ability to eliminate T2 and HT2. These toxins were effectively eliminated at rates up to 15 ppb/hr or 10 ppb/g of biomass/hr in laboratory conditions. What is more, mycotoxin balances in the broth and at the cells level showed that the main elimination mechanism is biodegradation, cells adsorption or absorption representing only 5% of the global elimination.

Frithjof Thiele

Frithjof Thiele completed an apprenticeship as brewer and maltster at the Binding Brewery in Frankfurt, Germany. He studied Brewing and Beverage Technology at the TU-Munich-Weihenstephan. He did his doctoral thesis (Title: Influence of Yeast Vitality and Fermentation Parameters on Yeast Metabolites and Flavour Stability of Beer) at the Lehrstuhl fuer Technologie der Brauerei I in Weihenstephan. During his time at the Chair for Brewing Technology I he was responsible for research and consulting in the field of yeast technology and fermentation with national and international assignments. In 2008 he was working as a Post-Doc at the Department of Food and Nutritional Sciences, University College Cork, Ireland and changed in 2009 to the Radeberger-Gruppe KG as Product and Process Developer

Marta Fontana



She got a degree in Food Science at University of Udine, Italy. She is a PhD student in Food Science at University of Udine. She worked as quality control technician at a cooperative wine growers association in 1994 and 1995 in Friuli Venezia Giulia region, north east of Italy. In 1996 she worked in a private laboratory and she was involved in quality control of grapes, musts and wines. In 2005 she started her PhD working on the barley and malt quality aspects at the Department of Food Science, University of Udine. In 2007 and 2008 she spent 4 months at University College of Dublin working with Prof. Enda Cummins, her topic research was the application of non parametric statistical analysis to elaborate data regarding beta-glucans in barley

Emmanuel J. Rondags



Assistant professor in microbiology at the national superior school of agronomy and food industry in Nancy, France (Former french brewery school). Implicated in microbial processes development and optimization with applications in depollution and food industry.

Effect of interactions existing between barley dormancy and exogenous conditions of germination on some selected parameters of malt quality

Josef Prokeš¹, Helena Fišerová²,
Alena Helánová¹, Jan Hartman³

¹Research Institute of Brewing and Malting Prague, RIBM Brno, Brno, Czech Republic, ²Mendel University of Agriculture and Forestry in Brno, Brno, Czech Republic, ³National Varieties Testing Station Brno, Brno, Czech Republic

DESCRIPTION OF TOPIC:

The aim of this study was to analyse physiological condition of kernels of two barley varieties in the course of dormancy. Analyses were performed on three sampling dates in an interaction with the exogenous modification of intergrain gas produced in the course of malting.

Results: Experimental results corroborated physiological differences existing between tested barley varieties. During germination, Jersey variety produced more CO₂ and less ethylene than Tolar (which showed a deeper dormancy). In the course of dormancy, overall CO₂ production increased in both varieties; however, that of ethylene showed a reversed trend. In the course of dormancy, parameters selected for the evaluation of quality of malts produced within three different time intervals improved: activity of α -amylase increased, content of β -glucans decreased and malt modification and homogeneity improved. After a change in composition of the gas environment, the yield of malting insignificantly decreased, while activity of α -amylase significantly increased; the content of β -glucans in malt decreased, malt modification increased and malt homogeneity slightly (insignificantly) decreased.

Behaviour of organic radicals in different malt types during the malting and mashing process

Frank-Jürgen Methner¹,
Natalia Cortes Rodriguez¹, Thomas Kunz¹

¹Technische Universität Berlin, Institute of Biotechnology, Berlin, Germany

DESCRIPTION OF TOPIC:

The ESR spectroscopy is a rapid method for detecting ions with unpaired electrons and organic radicals. Besides the liquid measurements the ESR-spectroscopy has been used in the past to control the concentration of organic radicals in malt or green malt, by using Mn²⁺ as an internal standard. A novel method for solids measurement using a new reference signal was applied. Based on this, it was possible to analyse the radical concentration in barley, malt and spent grain quantitatively. It has been additionally used for the investigation of radical concentration in different fractions of different types of malt samples as well as their development during the mashing and malting process under different technological conditions.

Results: The results show that withering and kilning have a major influence on the radical generation in malt. A strong increase during these processes shows high stress conditions and intensive oxidation reactions. Also different radical concentrations located on certain malt fractions in different malt types could be detected. In pilsner malt the highest concentrations were located in the husks fraction and the lowest were found in the endosperm. A correlation between extract yield and organic radical concentration in spent grain with respect to mass was achieved. Coloured and roasted malt contain a higher organic radical concentration and also a different distribution of these radicals in the different fractions. This leads to a higher probability that organic radicals participate in the oxidation reactions during mashing.

Impact of the steeping process on the modifications of lipid transfer protein (LTP) from malt

Jean-Luc Runavot¹, Bénédicte Bakan²,
Patrick Boivin¹, Didier Marion²

¹IFBM-Qualtec, Vandoeuvre les Nancy, France, ²INRA, Nantes, France

DESCRIPTION OF TOPIC:

The aim of this work is to assess the impact of the steeping process on LTP modification during malting.

Results: LTP1, is a major beer protein (50% of beer protein) and contributes to the foaming properties of beer. While the barley protein is unable to form foams the corresponding beer LTP1 display good foaming properties. This is due to both glycosylation and acylation during the malting process and denaturation on boiling during brewing. The modifications of LTP are followed by quantification of acylated LTP and comparison of LTP glycosylation content in malts obtained at different hydration diagrams.

Josef Prokeš



Education: abs. Fac. of Agronomy, MZLU, Brno leader of the accredited lab 2008 PhD. Fac. of Agronomy, MZLU, Brno

Frank-Jürgen Methner



From 1975 to 1981 Studies in Brewing Science at Berlin Institute of Technology (TU). After the Studies working as an operating supervisor at the Schlösser Brauerei. From 1982 to 1986 Scientific Assistant with teaching duties at Research Institute for Brewing and Malting Technology of the VLB. Research projects, and PhD-thesis in "Aroma Formation of Berliner Weissbier with special focus on Acids and Esters" were further tasks. For 18 years, starting in 1987, he was holding a leading position as a Director at the Bitburger Brauerei, Bitburg, Germany, with responsibilities in fields such as technology and quality assurance. Beginning with the winter-semester 2004/2005 he took over the chair of Brewing Science at Berlin Institute of Technology (TU Berlin).

Jean-Luc Runavot



phD student

P 105

Protein fractions in two-row barleys as malt quality index

Stefano Buiatti¹, Marta Fontana², Paolo Fantozzi³, Giuseppe Perretti³¹University of Udine, Department of Food Science, Udine, Italy, ²University of Udine, Department of Agriculture and Environmental Sciences, Udine, Italy, ³University of Perugia, Italian Brewing Research Center, Perugia, Italy

DESCRIPTION OF TOPIC:

The composition of the protein fractions is affected by genotype and environmental conditions. The focus is on understanding how albumin, globulin, hordein and glutelin could be an index of malt quality (more than the total protein alone). The effect of different N fertilization levels in two years on protein fractions and the relationships between malt quality parameters and these fractions have been investigated on autumn barley varieties.

Results: There was a significant difference in protein fraction composition. Varieties influence significantly albumin-globulin and hordein level; hordein and glutelin are influenced by N fertilization level and year influences glutelin level. Hordein was negatively correlated with HWE ($r=-.64^{***}$), index refractometric ($r=-.67^{***}$), friability ($r=-.71^{***}$) and positively correlated with viscosity ($r=.48^{**}$), β -glucan ($r=.64^{***}$) and N level in barley ($r=.68^{***}$). Glutelin was negatively correlated with friability ($r=-.44^{***}$) and positively correlated with FAN ($r=.50^{***}$) and N level in barley ($r=.56^{***}$). Albumin and globulin were not correlated with the considered factors.

P 106

Chasing the premature yeast flocculation factor from barley to beer

Gillian M Fisher¹¹BRI, Nutfield, United Kingdom

DESCRIPTION OF TOPIC:

Some of the most difficult and frustrating problems to solve are those that happen only occasionally and have no obvious pattern or cause. One such problem in brewing is when the yeast begin to flocculate before fermentation is finished. Over the years, brewers have asked what causes this premature yeast flocculation (PYF)? We are still waiting for the answer. Today, the most recent research suggests that PYF is connected to malt quality and might possibly be triggered by conditions in the field before the barley is harvested. In this paper we will discuss our work tracking this PYF factor during the malting process. We approached this problem by investigating the link between the malting process and PYF and asking whether malting conditions can be adapted such that a 'PYF barley' can be prevented from becoming a 'PYF malt'.

Results: Small scale malting trials confirmed that PYF factor can be removed from barley during steeping, however the malt can become PYF during germination whether or not it started as PYF barley. Air recirculation during germination decreases PYF. In commercial maltings a PYF barley can result in PYF positive or negative PYF malt according to whether the process conditions were sufficiently aerobic.

P 107

Studies of flavour development during malt roasting processes

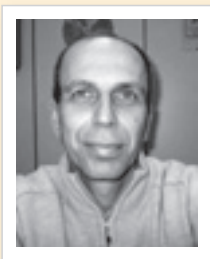
David John Cook¹, Hafiza Yahya¹¹University of Nottingham, Division of Food Sciences, Loughborough, United Kingdom

DESCRIPTION OF TOPIC:

Speciality malts can be used to add colour and flavour in the brewing process. Published literature mainly describes the analysis of flavour compounds in roasted malt products, rather than examining how process conditions may be manipulated to influence the volatile profile. Our group has established a rapid on-line APCI-MS technique, capable of monitoring thermal volatile generation in malts in real-time, so that comprehensive studies of the impact of process conditions (time, temperature, humidity) on the malt volatile profile may be undertaken. Here we report results obtained using the on-line technique and compare these with flavour generation profiles obtained from time-course studies during commercial malt roasting operations.

Results: 13 significant malt volatiles were identified (on the basis of EI mass spectrum and Kovat's Retention Index) which gave 'unique' APCI-MS ions during on-line analysis. Quantitative time-course data were obtained for 15 significant volatiles generated during the manufacture of roasted barley, crystal and black malts on both a pilot and industrial scale.

Stefano Buiatti



He got a degree in Agricultural Science at University of Bologna, Italy. He is researcher at University of Udine 1985 present. He worked as Quality Control Technician at Moretti Brewery in Udine, Italy in 1985. Research secondment to Brewing Research International, Nutfield (UK) in 1997 and 1998 (6 months) and in 1999 (3 months). Expert as project evaluator for EU since 1999. In charge of the pilot brewery at the University of Udine, Italy. Professor at University of Udine on Brewing science and Cleaning and Disinfection of Food Plants: He has been teaching Brewing Science since 1994 and Cleaning and Disinfection of Food Plants since 1999. He works on optimization of analytical methods, chemical and microbiological quality assessment of craft and industrial beers.

Gillian M Fisher



Gillian has an honours degree in botany from University of London, she started her career in the biotechnology industry culturing yeast and other micro-organisms for protein production at Imperial College. Gillian joined BRI in 1995, building on her early employment in quality control at Whitechapel Brewery and research at Truman's Brewery. After working in Analytical Services analysing beer and malt, she was promoted to Quality Assurance Manager and was responsible for maintaining the ISO 17025 Accreditation status of the Analytical laboratory. After 10 years she transferred to the Technical Development team working on analysis of Isinglass. Since then Gillian has trained in a variety of bench scale fermentation tests including the BRI light transmission test and EBC tall tubes she now focuses on fermentability and premature yeast flocculation studies for international brewers and maltsters.

David John Cook



David Cook is Lecturer in Brewing Science at the University of Nottingham, UK and is Course Director for their innovative e-learning based Postgraduate Courses for Brewers. He is currently engaged in research across the malting and brewing fields, with particular focus on malting science, flavour formation, stability and perception. Other research interests include the regulation of germination in barley and the role of odorant binding proteins in the human sense of smell. Dr. Cook is a member of the Examiners Board for the IBD Diploma in Brewing and of the EBC Barley Genetics and Physiology Sub-Group.

Demand response and dispatchable industrial loads for the use in virtual power plants

Jochen Lambauer¹, Jan Stichtenoth², Thomas Lauer³

¹Institut für Energiewirtschaft und Rationelle Energieanwendung, Universität Stuttgart, Stuttgart, Germany, ²RWE Innogy Cogen GmbH, Dortmund, Germany, ³Bitburger Braugruppe GmbH, Bitburg, Germany

DESCRIPTION OF TOPIC:

Within the project "Virtual Power Plant" (VPP) RWE Energy AG evaluates the options to bundle and merchandise small power and energy consuming units in the energy market. In a sub-project IER analyses the availability and useability of dispatchable loads in a VPP at the Bitburger brewing plant. Dispatchable loads and storage facilities are checked towards options for their technical and economical applicability in a supra-regional market model of a VPP.

Results: For Bitburger brewing plant dispatchable loads of more than 1.1 MW are identified and can be technically and economically used in a market model of a VPP. The results at Bitburger brewing plant can be transferred to other sites in beverage and food industries as the applied processes are similar. In addition the load profile of Bitburger is leveled and the maximum load demand can be reduced. Loads starting from 100 kW have the potential to be utilised within a VPP.

Development of a demonstrator application for the model based weak point analysis of bottling plants

Stefan Flad¹, Peter Struss², Horst-Christian Langowski¹

¹TU München, Lehrstuhl für Lebensmittelverpackungstechnik, Freising, Germany, ²TU München, Lehrstuhl für Informatik IX, Garching, Germany

DESCRIPTION OF TOPIC:

The efficiency of today's bottling plants is not often higher than 40 to 70 percent. In Order to optimize the plants downtime originating components should be identified automatically. For this reason a model based diagnosis algorithm has been developed in an interdisciplinary research project that will be presented at EBC 2009 in the acceptet lecture of Dr. Tobias Voigt. For the practical benefit of breweries, the diagnosis results need to be analyzed and visualized in an operator comprehensible way.

This contribution will present a demonstrator application for the automatic weak point analysis of bottling plants. It was developed to show the practical opportunities of this new approach.

Results: The first version of the demonstrator application will be implemented in industrial scale bottling plants in February 2009. A validation through simulation and real data from proved evidence between the automatically diagnosis results and the manually monitored behavior of the plants. Technical downtime reasons can be identified with an accuracy up to 95 percent. With this information a plant operator can quickly take actions to optimize critical weak points.

Quorum sensing of brewery biofilm microbes

Outi Priha¹, Riikka Juvonen¹, Kaisa Tapani², Erna Storgårds¹

¹VTT Technical Research Centre of Finland, Espoo, Finland, ²Oy Sinebrychoff Ab, Kerava, Finland

DESCRIPTION OF TOPIC:

Bacteria are no longer regarded as undifferentiated cells focused on multiplication. Instead it has been shown that cell-to-cell signalling both within and between bacterial species is a widely spread phenomenon, and there is evidence that quorum sensing participates also in biofilm formation. Compounds inhibiting either the synthesis or use of signalling molecules have been detected, and in the future there might be a possibility to interfere harmful biofilm formation of bacteria in breweries by controlling their signalling.

Results: samples the most common signalling molecule group were acylated homoserine lactones (AHLs) detected by *A. tumefaciens* NTL4, since 90 colonies produced them. Short chain (C4-C8) AHLs detected by *C. violaceum* CV026 were produced by 26 colonies and long-chain AHLs by 8 colonies. From identified brewery isolates 7 strains produced AHLs detected by *A. tumefaciens* NTL4 and 25 strains produced long chain AHLs, but none of the strains produced short-chain AHLs.

Jochen Lambauer



born June 20th, 1978 Since 11/2005: Scientist at Institut für Energiewirtschaft und Rationelle Energieanwendung (IER), Universität Stuttgart 1999 - 2005: Study of Environmental Engineering (Dipl.-Ing.), Universität Stuttgart 1999 - 2003: Bachelor of Science (B. Sc.) in Environmental Engineering, Universität Stuttgart

Stefan Flad



Stefan Flad (born 1982), got the university-entrance diploma at June 2002 at the Dom-Gymnasium in Freising. After that he studied from 10/2003 till 11/2008 at the Technical University of Munich / Garching. In November 2008 he graduated as an engineer (Dipl.-Ing.) for mechatronics and information techniques. In 12/2008 he started working as doctoral candidate and research associate at the Chair of Food Packaging Technology, Technical University of Munich. His fields of activity at the university are: Analyzing and diagnosis of bottling plant in food and brewery industry, member of the working team Weihenstephaner Standard

Outi Priha



Outi Priha has done her PhD in microbiology. She has worked at VTT since 2002, and has been involved in management of biofilms in different industrial processes. Her main interest is in understanding microbe-surface interactions and functions of microbial communities.

P 112

Prediction of flocculation ability of brewing yeast inoculates by flow cytometry, proteome analysis and mRNA profiling

Franziska Heine¹, Frank Stahl², Heike Sträuber¹, Claudia Wiacek³, Dirk Benndorf⁴, Cornelia Repenning², Frank Schmidt⁵, Thomas Scheper², Martin von Bergen⁶, Hauke Harms¹, Susann Müller¹

¹Helmholtz Centre for Environmental Research - UFZ, Environmental Microbiology, Leipzig, Germany, ²Leibniz University Hannover, Hannover, Germany, ³TU Bergakademie Freiberg, Freiberg, Germany, ⁴Otto-von-Guericke-Universität Magdeburg, Magdeburg, Germany, ⁵Ernst-Moritz-Arndt-Universität of Greifswald, Interfaculty Institute for Genetics and Functional Genomics, Greifswald, Germany, ⁶Helmholtz Centre for Environmental Research - UFZ, Proteomics, Leipzig, Germany

DESCRIPTION OF TOPIC:

The ability of brewing yeast to flocculate is an important feature for brewing of qualitatively good beer. Flocculation involves two main cell wall structures, which are the flocculation proteins (flocculins) and mannans, to which these flocculins bind. Unfortunately, in practice the flocculation ability may get lost after several repitches.

Results: Mannose and glucose labelling with fluorescent lectins allowed differentiating powdery and flocculent yeast cells under laboratory conditions. Using microarray techniques and proteomics, the four flocculation genes Lg-FLO1, FLO1, FLO5, FLO9 and the protein Lg-Flo1p were identified as factors of major importance for flocculation. The expression of the genes was several times higher in flocculent yeast cells than in powdery ones.

P 113

Differences in growth behaviour of *Pectinatus frisingensis* isolates in beer

Inge Suiker¹, Tadhg O'Sullivan¹, Anne Vaughan¹

¹Heineken Supply Chain, Research & Innovation, Brewing Science, Zoeterwoude, Netherlands

DESCRIPTION OF TOPIC:

The growth behaviour in beer of fifty-one *Pectinatus* strains, isolated from eight brewery environments throughout the world or sourced from culture collections, was analysed. The isolates were grouped on the fingerprint types determined in a previous study (by using rep-PCR). The objective of this study was to investigate the relationship between genetic fingerprint types and growth behaviour in beer.

Results: For isolates from four fingerprint types, different growth curves were observed. The fifth fingerprint type is made up of only one isolate showing a unique growth curve. Within the remaining fingerprint type the five isolates showed similar growth patterns.

P 114

Analysis of metabolic activities of beer-spoilage lactic acid bacteria in chinese beer

Fei Qian¹, Ingrid Bohak¹, Werner Back¹

¹Lehrstuhl für Technologie der Brauerei I, TUM-Weihenstephan, Freising, Germany

DESCRIPTION OF TOPIC:

This study shows the first analysis results about typical beer-spoilage lactic acid bacterium and their metabolic activities in final chinese beer, especially the metabolism of sugar and organic acid.

Results: *L. brevis*, *L. plantarum*, *L. casei* and *L. acetotolerans* were identified as the most-appeared contaminants. Due to diversification of subtype of *L. brevis*, three *L. brevis* cultures can hydrolyse maltose, which leads to increase of glucose concentrations, whereas other three *L. brevis* cultures metabolize total glucose directly. Maltose and glucose are the major carbon source for *L. plantarum*. It metabolizes also sucrose and fructose. *L. casei* is maltose and sucrose positive. *L. acetotolerans* has never been found in beer before, its metabolic activities of sugar in beer are very low, and besides fructose and glucose it metabolizes only maltose. Almost all lactic acid bacterial fermented citrate.

Franziska Heine



2002: Abitur 2002-2007: University Leipzig, study course biology 2007: Diploma in Biology 2008-present: PhD-student, sponsored by the Scholarship Programm of the German Federal Environmental Foundation

Inge Suiker



Inge was educated as a clinical chemical technician (1993), in Beverwijk, after which she did HLO medical microbiology in Leiderdorp (1998). She worked on parasitology and molecular microbiology in hospital laboratories before joining Heineken as a research assistant in February 2001. Inge recently graduated as in Biomolecular Sciences at the university of Utrecht.

Fei Qian



Born in 1973. Technical graduation as Brewer and Maltster in Academy for Brewing Technology Wuhan, China (1988-1991). Teacher in Academy for Brewing Technology Wuhan, China (1991-1998). Study at TU München-Weihenstephan as Diploma-Brewmaster, major: Brewing Science (1998-2000). Director and Seminar leader in Academy for Brewing Technology Wuhan, China (2000-2002). Postgraduate Study at TU München-Weihenstephan as Diploma-Engineer, major: Brewing Science and Beverage Technology (2002-2006). PhD-study on the Chair for Brewing Technology (Lehrstuhl für Technologie der Brauerei I, TU München-Weihenstephan), major research area: microbiological stability of Chinese beer (Aug 2006 till today).

Methods for rapid authentication and differentiation of brewing yeast strains

Tithira Tirangika Wimalasena¹, Sarah Nicholls¹, Katherine Ann Smart¹

¹University of Nottingham, Division of Food Sciences, Loughborough, United Kingdom

DESCRIPTION OF TOPIC:

Yeast quality control is important in the brewing industry. This includes ensuring the right yeast is used in the fermentation, testing to ensure lack of contamination with wild yeasts and checking for any genetic drift in the added yeast during propagation or fermentation that might introduce off flavours or inhibit performance. Restriction Fragment Length Polymorphism (RFLP) or karyotyping is considered as the most effective method to differentiate yeast strains but require considerable knowledge in the molecular biology. Polymerase Chain Reaction (PCR) technology is widely accepted as a diagnostic tool by breweries but has not been applied to brewing strain authenticity testing. So here we present a PCR kit comprising multiple but customised primer sets will provide a rapid differentiation of brewing strains.

Results: Using combined PCR and RFLP we were able to develop specific primers to differentiate ale (*S. cerevisiae*) and lager (*S. pastorianus*). Furthermore, we have also identified primers to differentiate specific lager strains in the University of Nottingham yeast culture collection.

New insights in label removal

Georg Wenk¹, Roland Pahl², Ingrid Weber²

¹Research and Teaching Institute for Brewing (VLB), Research Institute for Engineering and Packaging (FMV), Berlin, Germany, ²Research and Teaching Institute for Brewing (VLB) e.V., Berlin, Germany

DESCRIPTION OF TOPIC:

The label come-off time is crucial for the cleaning process in bottle washing machines. If labels come off too late, they will be distributed in the machine and can block caustic and freshwater cones. This will reduce the cleaning efficiency of the bottle washer and will cause an increasing number of rejected bottles, which have to be destroyed or returned to the bottle washing machine. Either way leads to higher production costs and decreased plant efficiencies.

This research examines the come-off time of different paper labels against the influencing factors paper, labeling glue and process parameters.

Results: Both printing methods increase the come-off time, but offset printing shows a higher impact. Lacquering labels increases the come-off time only with metallized papers using offset printing. Imprinting papers reduces the come off time with metallized papers only.

With both labels an almost linear effect of the caustic temperature was discovered while different caustic concentration had an effect only on the non-metallized papers using a reduced concentration. However, the major effect on the come-off time of metallized papers was found to be the amount of glue.

Practical experiences on the use of UVC-lights as a part of disinfection in filling process

Kaisa Tapani¹, Pilvi Ronkainen¹, Mika Huttunen², Kimmo Jääskeläinen²

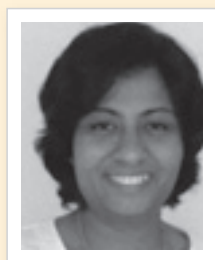
¹Oy Sinebrychoff Ab, Laboratory, Kerava, Finland, ²Oy Sinebrychoff Ab, Production, Kerava, Finland

DESCRIPTION OF TOPIC:

High hygiene level is a key factor to avoid secondary contaminations in filling process. Disinfection with traditional chemicals requires stoppages in production. Continuous UVC-disinfection can be automated and used during production. UVC has a strong germicidal effect penetrating cell membranes and damaging DNA. Good hygiene practice, cleanability and safety should be considered in design of UVC-lamp installation.

Results: Packaged beer results improved with UVC-disinfection in use. Empty can air rinsing and UVC-disinfection is as effective as rinsing with water.

T. T. Wimalasena



Tithira Wimalasena was awarded a first-class honors degree in microbiology at Osmania University, India in 2000. She then joined University of Nottingham to complete her MSc in Applied Molecular Microbiology where she stayed to complete a Ph.D. degree in the School of Biology. Her Ph.D. research focused on the unfolded protein response in human fungal pathogen *Candida albicans*. Tithira joined Katherine Smart's research group as a postdoctoral researcher at School of Biosciences in 2007. Currently Tithira is funded by Lachesis fund to develop novel molecular tools to be used for the alcoholic beverage industry.

Georg Wenk



In 2000 Mr. Georg Wenk started studying Brewing and Drink Technology at the Technical University in Munich-Weihenstephan. Since August 2005 he is working for the VLB Berlin at the Research Institute for Engineering and Packaging Technology (FMV). Amongst other things he is responsible for labelling technology and special measurement equipment for breweries and bottlers.

Kaisa Tapani



MSc in Microbiology at University of Helsinki, 1998; Research Projects at VTT, 1995-1997; Oy Sinebrychoff Ab, since 1998.

P 118

Filtration and stabilization results from a brewery using a kieselguhr free filter aid

Nikolaj Schmid¹, Gero Spika¹

¹BASF SE, EMN-EB, Ludwigshafen, Germany

DESCRIPTION OF TOPIC:

Kieselguhr filtration is the state-of-the-art filtration technology for beer, with thousands of filter lines in operation globally. Despite discussions about health risk sand disposal costs kieselguhr is the state-of-the-art filter aid. The current consumption of kieselguhr worldwide by the brewing industry is more than 180.000 tons. Disposal costs for the used kieselguhr are an increasing part of total filtration costs, and so brewers are commonly interested since decades in finding a more economical filter aid. Crosspure is a synthetic polymer for filtration and stabilization in one step / one filter. Just like PVPP, Crosspure can be regenerated in a combined regeneration and filtration system with dosing vessel, filter unit and CIP system. For the first time a brewery implemented Crosspure in a industrial scale. Results from the brewery will be presented.

Results: Replace a kieselguhr filtration in industrial scale by Crosspure, a synthetic ploymer for filtration and stabilization in one step / one filter.

P 119

New apparatus and procedure to enhance the utilisation of bitter-acids

Marcus Hertel¹, Michael Dillenburger¹

¹HERTEL GmbH, Salzburg, Austria

DESCRIPTION OF TOPIC:

With about 30% , utilisation of hops in the brewing process is very low. This is due to the fact hat most alpha-acids, which cause the bitter taste, are not isomerised and/or extracted out of the added hop products. In addition, alpha-acids can adhere to trub particles and yeasts so that they are separated out of the beer at a clearing process again.

Results: With the new invention, alpha-acids are isomerised to an optimum (reachable) level. In the isomerised form, the hop bitter acids show a clearly better solubility in water/wort. In addition, an adhesion is minimized due to the process guidance. The utilisation of hops (bitter acids) is more than doubled while using the invention (> 80%). This is already confirmed in laboratory scale and in a pilot plant.

P 120

Novel malt-based isotonic beverages

Moritz Krah¹, Tamara Assenheimer¹, Werner Back¹

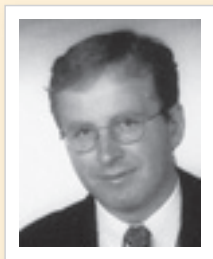
¹TU München, Lehrstuhl für Technologie der Brauerei I, Center of Life and Food Sciences Weihenstephan, Freising, Germany

DESCRIPTION OF TOPIC:

In recent years a number of novel, innovative beverages have been launched. Due to growing consumer awareness for the negative impact of malnutrition in western countries novel drinks based on natural raw materials have attracted a growing interest. Especially malted grains and natural fruit juices are suitable for the production of such beverages as they are generally considered as positive and healthy food ingredients. A huge variety of malted cereals as barley, the most commonly known, wheat, spelt wheat, rye, oats, triticale and others, e.g. gluten-free pseudocereals may be used.

Results: Traditional tasting schemes for beer or soft-drinks were not suitable for the produced beverages. A new tasting scheme had to be created. The main flavor and aroma attributes of the produced beverages were refreshment, purity of the acidic character, harmony of the used fruits with the lactic acid and stale flavors amongst others. The effect of ageing, pasteurization and flash pasteurization on flavor and flavor stability could be measured with similar lead substances as found in beer like 2-furfural. The produced beverages showed good flavor stability though losses in olfactory attributes occurred during heating and aging.

Nikolaj Schmid



Dr. Nikolaj Schmid completed his studies at the TU München-Weihenstephan with an doctor thesis about kieselguhr recycling. Then he joined the R&D department of PallSeitzSchenk for 5 years. In 2006 he joined BASF SE and is currently Technical Business Manager for Europe for Divergan and Crosspure.

Marcus Hertel



Dr.-Ing. Marcus Hertel was born in 1975 in Nürnberg, Germany. He has been the director of the Hertel Brau-vertrieb GmbH, Nürnberg/Germany since 2006. Since 2007, he has been the director of the Hertel GmbH Salzburg/Austria. In his Ph.-D.-Thesis he made basic reasearch in reaction kinetics and the steaming behaviour of wort flavour components

Moritz Krah



Moritz Krah was born in 1980 in Schwetzingen/Germany. After attaining the German Abitur (A-level certificate) in 2000, he started studying brewing and beverage technology at the Technische Universität München in Weihenstephan. In 2005 he graduated with a Dipl.-Ing. degree and has since then been working as a Ph.D. student at the Chair for Technology of Brewing 1 in Weihenstephan.

Industrial results of precoat filtration on a candle filter with regenerable filter aid

Juerg P. Zuber¹

¹FILTROX AG, CTO, St. Gallen, Switzerland

DESCRIPTION OF TOPIC:

Precoat filtration still is the state of the art filtration technology for beer with thousands of filter lines in operation around the world. Despite all discussion about health risk and disposal problems, D.E. (Diatomaceous Earth) is the state of the art filter aid for precoat filtration. For at least 15 years the experts of the brewing industry have been looking for filter aids, which could replace D.E., so far without much success. Over the last years BASF developed a new, regenerable filter aid called CROSSPURE®, which was thoroughly tested on an industrial scale FILTROX candle filter. The regeneration process is similar to the well established one for regenerable PVPP. Precoat filtration with this new filter aid contributes to the preservation of the environment, because the energy consumption as well as the waste generated is far lower than with any other filtration system.

Results: Filtration parameters and beer quality are comparable to D.E. filtration, but filtration cost is substantially lower than D.E. filtration and stabilisation.

Kvass - a Russian fermented cereal based beverage

Martin Zarnkow¹, Konrad Müller-Auffermann¹, Werner Back¹, Martina Gastl¹

¹TU München, Lehrstuhl für Technologie der Brauerei I, Freising, Germany

DESCRIPTION OF TOPIC:

Kvass or kvas (literally „leaven“; borrowed in the 16th century from Russian), sometimes translated into English as bread drink, is a fermented mildly alcoholic beverage made of black or rye bread. It is popular in all ex-Soviet states. Its origins go back 5,000 years to the beginnings of beer production. The alcohol content of Kvass is low (0.05-1.44%). It is often flavoured with fruits or herbs such as strawberries or mint. This presentation will give an overview on the Kvass technology, which is used in the mentioned countries, combined with different trials for a better understanding of the mostly used raw material rye (*Secale cereale* L.).

Results: Because there are no typical receipts for Kvass-making all practicable technologies were considered. Nevertheless most of the producers use Kwass-extract, which is made of strongly concentrated Kwass-malt wort. Bread is no longer used for Kwass. The biggest problem of the raw material rye is its high ability for high viscous worts. This can be related to a high content of pentosanes. Further on, oxygen was found with great impact on this mash attribute. Exogenous enzymes solved some problems, but the separation of solid and fluid still depends on the malt and adjunct charge and the lautering system.

Advances in the production of gluten free malt and beer

Elke Arendt¹, Florian Hübner¹, Christina Klose¹, Frithjof Thiele¹

¹University College Cork, Department of Food & Nutritional Science, Cork, Ireland

DESCRIPTION OF TOPIC:

The increasing number of people suffering from Coeliac Disease, together with a general growing demand for novel foods and beverages, has given birth to a new market consisting of malts and beers made from gluten free. The technology traditionally used for the production of malt and beer made from barley can not be applied for gluten free cereals. This presentation will give an overview on the changes to the relevant substances taking place during malting and brewing process of gluten free raw material and the difficulties encountered in the process.

Results: The areas covered in the presentation are the detailed characterisation of gluten free cereals and the assessment of these cereals as potential ingredients for gluten free malts and beer. Advanced microscopy has been used to determine the ultra structural changes during the malting of gluten free cereals, where as the proteomic approach was used to explain the protein changes taking place during malting. A detailed nutritional analysis of the malts and beers which includes the impact of processing on the antioxidant capacity, poly phenol content, dietary fibre and mineral content and mineral availability will be shown.

Juerg P. Zuber



Juerg Zuber completed his studies at the Federal Institute of Technology (ETH) in Zurich, Switzerland with a masters degree in process engineering in 1977. He then joined Buhler AG, where he worked for more than 20 years in a variety of R&D and management positions for the food industry. In 2000 he joined FILTROX AG and is currently CTO of the FILTROX group.

Martin Zarnkow



Apprenticed as a brewer and maltster from 1989-1991 at a small brewery in Franconia. Finishing a Diplom-Ingenieur (FH) graduation, option brewing technology, 1996 at the TU München Weihenstephan. Work as a brew master for one year in a medium-sized brewery in Germany. Since 1997 science assistant and head of the beer laboratory at the Lehrstuhl für Technologie der Brauerei I at the TU München Weihenstephan. Since September 2005 work as PhD research fellow at the University College of Cork, Ireland on the subject: Malting and brewing with non-traditional cereals.

Elke Arendt



Dr Elke Arendt is a senior lecturer in the Department of Food and Nutritional Sciences, University College Cork since 1993. She lectures and carries out research in the area cereals, malting and brewing science specific focussing on gluten free foods and beverages, starter cultures, functional beverages, rheology and food structure. Prof. Dr. Arendts research programme at UCC, to date, has resulted in over 120 peer-reviewed research papers, 1 book, 25 book chapters, and approximately 350 additional published articles and abstracts. Her current research group comprises of 26 researchers (post docs and PhD students).

P 124

Development of a hops kettle addition extract to replace aroma hop pellets

Michael Babb¹, Lou Burroughs¹, Polly Barrett¹, David Bolliet¹, Greg Haner¹, Mark Schulze¹, Doug Williams¹

¹Kalsec Inc, Kalamazoo, United States

DESCRIPTION OF TOPIC:

Aroma hops in cone or pellet form are added to impart hop aroma and flavor character to beer. However, this can suffer from low utilization of flavor compounds, high cost, limited availability or variable hop quality. The uncoupling of bitterness and hop aroma and flavor character provides greatest flexibility for the brewer. In this study, we describe our work to develop a non-acidic kettle addition hop extract to replace the hop aroma and flavor character (independent of bitterness) from Saaz hop pellets in a European style lager.

Results: GC/MS concentrations of linalool (10-100 ppb) and humulene oxides (10-50 ppb) were strongly correlated to flavor differences between beer brewed from pellets and different amounts of hop extracts. In a triangle test, no difference was noted ($p > 0.05$) between beer brewed with hops pellets and beer replacing a portion of the hops pellets with a kettle addition extract.

P 125

Ganoderma lucidum - medical mashroom as a raw material for beer with excellent sensorial and pharmacodynamic properties

Ida J Leskošek-Čukalović¹, Milomir Nikšić¹, Viktor Nedović¹, Saša Despotović¹, Vele Tešević²

¹Faculty of Agriculture, Food Technology and Biochemistry, Belgrade, Serbia, ²Faculty of Chemistry, Instrumental Methods of Chemical Analysis, Belgrade, Serbia

DESCRIPTION OF TOPIC:

Lengthy, Reship, Yogi, "Elixir of life", "Food of Gods", are the synonyms for *Ganoderma lucidum*, a woody mushroom highly regarded in Far East folk medicine. It is broadly used in the belief that it boosts up the immune system and treats various human diseases, such as hepatitis, hypercholesterolemia, asthma, allergies and even cancer. The paper gives an overview of use of *Ganoderma* as a source of bioactive compounds for functional drinks based on beer. It deals with determinations of main bioactive substances contents, potential therapeutic action and sensory evaluation of the final products obtained by *ganoderma* and different medical herbs used for sensory adjustment.

Results: Sensory evaluation showed that *Ganoderma* could give the beer with very good properties. Depending on dosage, combination of bitter constituents derived from hop and *ganoderma* give specific more or less pleasant bitterness. Products are enriched in bioactive components extracted from *ganoderma*: triterpenoids, polysaharides and lectins thanks to whom *Ganoderma* possesses its pharmacodynamic properties.

P 126

Critical factors at mashing-in influencing lipid oxidation

Sofie Malfliet¹, Annemie De Buck¹, Joseph van Waesberghe², Guido Aerts¹

¹KaHo St.-Lieven Laboratory of Enzyme, Fermentation and Brewing Technology/M2S, KUL Association, Leuven Food Science and Nutrition Research Centre (LForCe), K.U.Leuven, Gent, Belgium, ²IVEWE, Hoogstraten, Belgium

DESCRIPTION OF TOPIC:

Lipid oxidation takes place during the whole malting process and is known to be relevant for the early appearance of stale and oxidised flavours in pale lager beer. The membrane bound lipoxygenase (LOX), still present in kilned malts, potentially catalyses the formation of trihydroxy fatty acids (thfa) at mashing-in. Considering the relevance of thfa for the final flavour stability of pilsner beers, the objective is to restrict enzymatic lipid oxidation especially at the start of the wort production in order to control the concentration of thfa in the resulting wort.

Results: On lab scale, mashing-in at 45°C results in a large increase of thfa, higher after fine milling than after coarse milling. At 70°C and pH 5.0, only a small, negligible increase of thfa is observed, independent on fine or coarse milling.

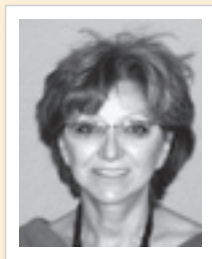
On pilot scale, mashing-in at $\geq 63^\circ\text{C}$ and pH 5.2, only 2-4 mg thfa/L at 12°P are detected in the pitching wort, which is mainly a concentration originating from the malt used. Even using malt with high potential LOX activity, the concentration of thfa in the pitching wort never exceeds 4 mg/L, independent of the milling size. If mashed-in at lower temperature and high pH, concentrations of 8-12 mg thfa/L are detected.

Michael Babb



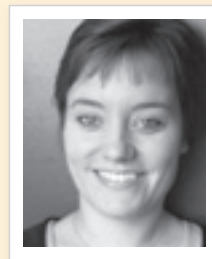
Mike has a B.S. degree in Chemical and Petroleum Engineering from the Colorado School of Mines. Mike also studied Brewing Technology at the Technical University of Munich – Weihenstephan, and has a Masters degree in Education and Curriculum Development from Colorado Christian University. He worked at the Coors Brewing Company for 20 years in a number of positions including Process Development, R&D, Manufacturing Management, and International Head Brewer. Mike was an instructor and Director of Education for brewing education at the Siebel Institute of Technology for 7 years. Mike joined Kalsec in November 2003 as Hops Products Technical Sales Associate, and is currently Director – Hops Product Management.

Ida J Leskošek-Čukalović



Earned the BSc and MSc degrees in Tehnicka Science from the Faculty of Technology and Metallurgy and a PhD in Biotechnical Science from the Faculty of Agriculture, University of Belgrade, Serbia. Since 1978, employed by the Institute for Food Technology and Biochemistry, Faculty of Agriculture in Belgrade. Currently a full Professor of Brewing Technology, Head of the Department of Preservation and Fermentation Technologies, and Head of the Division for Brewing. Besides working as a Professor and a Researcher at the Faculty of Agriculture, worked as a Professor of Technology of Microbial Metabolites at the Department of Biochemical Engineering, Faculty of Technology and Metallurgy, Belgrade. Member of the Management board of the Yugoslav Association of Nutrition.

Sofie Malfliet



Born in 1980. Studies: Academic degree in Industrial Engineering - Biochemistry at KaHo St.-Lieven, Gent (2004). Appointments: 2008-present: PhD study on microflora management during malting at KaHo St.-Lieven, Laboratory of Enzyme, Fermentation and Brewing Technology (EFBT)/M2S, K.U.Leuven Association, Leuven Food Science and Nutrition Research Centre (LForCe). 2004-2008: Research Assistant working on beer flavour and flavour stability at KaHo St.-Lieven, Laboratory of Enzyme, Fermentation and Brewing Technology.

P 127

Influence of mashing diagramme on arabinoxylan hydrolysis

Marc Schmitt¹

¹IFBM, R&D, Vandoeuvre, France

DESCRIPTION OF TOPIC:

Non starchy polysaccharides are the main constituents of endosperm cell walls and aleurone layer. These substances are β -glucans and arabinoxylans. Arabinoxylans that represent 7 to 11% content of the barley grains are not hydrolysed during malting process. These malt substances are known to be implicated in wort viscosity, mash and beer filtration problem. The purpose of this study was to determine the impact of mashing diagramme.

Results: Experiments carried out with malts with different arabinoxylans content clearly showed that the optimum temperature to hydrolyse arabinoxylan is 50°C. Lower and higher temperature led to higher arabinoxylan content in the wort. These results were in connection with the optimum temperature activity of endogenous malt arabinoxylanase. Lower arabinoxylan content in wort came with a lower viscosity and less mash filtration time.

P 128

Impact of cell wall mannoproteins on flocculation of *S. cerevisiae* and *S. pastorianus*

Trevor P Cowley¹, Katherine A Smart¹

¹University of Nottingham, Biosciences, Loughborough, United Kingdom

DESCRIPTION OF TOPIC:

Process developments require an understanding of yeast responses to changing environments. Whilst it has been previously demonstrated that freshly propagated yeast ferment and flocculate poorly compared to cropped slurries of generation 2 or more the reasons for these differences have not been elucidated. This poster will provide a basis for this frequently observed phenomenon and indicates the means by which flocculation competence may be regulated in full scale fermentations.

Results: We recently established that brewing yeast cell wall composition modifies in response to changes in fermentation gaseous environmental conditions modifying flocculation performance.

P 129

Zinc supplementation to multi-brew fermentations and zinc toxicity

Behnam Taidi¹, Johannes Rosti¹, Jacques Gangloff¹

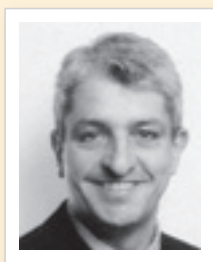
¹Carlsberg, Technical and Development, Strasbourg, France

DESCRIPTION OF TOPIC:

This study builds on work presented previously at the World Brewing Congress 2004 on the best way to add zinc to wort. The current study deals with the addition of yeast to multi-brew fermentations and zinc toxicity.

Results: The entire zinc requirement for a multibrew fermentation could be added to the wort which is also pitched with the entire yeast population required for the fermentations. The levels of zinc toxicity were determined.

Marc Schmitt



Marc SCHMITT is raw material and biochemistry Manager at IFBM. He joined Qualtech at the beginning of 2002 as manager of the Malting & Brewing Laboratory. He has been lecturer in biochemistry and biosciences engineering at Nancy University from which he received his BSc in biochemistry (1989), and his MSc in microbiology, enzymology and nutrition (1991). Eventually he completed his PhD in food biochemistry which was awarded by Nancy University (1996). From 1994 to 2002, he managed the Central laboratory of the French Cheese Institute. He is a member of several working groups of French Association of standardization (AFNOR). Member of the Analysis Committee of the EBC since May 2004.

Trevor P Cowley



Trevor Cowley obtained his first degree in Natural Sciences with Biology (Hons) from the Open University, UK (2006). This was followed by an MSc in Applied Biomolecular Technology from the University of Nottingham, which included a placement in the QA department at Coors Brewers to investigate the optimal VDK stand time for fermenting beer. Currently he is a PhD student under the supervision of Professor Katherine Smart; sponsored by the Institute of Brewing and Distilling. His research focuses mainly on the molecular basis of flocculation in yeast cells.

Behnam Taidi



Behnam, a biochemist by training and has held various Brewing Research positions for the last 15 years. Starting from BRI to Scottish Courage, then Scottish & Newcastle and now Carlsberg, Behnam's traditional expertise lies in yeast and fermentation but in recent years he has expanded into the areas of by-product utilisation, raw materials development and microbiology. Behnam serves on the CBMO (the French committee for approval of brewing barley varieties). Behnam is also the chairman of the EBC Brewing Science Group. Behnam is currently Yeast Manager for Group Carlsberg, coming back to his first passion of Yeast and Fermentation.

P 130

Yeast vitality determination based on intracellular NAD(P)H fluorescence measurement

Tomáš Brányik¹, Michal Kuřec¹, Petr Bednář¹, Gabriela Kuncová²

¹Institute of Chemical Technology Prague, Department of Fermentation Chemistry and Bioengineering, Prague, Czech Republic, ²Institute of Chemical Process Fundamentals, Prague, Czech Republic

DESCRIPTION OF TOPIC:

In this work a cell vitality assessment method based on on-line intracellular fluorescence measurement is presented. The intracellular NAD(P)H fluorescence of a yeast suspension is recorded during transition from aerobic to anaerobic conditions and the output signal is evaluated as a measure of yeast vitality (quality). This method showed good correlation even with low dead cell numbers where the acidification power test failed.

Results: The applicability of the intracellular NAD(P)H measurement during AA transition for yeast vitality monitoring was verified during experiments mimicking real storage conditions of pitching yeast in breweries with cells exposed to starvation and gradual loss of viability. During storage the deteriorating yeast viability (3-9% dead cells) was tracked by rel. FI determination and acidification power (AP) test. The comparison of rel. FI with AP tests came out clearly for the benefit of FI measurement as it is shown by the correlation coefficients. Simultaneously, the time and labour requirement of rel. FI determination is comparable with the AP tests while both are faster and less labour demanding than cell culture based methods.

P 131

Predicting lager yeast petite formation

Katherine A Smart¹, Stephen Lawrence¹, Sarah Nichols¹, Tithira Wimalasena¹

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DESCRIPTION OF TOPIC:

Brewery fermentations and handling of yeast populations between successive fermentations exposes brewing yeast cells to a number of biological, chemical and physical stresses. It is generally accepted that repitching of yeast in subsequent fermentations leads to an increase in incidence in petite mutations. Eventually this can lead to aberrant fermentation profiles and impaired product quality. Certain strains have an inherent resistance to petite formation. In this paper, the rationale for that resistance is discussed in the context of mtDNA copy number and sequence. This paper will also consider how petites form, when in the process they form and how their formation may be predicted using a rapid test.

Results: The frequency and propensity of yeast to form mitochondrial mutants during serial repitching was determined. Stresses that are encountered by yeast during fermentation and yeast handling have been examined to assess their impact on mtDNA copy number and genome integrity. We have developed a rapid test kit to predict that detects mitochondrial DNA instability before petite formation is evident.

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Dry yeast - myths and facts

Chris Powell¹, Chris Boulton², Tobias Fischborn¹

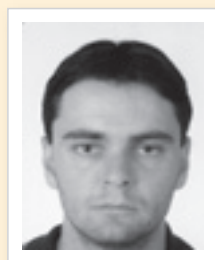
¹Lallemand Inc., Research and Development, Montreal, Canada, ²Nottingham University, Department of Brewing Science, Nottingham, United Kingdom

DESCRIPTION OF TOPIC:

There are many applications for active dry yeast (ADY) in brewing, depending largely on the scale, type and products of individual breweries. Uses include replacing propagated yeast, seeding propagators, fermenting small batches of beers and bottle conditioning. Despite the range of applications, as well as other characteristics such as long shelf life, until recently multi-national brewers have been reluctant to employ dry yeast. This is often due to the fact that there are many misconstrued beliefs surrounding the use of ADY in brewing. Such ideas include the manner in which ADY should be rehydrated and its use during fermentation. For example, a recently conducted survey indicated that many brewers believe that ADY cannot be serially repitched. Here we attempt to remove some of the myths behind the use of ADY and demonstrate that ADY can be used in a similar fashion to propagated slurries.

Results: The results indicate that a specific rehydration temperature and agitation protocol should be used to ensure fermentation performance. Analysis of chromosomes, inter- σ region variability and Ty element translocations show that ADY cultures are stable during serial repitching. Fermentation data indicated minor differences for the first fermentation using both wet and dry yeast. Subsequent generations produced a consistent product irrespective of the yeast source.

Tomáš Brányik



Holds a degree in Bioengineering and a PhD in Biotechnology from the Institute of Chemical Technology (ICT) in Prague. Appointments: 2000-2004 he held a position of post-doctoral fellow at the Department of Bioengineering, University of Minho (UM), Braga, Portugal. Presently he holds an associate professor position at the Department of Fermentation Chemistry and Bioengineering, ICT, Prague while also holding the position of a research fellow at the Department of Bioengineering, UM. His research interests are in the area of fermentation engineering and immobilized cell physiology with emphasis on continuous beer fermentation.

Katherine A Smart



Katherine Smart completed a BSc (Hons) Biological Sciences at Nottingham University in 1987. As the Rainbow Research Scholar she completed a PhD in Yeast and Fermentation at Bass Brewers. She held a Research Fellowship at Cambridge University before joining Oxford Brookes University in 1992, aged 25, as a Lecturer in Fermentation. In 2000, she was awarded the Scottish Courage Readership and became a Fellow of the IBD. In 2005 she returned to the University of Nottingham where she became the SABMiller Professor in Brewing Science. Her research has gained several awards including: IBD Cambridge Prize, Royal Society Industrial Fellowship and the Save British Science Award. She has authored many publications on yeast cell biology, stress responses and fermentation.

Chris Powell



Chris Powell obtained a BSc in Biology and Environmental Biology in 1996 and in 1997 Chris moved to Bass Brewers (now Coors) to work as part of the Research and Development team. Chris began his Ph.D. later in the same year at Oxford Brookes University, in conjunction with Bass, and received his doctorate in 2001 on the subject of yeast cellular ageing and fermentation performance. Subsequently, Chris became involved in a project funded by the European Commission, exploring mechanisms for the rapid detection of microbial contaminants within breweries. Chris joined Lallemand in 2004 and is currently in charge of genetic R&D for the identification and characterization of micro-organisms utilized within the food and beverage industry, in addition to research focused on brewing yeast.



EBC 2009 Congress Hamburg Congress Supporting Documentation

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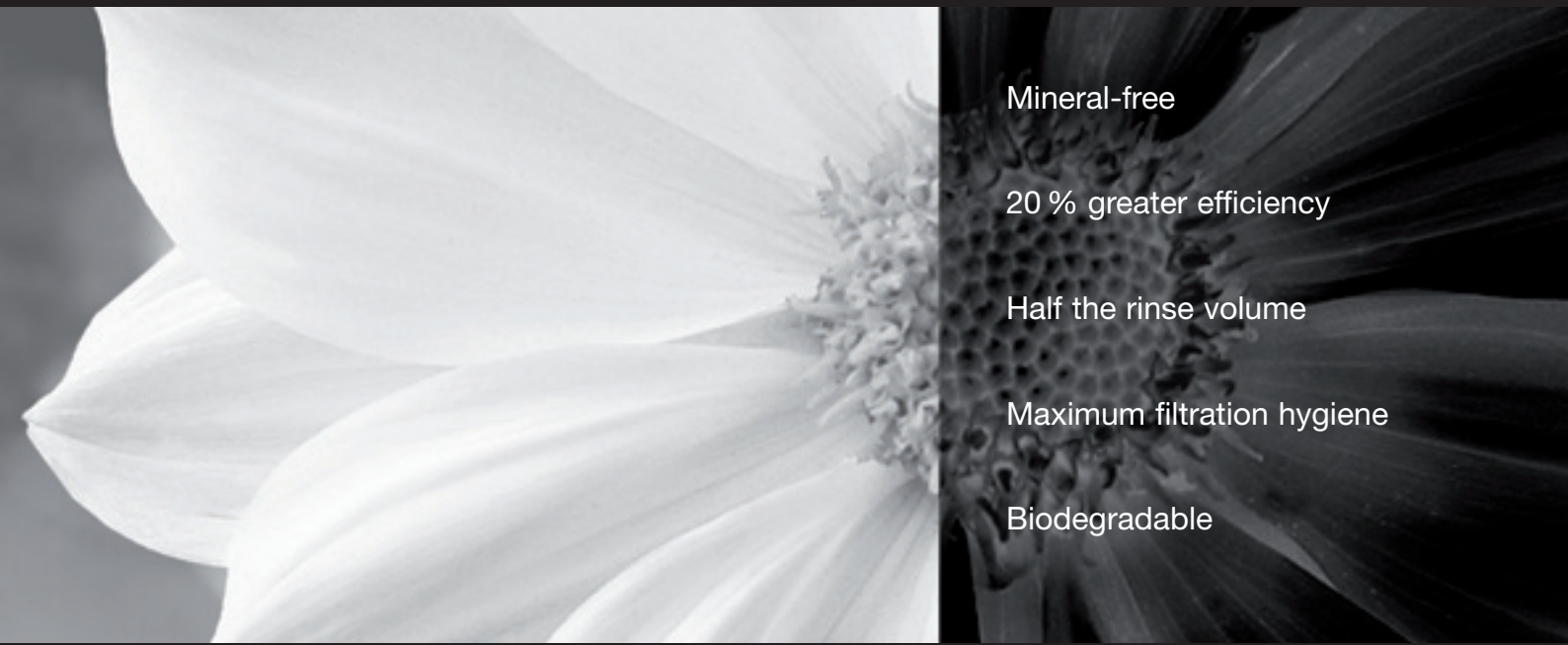
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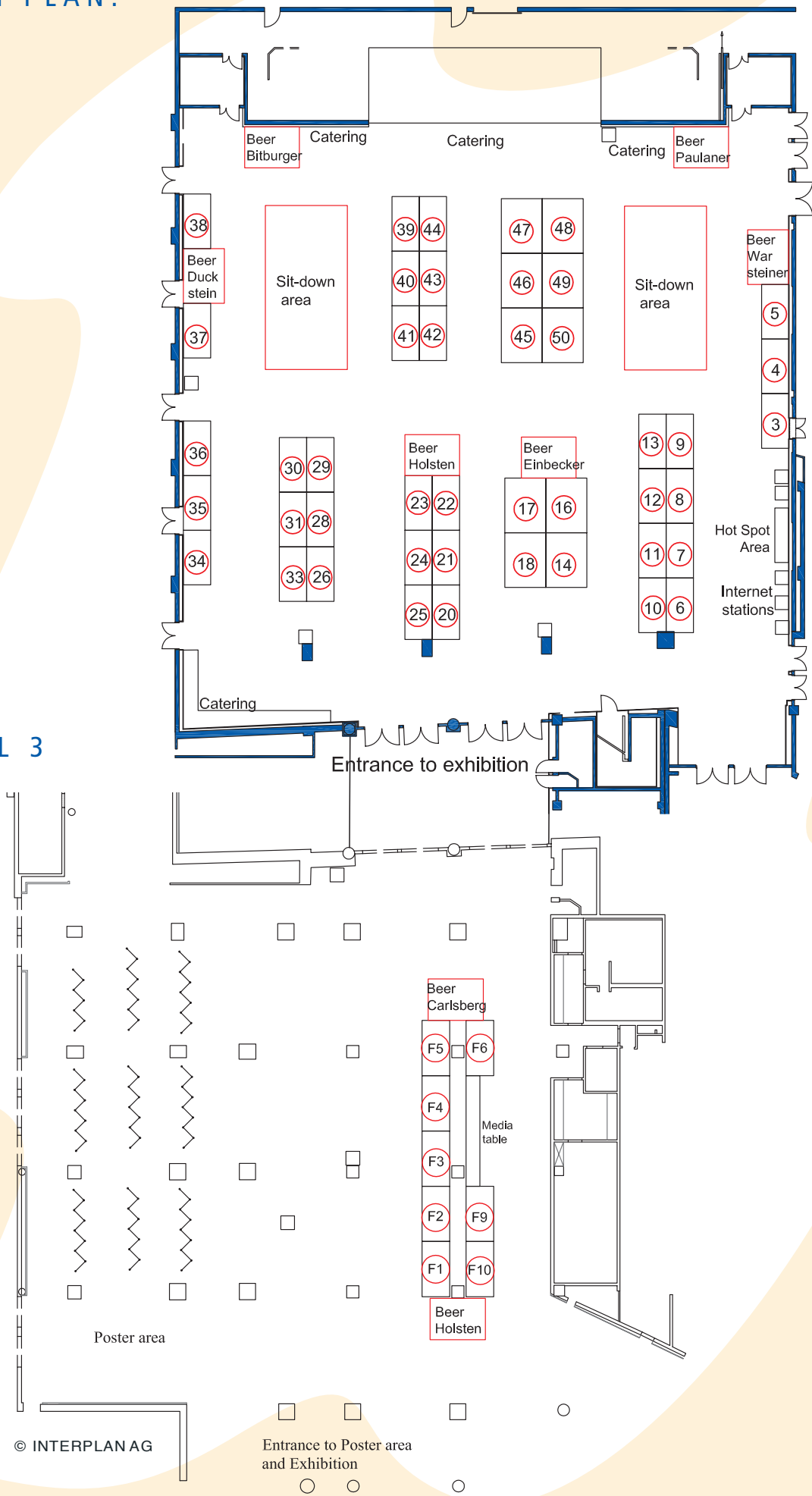


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KHS AG



KHS AG, Dortmund - an international manufacturer of filling and packaging systems for the beverage, food, and non-food industries – was established in 1993 from a merger of Holstein & Kappert AG, Dortmund, founded in 1868, and Seitz-Werke GmbH, which was founded in 1887 and later became SEN AG, Bad Kreuznach. The company is a wholly-owned subsidiary of Klöckner-Werke AG. KHS is a global leader and provider of machines, lines and systems and first choice in the packaging industry with a focus on beverage applications and turnkey solutions.

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KIESELMANN GMBH



KIESELMANN valve technology means high security and long life design. KIESELMANN butterfly valves are preferably applied for panels or tank shut-off. The leakage type is a cost-efficient valve for leakage secure processes. KIESELMANN double seat valves, with EHEDG certificate, reliably avoids mixture due to two independent valve disks with depressurised leakage discharge. The leakage space can be cleaned by lifting or lowering the valve disks. KIESELMANN safety valves reliably protect against overpressure, plug valves guarantee exact pressure ratios for a certain product quality. KIESELMANN engineering offers planning and production from individual units to complex process plants.

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KRONES



The Krones Group, headquartered in Neutraubling, Germany, plans, develops, and manufactures machines and complete lines for the fields of process technology, bottling, canning and packaging, plus intralogistics. The principal customer groupings are beverage and food producers, plus the chemical, pharmaceutical and cosmetic industries. Since being founded in 1951, Krones has evolved far beyond its original role as a mere producer of machinery and bottling lines. The company has meanwhile become an "all-round partner" for its customers, creating harmonious, optimised synergies of mechanical engineering, line-related expertise, process technology, microbiology and information technology. Today, Krones is synonymous with "systems engineering".

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93053 Neutraubling
Germany

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LANDALUCE, S.A.



Landaluce with almost 50 years on the market is one of the main suppliers to most of the international brewing companies in more than 50 countries. The scope of supply includes : Fermenting and BBT tanks, brewhouses both with lauter tuns and Mash Filters with high efficiency and low operational cost, premashers, modern wort boiling systems, process automation, new projects and upgrading of existing installations.

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P.O.B 43
39300 Torrelavega
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LGC STANDARDS



LGC Standards, a leading supplier of quality control products, reference materials and proficiency testing schemes, will be exhibiting the BAPS (Brewing Analytes Proficiency Scheme) and MAPS (Malt Analytes Proficiency Scheme) proficiency testing schemes with particular emphasis on Sensory Analysis in the BAPS scheme. With over 300 laboratories taking part in BAPS and more than 120 on MAPS, these are the leading schemes in the field of beer and malt analysis and an essential component of the laboratory manager's quality tool box.

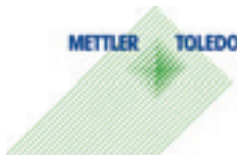
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METTLER TOLEDO PROCESS ANALYTICS



METTLER TOLEDO is a leading supplier of process analytical measuring loops. New products presented are: Optical Oxygen Sensor: based on fluorescence quenching technology dissolved oxygen is controlled in the whole process. Less plant downtime and maintenance are major user benefits. The system fully supports ISM® (Intelligent Sensor Management) technology which offers quick loop configuration and predictive maintenance tools. Turbidity/Colour System: the optical dual-angle instrument allows a prediction of whether beer haze is due to particles or colloidal substances. The unique optional colour measurement in the same sensor guarantees consistent beverage quality in blending processes.

Stefan Bardeck
Food & Beverage Market
Specialist

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MEURA



Specialist in engineering, design and manufacturing of brewing equipment, Meura was established in Tournai (Belgium) in 1845.

A pioneer by tradition, Meura has always promoted innovation. Meura's latest development is a continuous brewhouse called the "Meurabrew". The Meurabrew is an integrated combination of proven Meura technologies adapted to continuous brewing operation. Compared to the batch brewhouse, the Meurabrew combines a lot of exceptional performances advances regarding yield, beer quality, energy consumption, installation space and ecological aspect.

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NORIT NV



The Norit Group develops and applies state-of-the-art purification technologies to help society, through our clients, meet environmental, health, and safety challenges, and work towards a sustainable future. Norit supplies consumables, components, systems, and solutions, based on proprietary technology to a variety of industries including the water, beverage, food, chemical and pharmaceutical industries. Norit's offerings for sustainable brewing and beverage processing include Norit Haffmans Total CO₂ and O₂ Management solutions, Norit Südmo hygienic and aseptic valve technology, cold cellar systems, DE-free Beer Membrane Filtration, and water treatment technologies such as Norit's Membrane BioReactor.

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Manager R & D

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NOVOZYMES A/S



Novozymes is the world leader in bioinnovation. Together with customers across a broad array of industries we create tomorrow's industrial bio-solutions, improving our customers' business and the use of our planet's resources.

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OPTEK-DANULAT GMBH



optek is the world's leading manufacturer of inline photometric process instrumentation. With more than 10.000 installations in breweries only, i.e. Filter Control, Separator Control, Yeast Pitching, Interface Detection, Brewhouse Turbidity and Color Measurements our team provides the best in quality, consulting, support and long-term performance.

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PALL GMBH



Pall Food & Beverage is focusing on the Total Fluid Management Concept which covers the environmental aspect, cost savings and food compliance. The displayed products stand in closed relationship to these aspects:

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- Water treatment for incoming water and water reuse at point of use with Pall Aria stainless steel technology
- SUPRApak filter modules for the particle and fine filtration of beer downstream a DE filter, the new format for high performance combined with best economics
- Polyether sulphone filter cartridge for final filtration of beer with optimized filter area due to laid over pleat technology for high stability and longer life time
- W-Code program for products used in Food & Beverage industry fulfilling the latest European legislation with regards to food contact materials.

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PROLEIT INTERNATIONAL GMBH & CO. KG



ProLeiT AG develops and markets not only its own process control system Plant iT, but also automation and IT solutions for the process industry like breweries, chemicals, pharmaceuticals, food and beverage industry. The preparation of design and functional specifications, the development of user software, including commissioning, training, service and support belong to the delivery scope for turn-key automation solutions. The technical basis is the in-house developed technology-related Plant iT process control system that is also made available for qualified partners. ProLeiT gains its advantage out of the combination of technological knowhow and automation perfection.

brewmaxx,

As a special solution for the brewing industry, ProLeiT offers a technologically-oriented process control system optimized for the specific requirements of this industry sector. As an option energy data management and intelligent load management, production data acquisition for filling plants.

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PUREMALT PRODUCTS LIMITED



PureMalt Products Limited produces refined Roast Malt Beers of Crystal Malt and Roasted Malt, suitable for late addition to beer. The ZAB range offers solutions for Non and Low Alcoholic Beers, and Malt Beverages. Recent developments include a fine tasting Malta prepared only from Malt, and available for dilution from 65° brix.

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SAHM



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SKALAR ANALYTICAL B.V.

Skalar San⁺⁺ Beer and Malt analyzer

Over more than 30 years Skalar has been producing and developing automated applications for the Malt and Brewing industries, known as the Skalar San⁺⁺ Beer and Malt analyzer. The Skalar San⁺⁺ Beer and Malt Analyzer is a modular system that can be configured to meet your requirements. A total of 16 parameters can be analyzed simultaneously. A typical San⁺⁺ Beer analyzer can hold applications for Bitterness, Total SO₂, F.A.N., -Glucan, while the Malt Analyzer carries applications such as Diastatic Power, -Amylase, Free Amino Nitrogen, -Glucan and color. For more information, visit our booth 47 at the EBC congress or visit the Skalar website.

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STEINFURTH MESS SYSTEME GMBH



Steinfurth – specialist for quality control instruments

Steinfurth, specialist for customized quality control instruments will be presenting its automatic Foam Stability Tester and the SF-PastControl System (pasteurisation logger). The effective instruments are very easy to operate and can be placed to use in the laboratory or directly on the filling line. Steinfurth's range of products for the beverages industry comprises CO₂ measuring systems, devices for calibrating pressure and temperature, torque tester, logger for pressure, temperature and pasteurisation, packaging testing devices, measuring systems for beer quality, laboratory carbonisation systems and sampling devices.

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Michaela Käsling

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smartDRAFT™ – a Draught Beer innovation

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smartDRAFT™ consists of a unique 2 chamber Keg including low pressure CO₂ compartment, a Tap combining gas regulation, keg coupling and a dispense tap in one unit and a cooler with smart features.

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Luzia Hofmann

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THE BREWERS OF EUROPE EBC DIVISION



The Brewers of Europe are the voice of the European brewing sector. Its

priorities include the advocacy of moderate and responsible beer consumption as part of a balanced, healthy and social life style as well as to promote initiatives and campaigns to inform consumers of the benefits of moderate beer consumption and the risk of alcohol abuse. They support and initiate continued independent scientific research into the relationship between beer consumption, health and behaviour and into issues relating to quality and safety throughout the supply chain, promote independent self-regulation as an effective and credible alternative to the consumption control approach and, very importantly, assist national brewers in fighting excise distortions throughout the continent. Since 2008, EBC is an autonomous part of the Brewers of Europe, defining itself as their scientific and technical arm.

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THE UNIVERSITY OF NOTTINGHAM



The University of Nottingham offers a choice of Postgraduate Brewing Science qualifications and individual modules designed for professionals working in the Brewing and allied industries. These pioneering programmes are delivered through the latest innovations in e-learning, coupled with intensive residential taught courses. We are engaged in a range of research programmes in support of and in collaboration with the worldwide brewing industry. Areas of current research interest include brewing yeast genetics and metabolomics, brewing yeast physiology and handling, flocculation, fermentation technology & biofuels, malting science, crop science and beer flavour technology.

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Union Engineering produces plants for generating, extracting and recovering of CO₂. Our services cover production, installation, start-up and commissioning as well as service contracts, trouble shooting and consultancy about CO₂ technology. We have more than 75 years of global experience in producing CO₂ plants for breweries, distilleries, soft drink producers, bottlers and industrial gases companies – new plants as well as extensions of existing ones. We can also offer you turnkey installations. Our plants produce CO₂ at the highest quality levels needed, meeting all quality specifications and quantities, e.g. EIGA, WHO and others.

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VLB BERLIN



VLB Berlin is a German research institute and service provider with a focus on brewing and beverage technology. It was founded in 1883. Today around 100 people work in the fields of research, teaching, service and information for the brewing, malting, beverage and their supply industries. The VLB has its roots in the German brewing industry but also works internationally. Customers all around the world take advantage of our training courses and of our broad experience in the fields of analyses and consulting.

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THERMO FISCHER SCIENTIFIC GMBH



Thermo Fisher Scientific Inc. (NYSE: TMO) is the world leader in serving science, enabling our customers to make the world healthier, cleaner and safer. Thermo Scientific - Discrete Photometric Analysis. The Thermo Scientific Arena analyzers are sophisticated photometric systems for precise, easy product analysis and quality control. These fully automated instruments ensure continuous and reliable operation in any size laboratory.

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The Association of German Hop Growers is the central umbrella organization of the hop-producers in Germany and their regional organisations: Hallertau, Tettnang, Elbe-Saale, Spalt and Hersbruck.

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VTT TECHNICAL RESEARCH CENTRE OF FINLAND



VTT Technical Research Centre of Finland is an impartial multidisciplinary contract research organisation. With its staff of 2,700 experts and extensive scientific and technology networks VTT produces research, development, testing and information services to the public sector as well as domestic and international companies and organisations. VTT's technological focus areas are applied materials, bio and chemistry processes, energy, information and communication technologies, industrial systems management, microtechnologies and electronics, and technology in the community.

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WORLD BREWING ACADEMY



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ZIEMANN GROUP



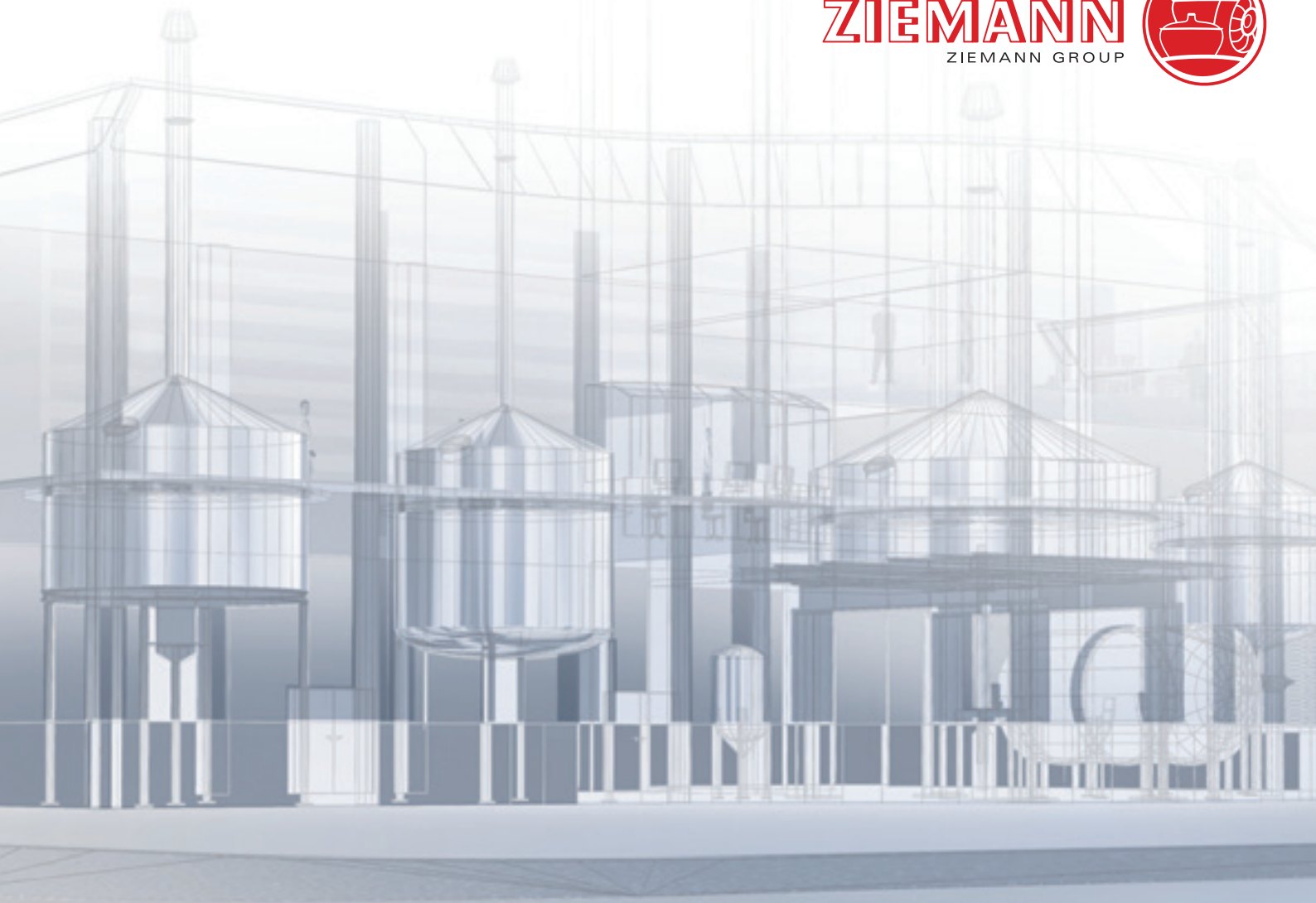
156 years of know-how and experience have made the ZIEMANN GROUP an innovative global market leader and pioneer in turnkey projects for the international brewing industry. With worldwide production facilities in 6 countries, ZIEMANN is the world's largest supplier of brewing equipment. ZIEMANN customers enjoy a decisive advantage:
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Joachim Gunkel
Managing Director

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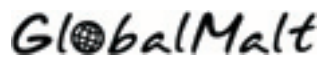
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Hosting Organization

Die deutschen Brauer
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