Program Book

Master Brewers Association of the Americas
123rd Anniversary Convention

June 18–20, 2010
Rhode Island Convention Center
Providence, RI, U.S.A.

Part of Brewing Summit 2010
A Revolution In Brewing

For 86 years, Gusmer has taken a revolutionary approach to serving the brewer’s vision. It’s why we have developed our extensive R&D and Application Support Labs, offer the most advanced products and provide a ready resource for problem-solving. To find out how our experience can be there for you every step of the way, contact Gusmer today.

Gusmer Enterprises, Inc.
www.gusmerbeer.com
sales@gusmerenterprises.com

West Coast:
81 M Street
Fresno, CA 93721
Tel: 559.485.2692
Fax: 559.485.4254

East Coast:
1165 Globe Avenue
Mountainside, NJ 07092
Tel: 908.301.1811
Fax: 908.301.1812

Midwest:
1401 Ware Street
Waupaca, WI 54981
Tel: 715.258.5525
Fax: 715.258.8488
Together we realize your visions
From brewing to bottling

Visit us!
Stand 404 & 406

Taking care of brewing  ZIEMANN – worldwide manufacturing  www.ziemann.com
Acknowledgments

MBAA Technical Committee

Committee Chair
Mary B. Pellettieri
MillerCoors

Committee Members
Daniel J. Carey
New Glarus Brewing Co.

Florian Kuplent
Anheuser-Busch InBev

Gary L. Dick
New Belgium Brewing Co.

Glynn Grisham
MeadWestvaco

Horace G. Cunningham
Terrapin Beer Co.

Jens Voigt
Technical Univ Munich Weihenstephan

John A. Mallett
Bell’s Brewery Inc.

John Ian Stanners

Matthew R. Brynildson
Firestone Walker Brewing Co.

Ramon L. Garcia Tatis
Food & Beverage Industry Consultant

Susan E. Welch
Malteurop North America Inc.

Timothy J. Kostelecky
John I Haas Inc.

Tomohiko Ichii
Kirin Brewery Co. Ltd.

Vincent M. Coonce
MillerCoors

Ex-officio
Raymond J. Klimovitz
Klimovitz Brewing Consultants

Table of Contents

Program Overview ................................................................. 5
Thursday Schedule ............................................................... 7
Friday Schedule ................................................................. 11
Saturday Schedule ............................................................. 9
Sunday Schedule ............................................................... 11
Abstracts—MBAA Convention Oral Presentations .................. 13
Abstracts—MBAA Convention Poster Presentations .............. 26
Author Index ................................................................... 35

Advertisers’ Index

Briggs of Burton ........................................................................ 3
Buhler Inc. ................................................................................ 4
Gusmer Enterprises, Inc. ........................................................... MBAA Cover II
Nalco .................................................................................... 6
Ziemann Group ...................................................................... 1

Governing Committees

Executive Committee
President James L. Diamantis; 1st Vice President Robert McCaig; 2nd Vice President Karl F. Ockert; Treasurer Michael B. Sutton; Past President George F. Reisch; Technical Director Raymond J. Klimovitz

Board of Governor Representatives
District Caribbean Allan C. Fields; District Cincinnati William R. Weisenburger; District Colombia Jorge Bonnells; District Eastern Canada Jacques Seguin; District Michigan John A. Mallett; District Mid-Atlantic Walter Heeb; District Mid-South Fred M. Scheer, Sr.; District Milwaukee Michael Scanzello; District Northern California Ruth Ellen Martin; District New England Herbert E. Lindtveit, Jr.; District New York Richard W. Ellis; District Northwest William L. Pengelly; District Ontario Travis L. Audet; District Philadelphia Thomas L. Kehoe, Jr.; District Rocky Mountain Gary L. Dick; District Southern California John A. Marrappa; District Southeast Jeffrey Tito; District St. Louis Wayne R. Brinkman; District St. Paul-Minneapolis Robert W. DuVernois; District Texas Joseph W. Caracausa; District Venezuela Carsten Zufall; District Western Canada Robert McCaig; District Western New York James L. Kuhr
Some say that 2020 vision is a very good thing. We would agree.

We continually strive for an understanding of the things that matter to our clients. The World is a rapidly changing place - different challenges are emerging every day, new thinking is required. Process Engineers like us, need to help clients be ready for the challenges not just of today, but ten years hence.

The International Brewing Convention returns to Manchester, UK between 18th and 20th October, 2010. A Platinum sponsor for this very prestigious event. A number of incredibly strong speakers have already committed their support, including some of the most powerful voices in our industry.

Visitors will be able to attend for all three days of the conference, or select one or two days from the programme to fit busy schedules. The conference theme is 'Ahead of the Curve' - shorthand for an exploration of our industry’s vision for the year 2020.

What’s more, we have chosen to sponsor the sample room - so come and share a beer and a few thoughts with us.

www.ibcmanchester.org
A pint of beer is an inspiration. Good beer begins with the processing of malt. Our specialists are always looking for ways to make the processing of malted and unmalted grain even more efficient. Our system solutions and processing technology are being used in almost every large brewery in the world. Buhler will support you at every stage of the process of grist production – from intake, to cleaning and conditioning, all the way to grinding. Benefit from our expertise.

Visit us: Booth 507

Buhler Inc., 13105 12th Ave N., Plymouth, MN 55441, T 763-847-9900
buhler.minneapolis@buhlergroup.com, www.buhlergroup.com
# MBAA Program Overview

Sessions and events all take place at the Rhode Island Convention Center unless otherwise indicated.

<table>
<thead>
<tr>
<th>Thursday, June 17</th>
<th>8:00 a.m. – 1:30 p.m.</th>
<th>MBAA Executive Committee Meeting • 550 B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2:00 – 5:00 p.m.</td>
<td>MBAA Board of Governors Meeting • 557</td>
</tr>
<tr>
<td></td>
<td>5:00 – 6:00 p.m.</td>
<td>MBAA District Officers’ Forum • 557</td>
</tr>
<tr>
<td></td>
<td>6:00 – 6:30 p.m.</td>
<td>MBAA Technical Committee • 550 B</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Friday, June 18: Shared Day of Programming with ASBC</th>
<th>8:30 – 9:30 a.m.</th>
<th>ASBC Technical Subcommittee Meeting – New and Alternate Methods of Analysis • 550 A</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>8:30 – 10:00 a.m.</td>
<td>Exhibits • Ballroom/Exhibit Area</td>
</tr>
<tr>
<td></td>
<td>8:30 – 10:00 a.m.</td>
<td>ASBC and MBAA Poster Viewing • West &amp; East Pre-functions</td>
</tr>
<tr>
<td></td>
<td>10:15 – 11:30 a.m.</td>
<td>ASBC–MBAA Workshop: In-line/On-line Measurement • 555/556</td>
</tr>
<tr>
<td></td>
<td>11:30 a.m. – 12:30 p.m.</td>
<td>ASBC Technical Subcommittees • See program for details</td>
</tr>
<tr>
<td></td>
<td>11:30 a.m. – 2:00 p.m.</td>
<td>Exhibits and Lunch • Ballroom/Exhibit Area</td>
</tr>
<tr>
<td></td>
<td>11:30 a.m. – 2:00 p.m.</td>
<td>ASBC and MBAA Posters (authors present 1:00 – 2:00 p.m.) • East &amp; West Pre-functions</td>
</tr>
<tr>
<td></td>
<td>2:15 – 3:30 p.m.</td>
<td>ASBC–MBAA Workshop: Critical Quality Review: Culture, Communications, and Customers • 555/5556</td>
</tr>
<tr>
<td></td>
<td>3:45 – 5:00 p.m.</td>
<td>MBAA Workshop: Practical Malt Quality • 551 A/B</td>
</tr>
<tr>
<td></td>
<td>7:00 – 10:00 p.m.</td>
<td>Brewing Summit Social • Offsite: Squantum Association</td>
</tr>
<tr>
<td></td>
<td>10:00 p.m.</td>
<td>After Glow Party • Rotunda</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Saturday, June 19</th>
<th>8:00 – 9:45 a.m.</th>
<th>Technical Session: Sustainability • 552 A/B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10:00 – 11:40 a.m.</td>
<td>Technical Session: Brewhouse/Sensory • 555/556</td>
</tr>
<tr>
<td></td>
<td>11:30 a.m. – 2:00 p.m.</td>
<td>Exhibits and Lunch • Ballroom/Exhibit Area</td>
</tr>
<tr>
<td></td>
<td>11:30 a.m. – 2:00 p.m.</td>
<td>MBAA Posters (authors present 1:00 – 2:00 p.m.) • East Pre-function</td>
</tr>
<tr>
<td></td>
<td>2:15 – 3:30 p.m.</td>
<td>Technical Session: Malt • 555/556</td>
</tr>
<tr>
<td></td>
<td>3:45 – 5:00 p.m.</td>
<td>Technical Session: Finishing • 555/555</td>
</tr>
<tr>
<td></td>
<td>7:00 p.m. – 9:30 p.m.</td>
<td>President’s Closing Celebration • Rotunda</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sunday, June 20</th>
<th>7:30 – 8:45 a.m.</th>
<th>General Session and Award of Merit • 555/555</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>9:00 – 10:45 a.m.</td>
<td>Workshop: Money Down the Drain: Water Conservation Strategies • 552 A/B</td>
</tr>
<tr>
<td></td>
<td>11:00 a.m. – 12:45 p.m.</td>
<td>Technical Session: Engineering/WCM • 552 A/B</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Workshop: Brewhouse Optimization • 555/555</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Workshop: Running Powerslam: Wrestling Your Maintenance Program into Shape • 551 A/B</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Workshop: Hops • 551 A/B</td>
</tr>
</tbody>
</table>
Simple Yeast ACTIVITY Measurements at Your Fingertips

You need to know more than the number of yeast cells, now you can with the Nalco Yeast Activity Monitor

It’s a revolutionary new way to optimize your brewing process. Using a small sample, the Yeast Activity Monitor will accurately measure yeast metabolic activity in just 3 minutes.

- Say goodbye to slow, labor-intensive, error-prone cell counting.
- Automated workflows ensure precise and consistent measurements... regardless of the operator.
- Manages the data and communicates results in real-time over your corporate network.
- Perfect for monitoring yeast propagation, cropped yeast quality, fermentation pitching rates and visualizing batch kinetics.

It’s easy. It’s fast. And there is no guesswork involved.

Visit us in booth 610
Call Tom Lindley at (630) 305-2507

www.nalco.com/YAM

© 2010 Nalco Company
Nalco, the logo and the tagline are trademarks of Nalco Company
**MBAA Program**

### Thursday, June 17

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:30 a.m. – 6:00 p.m.</td>
<td>Registration</td>
<td>5th Level Lobby</td>
</tr>
<tr>
<td>8:00 a.m. – 1:30 p.m.</td>
<td>Executive Committee Meeting</td>
<td>550 B</td>
</tr>
<tr>
<td>2:00 – 5:00 p.m.</td>
<td>Board of Governors Meeting</td>
<td>557</td>
</tr>
<tr>
<td>2:00 – 5:00 p.m.</td>
<td>Poster Set Up</td>
<td>East Pre-function</td>
</tr>
<tr>
<td>4:00 – 11:00 p.m.</td>
<td>Bierstube/Hospitality</td>
<td>Westin: Waterplace Ballroom</td>
</tr>
<tr>
<td>5:00 – 6:00 p.m.</td>
<td>District Officers’ Forum</td>
<td>550 B</td>
</tr>
<tr>
<td>5:00 – 6:00 p.m.</td>
<td>Technical Committee Meeting</td>
<td>550 B</td>
</tr>
<tr>
<td>6:00 – 6:30 p.m.</td>
<td>Convention Orientation</td>
<td>554 A/B</td>
</tr>
</tbody>
</table>

**District Officers’ Forum**

*5:00 – 6:00 p.m. • 557*

All District officers are invited to attend this forum. Learn about the priorities of MBAA, discuss challenges facing your District, and brainstorm with other District officers on what works and what doesn’t. You will also receive a handout with information about how headquarters can assist you.

**Convention Orientation**

*6:00 – 6:30 p.m. • 554 A/B*

Discover how to take advantage of the wealth of activities offered at the MBAA Convention. This is a great opportunity to meet members who can answer your questions and help you make the most of your convention experience.

### Friday, June 18

**Shared Day of Programming with ASBC**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:00 – 8:00 a.m.</td>
<td>MBAA Presenter Breakfast (orals 1–9, posters 38–60, Friday Workshops)</td>
<td>Rotunda</td>
</tr>
<tr>
<td>8:00 – 8:30 a.m.</td>
<td>MBAA Poster Set Up</td>
<td>East Pre-function</td>
</tr>
<tr>
<td>8:00 – 9:00 a.m.</td>
<td>MBAA Global Emerging Issues Committee Meeting</td>
<td>553 A</td>
</tr>
<tr>
<td>8:00 a.m. – 4:00 p.m.</td>
<td>Registration</td>
<td>5th Level Lobby</td>
</tr>
<tr>
<td>8:30 – 9:30 a.m.</td>
<td>ASBC Technical Subcommittee Meeting – New and Alternate Methods of Analysis</td>
<td></td>
</tr>
<tr>
<td>8:30 – 10:00 a.m.</td>
<td>Exhibits</td>
<td>Ballroom/Exhibit Area</td>
</tr>
<tr>
<td>8:30 – 10:00 a.m.</td>
<td>MBAA and ASBC Poster Viewing</td>
<td>East and West Pre-functions</td>
</tr>
<tr>
<td>10:15 – 11:30 a.m.</td>
<td>MBAA Technical Session: Nutrition &amp; Enzymes</td>
<td>552 A/B</td>
</tr>
</tbody>
</table>

**Moderator: Jens Voigt, Technical Univ Munich Weihenstephan**

10:15 a.m. O-1 Innovative concepts for the production of non-alcoholic malt-based beverages. MORITZ KRAHL, Thomas Becker

10:40 a.m. O-2 Mindfulness: What happened? CHARLES BAMFORTH

11:05 a.m. O-3 A comparison of beer quality attributes between 100% barley malt and barley adjunct beer, with a focus on changes in the protein composition. ELISABETH STEINER, Andrea Auer, Martina Gastl, Stefan Kreisz

10:15 – 11:30 a.m. ASBC Technical Session: Packaging

**Moderator: Kathy Kinton, MillerCoors**

Abstracts found in the ASBC section.

10:15 a.m. O-37 Microbiological QA—Classification perplexity with modern packaging. ROLAND FOLZ

10:40 a.m. O-38 Technologies, tools, and challenges for packaging beer in PET. LORINDA (LORI) Y. YODER

11:05 a.m. O-39 Beverage and package quality—Two inseparable key parameters in the modern quality control of bottled beverages. JOHANN ANGRES

10:15 – 11:30 a.m. ASBC–MBAA Workshop: In-line/On-line Measurement 555/556

11:30 a.m. – 12:30 p.m. ASBC Technical Subcommittees

• MOA Wort Review

• Craft Brewers

11:30 a.m. – 2:00 p.m. Exhibits and Lunch

11:30 a.m. – 2:00 p.m. MBAA and ASBC Poster Viewing (authors present 1:00 – 2:00 p.m.)
2:15 – 3:30 p.m. MBAA Technical Session: Yeast

Moderator: Roland Folz, VLB Berlin

2:15 p.m. O-4 Profiling a lager fermentation completed using active dried yeast. CHRIS POWELL, David Jenkins, Tobias Fishbourn, Katherine Smart

2:40 p.m. O-5 Yeast activity monitoring. MICHAEL BRADLEY

3:05 p.m. O-6 Possible roles of the mitochondria in sulfur dioxide production by lager yeast. ERIC SAMP, Patricia Pratt

2:15 – 3:30 p.m. ASBC Technical Session: Innovation

Moderator: Fred Strachan, Sierra Nevada Brewing Co.

Abstracts found in the ASBC section.

2:15 p.m. O-40 A novel approach to brew alcohol-free beer. ZHUMAO JIANG, Zongcui Yue, Guangtian Zhou, Mengmeng Huang

2:40 p.m. O-41 Ingredients and energy from brewer’s spent grain. ANNKA WILHELMSON, Piritta Niemi, Juhani Sibakov, Pekka Lehtinen, Laura Flander, Raja-Lisa Heimiö, Kaarina Viljanen, Veli-Pekka Heiskanen, Niklas Von Weymarn, Johanna Buchert

3:05 p.m. O-42 Recycling and refining of alcohol from waste beer. ZHUMAO JIANG, Mengmeng Huang, Xiaolei Dong, Guangtian Zhou

2:15 – 3:30 p.m. MBAA-ASBC Workshop: Critical Quality Review: Culture, Communications, and Customers

3:45 – 5:00 p.m. MBAA Technical Session: Stability

Moderator: Daniel Carey, New Glarus Brewing Co.

3:45 p.m. O-7 A fresh look at beer flavor stability. ALASTAIR PRINGLE

4:10 p.m. O-8 The influence of unmalted barley on the oxidative stability of wort and the final beer. THOMAS KUNZ, David Mato Gonzalez, Frank-Jürgen Methner

4:35 p.m. O-9 The role of polyphenols in beer haze and astringency. KARL SIEBERT

3:45 – 5:00 p.m. MBAA Workshop: Practical Malt Quality

3:45 – 5:00 p.m. ASBC Closing Session: What’s the Buzz? Bierstube/Hospitality

4:00 – 7:00 p.m. Bierstube/Hospitality

7:00 – 10:00 p.m. Bierstube/Hospitality

10:00 p.m. After Glow Party

10:00 – 11:30 p.m. Bierstube/Hospitality

ASBC Technical Subcommittee Meetings

See the program for details

Each meeting is specific to an ASBC Technical Subcommittee run from 2009 to 2010 and will provide an overview of the results and recommendations. The meetings are open to all meeting attendees, and your feedback and participation in these meetings are essential to ensuring the quality of the methods being tested or reviewed.

ASBC–MBAA Workshop: In-line/On-line Measurement

10:15 – 11:30 a.m. • 555/556

Presenters include Al Worley, optek-Danulat, Inc., and Jeff DeVoy, Heuft U.S.A.

Moderators: Jeff Cornell, MillerCoors; Horace Cunningham, Terrapin Beer Co.

This workshop consists of three speakers covering in-line measurement technologies across a wide range of brewing and packaging applications. The focus will be placed on the theory and principles of the various technologies as well as the advantages and potential pitfalls in real-world applications. Attendees should come away with a good sense of the measurement science and how these various technologies are best applied to process measurements enabling improved quality and/or throughput. Specific topics include applied photometry for brewing applications, in-line package inspection, and applied technologies for dissolved oxygen measurement. The workshop will conclude with questions from the audience and an interactive discussion.

ASBC–MBAA Workshop: Critical Quality Review: Culture, Communications, and Customers

2:15 – 3:30 p.m. • 555/556

Presenters: Stu Oliver, MillerCoors; Dan Carey, New Glarus Brewing Co.; Jason Perkins, Allagash Brewing Co.; Paul Pettinger, New Belgium Brewing Co.

Moderators: Rebecca Newman, Consultant; Mary Pellettieri, MillerCoors

This workshop targets growing breweries that are seeking to understand and grow the maturity of their quality efforts. Representatives from micro-breweries to macro-breweries will be present to speak about the quality journey. The objective is to provide context and direction around creating culture of quality that fosters internal and external customer relationships.
MBAA Workshop: Practical Malt Quality
3:45 – 5:00 p.m. • 551 A/B

Presenters: Nigel Davies, Muntons PLC; Bob Hansen, Briess Malt
Moderator: Susan Welch, Malteurop North America Inc.

This workshop will include a panel of international brewers and maltsters who will present overviews and lead discussions on topics related to malt color and beer, such as: a comparison of how brewers and maltsters view color as a quality parameter, how malt formula is determined from beer color and how beer color is predicted by malt formula, variability in base malt color, variability in the analysis of base malt color, and a brewer’s perspective on color specifications and beer.

ASBC Closing Session: What’s the Buzz?
3:45 – 5:00 p.m. • 555/556

The Closing Session is an excellent capstone to the ASBC Annual Meeting. This interactive session will provide you with a recap of the entire ASBC Annual Meeting. The floor will then be opened for you to voice your thoughts about ASBC and discuss your experiences from the past three days. This session was new in 2009 and the feedback was outstanding. Make plans to join us for a great end-of-the-meeting synopsis.

Saturday, June 19

7:00 – 8:00 a.m. MBAA Presenter Breakfast (orals 10–29, posters 61–75, Saturday Workshops) Rotunda
7:45 a.m. – 4:00 p.m. Registration 5th Level Lobby
8:00 – 9:15 a.m. Technical Session: Fermentation 555/556

Moderator: Kathy Kinton, MillerCoors
8:00 a.m. O-10 Impact of fermentation on yeast quality and assessment of fitness to ferment. KATHERINE SMART
8:25 a.m. O-11 Influence of accelerated fermentation on yeast physiology and beer quality. KOJI ONODA, Thomas Kunz, Frank-Jürgen Methner
8:50 a.m. O-12 The nature and fermentability of last runnings. GRAHAM STEWART, John Andrews, Michaela Miedl, Richard Taylor

8:00 – 9:45 a.m. Technical Session: Sustainability 552 A/B

Moderator: Ruth Martin, Sierra Nevada Brewing Co.
8:00 a.m. O-13 Establishment of energy conservation management system at Asahi Beer. TOSHIHIKO NAGAOKA, Taro Kondo, Yuichi Kiwaki
8:25 a.m. O-14 Product improvement, cost reduction, and more sustainability with total O2 management. ARJEN VAN ZEIJST
8:50 a.m. O-15 Sustainability metrics and better practices in the BevBrew sector: Carbon, water, and energy footprints associated with water, waste, and co-product management. RAJ RAJAN
9:15 a.m. O-15a Integration of solar process heat. JOHANNES PREISS

8:00 – 9:45 a.m. Workshop: Evaluating Quality of Hop Pellets 551 A/B
10:00 – 11:40 a.m. Technical Session: Brewhouse/Sensory 555/556

Moderator: John Mallet, Bell’s Brewery Inc.
10:00 a.m. O-17 The origin of pilsner brewing technology. JENS VOIGT, Andreas Richter
10:25 a.m. O-18 New investigations on the process technology of mashing and lautering. JOHANNES TIPPMANN, Jens Voigt, Karl Sommer, Simon Henke
10:50 a.m. O-19 The influence of different malting and mashing methods on beer characteristics. TAICHI MARUHASHI, Martina Gastl, Thomas Becker, Ludwig Narziss
11:15 a.m. O-20 Impact of different hop compounds on the overfoaming volume of beer caused by primary gushing. MICHAEL MÜLLER, Thomas Becker, Martina Gastl

Brewing Summit Social
7:00 – 10:00 p.m. • Offsite: Squantum Association

Join your colleagues as ASBC brings their Annual Meeting to a close and MBAA kicks off its Convention. The social will take place at Squantum Association where we will mix and mingle in the historic Main Club House as well as the Bakehouse that is built out over the rocky coastline. Attendees will also enjoy the beautiful manicured gardens and dramatic views of the Providence River and Narragansett Bay. A wide selection of appetizers, dinner fare, desserts, and drinks along with the ambiance of the waterfront and the historic surroundings will make the evening complete. Shuttle service will be available from the Westin to the Squantum Association. Shuttles to the social will run from the Westin Providence from 6:00 – 7:00 p.m. and return service will be available from 9:00 – 10:30 p.m.

After Glow Party
10:00 p.m. • Rotunda

After the Brewing Summit Social, join us for a relaxing night of Irish coffee, cocktails, and networking. The After Glow Party is sponsored by Malteurop North America, Inc.
<table>
<thead>
<tr>
<th>Time</th>
<th>Session/Workshop</th>
<th>Location</th>
</tr>
</thead>
</table>
| 10:00 – 11:15 a.m. | Technical Session: Packaging and Cleaning<br>
**Moderator: Jim Diamantis, Wayne Chemical, Inc.**<br>10:00 a.m. O-21 Practical sustainable initiatives during cleaning and packaging operations. GEORGE AGIUS, Doug Funnell<br>10:25 a.m. O-22 Use and misuse of adenosine triphosphate (ATP) in the brewing industry. CHAD THOMPSON<br>10:50 a.m. O-23 Water conservation/reuse in the modern brewery: Advantages and pitfalls to avoid. JACK BLAND, Tom Soukup, Jaclynn Peterson | 552 A/B          |
| 11:30 a.m. – 2:00 p.m. | Exhibits and Lunch<br>11:30 a.m. – 2:00 p.m. MBAA Poster Viewing (authors present 1:00 – 2:00 p.m.)<br>2:00 – 4:00 p.m. MBAA Poster Take Down<br>2:00 – 5:00 p.m. Exhibit Take Down<br>2:15 – 3:30 p.m. Technical Session: Malt<br>
**Moderator: Robert Hansen, Briess Malting Co.**<br>2:15 p.m. O-24 Impact of different malting parameters on the protein composition of malt, wort, and finished beer. ELISABETH STEINER, Elke Arendt, Thomas Becker, Martina Gastl<br>2:40 p.m. O-25 New application areas for micromalting systems. MARTINA GASTL, Florian Schüll, Thomas Becker<br>3:05 p.m. O-16 Cutting the carbon footprint of malting by 75%—Achievable or just hot air? NIGEL DA VIES | 555/556          |
| 2:15 – 3:30 p.m. | Workshop: Practical Aging in Wood<br>2:15 – 3:30 p.m. Workshop: Technical Packaging: How It’s Made<br>3:00 – 7:00 p.m. Bierstube<br>3:45 – 5:00 p.m. Technical Session: Finishing<br>
**Moderator: Horace Cunningham, Terrapin Beer Co.**<br>3:45 p.m. O-27 Increasing brewery production yield and minimizing waste to reduce operating costs using advanced separation techniques. DIRK WEBER, Jonathan Pratt<br>4:10 p.m. O-28 Crosspure: Regenerable DE-free filtration for existing beer filters. ANDREW FRATIANNI<br>4:35 p.m. O-29 Ultraviolet control—Disinfection of air, surface, and water through quantifiable controls. TROY SMITH | 552 A/B<br>551 A/B<br>555/556          |
| 3:45 – 5:00 p.m. | Workshop: Old and New World Wheat Beer Styles: Raw Materials, Technology, and Flavor Profiles | 551 A/B          |
| 7:00 – 9:30 p.m. | President’s Closing Celebration | Rotunda          |
| 9:30 – 11:30 p.m. | Bierstube | Westin: Waterplace Ballroom          |

**Workshop: Evaluating Quality of Hop Pellets**<br>8:00 – 9:45 a.m. • 551 A/B<br>Presenters include Val Peacock, Hop Solutions, Inc.<br>Moderator: Tim Kostelecky, John I Haas, Inc.<br>Hop pellets are a major form of hops used by brewers worldwide. In this workshop you will learn how hop pellets are made and what quality parameters are important to the brewer. Topics include bale moisture, cleaning of hops, milling of cones to powder, blending the powder, and formation of the pellets in the die, as well as alpha acids yield, process and product temperature control, pellet blending, and packaging issues.

**Workshop: Practical Aging in Wood**<br>2:15 – 3:30 p.m. • 552 A/B<br>Presenters: Vinnie Cirluzo, Russian River Brewing; Lauren Salazar, New Belgium Brewing Co.; Jason Perkins, Allagash Brewing Co.<br>Moderator: Matt Brynildson, Firestone Walker Brewing Co.<br>A panel of expert brewers who utilize wood barrels to create high-end beers will share their experience with the audience. Panel members will discuss barrels that they utilize, care and maintenance of barrels, the kinds of beers that are suited for barrel aging programs, and much more information on why barrel aging continues to grow in popularity in brewing today.
Workshop: Technical Packaging: How It’s Made
2:15 – 3:30 p.m. • 551 A/B
Presenters: Tony Grandinetti, Ball Corp.; David Piccioli, Graham Packaging, Co.; Jeff Slaught, O-I; Doug Wynalda, Wynalda Litho
Moderator: Gary Dick, New Belgium Brewing Co.
A panel of packaging suppliers will share with the audience how their materials are made. Audience is welcome to ask questions throughout the presentations.

Workshop: Old and New World Wheat Beer Styles: Raw Materials, Technology, and Flavor Profiles
3:45 – 5:00 p.m. • 551 A/B
Presenters: Joe Casey, Craft Brewers Alliance; Roland Folz, VLB Berlin; Phil Leinhart, Brewery Ommegang; Cem Schwarz, TU Muenchen – Weihenstephan; Jens Voigt, TU Muenchen – Weihenstephan; Martin Zarnkow, TU Muenchen – Weihenstephan
Moderator: Florian Kaplent, Anheuser-Busch InBev
Wheat beers are one of the fastest growing segments in the U.S. beer market. Despite their common ingredient, wheat beers are quite diverse in how they are brewed and their sensory qualities. This workshop features presentations on the production technology and flavor profiles of the four major wheat beer styles: Bavarian Hefeweissbier, Berliner Weisse, Belgian Wit, and American Wheat.

President’s Closing Celebration
7:00 – 9:30 p.m. • Rotunda
The Closing Celebration is your place to mingle with friends and wind down at the MBAA Convention. Food stations will feature an assortment of appetizers, main courses, desserts, and, of course, cold beer.

Sunday, June 20

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>6:30 – 7:15 a.m.</td>
<td>MBAA Presenter Breakfast (orals 30 – 37, Sunday Workshops)</td>
<td>550 A/B</td>
</tr>
<tr>
<td>7:15 – 11:30 a.m.</td>
<td>Registration</td>
<td>5th Level Lobby</td>
</tr>
<tr>
<td>7:30 – 8:45 a.m.</td>
<td>General Session and Award of Merit</td>
<td>555/556</td>
</tr>
<tr>
<td>9:00 – 10:45 a.m.</td>
<td>Workshop: Brewhouse Optimization</td>
<td>555/556</td>
</tr>
<tr>
<td>9:00 – 10:45 a.m.</td>
<td>Workshop: Money Down the Drain: Water Conservation Strategies</td>
<td>552 A/B</td>
</tr>
<tr>
<td>9:00 – 10:45 a.m.</td>
<td>Workshop: Running Powerslam: Wrestling Your Maintenance</td>
<td>551 A/B</td>
</tr>
<tr>
<td>11:00 a.m. – 12:45 p.m.</td>
<td>Technical Session: Engineering/WCM</td>
<td>552 A/B</td>
</tr>
<tr>
<td>Moderator: Vince Cooce, MillerCoors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10:00 a.m.</td>
<td>O-30 Flexibility beats restrictions—Brewing control at its best. MARTIN LUTZ</td>
<td></td>
</tr>
<tr>
<td>10:25 a.m.</td>
<td>O-31 Inline measurement for process validation—New comprehensive process control tools for milling, mashing, lautering, and boiling. JENS VOIGT, Hans-Joerg Menger, Heinz Dauth, Johannes Tippmann</td>
<td></td>
</tr>
<tr>
<td>10:50 a.m.</td>
<td>O-32 Line right up! An examination of process quality issues related to pipe stress and poor connections. DARREN MOSER</td>
<td></td>
</tr>
<tr>
<td>11:15 a.m.</td>
<td>O-33 Using six sigma to optimize brewhouse performance. GRADY HULL</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>11:00 a.m. – 12:45 p.m.</td>
<td>Technical Session: Hops</td>
<td>551 A/B</td>
</tr>
<tr>
<td>Moderator: Matthew Brynilson, Firestone Walker Brewing Co.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10:00 a.m.</td>
<td>O-34 Influence of hopping on beer quality. ADRIAN FORSTER</td>
<td></td>
</tr>
<tr>
<td>10:25 a.m.</td>
<td>O-35 Influence of various degradation products of isohumulones on resulting beer quality. SEBASTIAN KAPPLER, Udo Kattein, Thomas Becker, Martin Krottenthaler</td>
<td></td>
</tr>
<tr>
<td>10:50 a.m.</td>
<td>O-36 Possibilities to influence the hoppy flavor of beer. STEFAN HANKE, Thomas Becker, Werner Buck, Martin Krottenthaler</td>
<td></td>
</tr>
<tr>
<td>11:15 a.m.</td>
<td>O-37 The usefulness of linalool models in predicting hop aroma. VAL PEACOCK</td>
<td></td>
</tr>
</tbody>
</table>
General Session and Awards
7:30 – 8:45 a.m. • 555/556
This is an interactive session not to be missed. Attendees will be encouraged to provide feedback about the convention and the Brewing Summit as a whole. Then, stay put as the Inge Russell Best Paper Award is presented and Award of Merit recipient Graham Stewart addresses the assembly.

Workshop: Brewhouse Optimization
9:00 – 10:45 a.m. • 555/556
Presenters: Fred Havel, Molson Coors Brewing Co.; Jeroen Vandenbussche, Meura; and Peter Gattermeyer, Krones AG
Moderator: Dan Carey, New Glarus Brewing Co.
The key to success in brewing is not only to make a great beer but also to make it efficiently so brewers can gain a competitive edge by optimizing their process. This panel of experts will offer insights into what it takes to operate a modern brewhouse.

Workshop: Money Down the Drain: Water Conservation Strategies
9:00 – 10:45 a.m. • 552 A/B
Presenters: Eckehard Adrian, Krones; Jeff Edgerton, BridgePort Brewing Co.; Michael Eumann, EUWA H. H. Eumann GmbH; Udo Funk, GEA Brewery Systems
Moderator: Karl Ockert, Bridgeport Brewing Co.
Breweries typically use anywhere from two to ten times the amount of water per unit of beer they produce. As fresh water becomes more highly valued and the costs of disposing dirty water increases, brewers need to focus on methods of optimizing water use in order to get the most out of every gallon coming into their plant. Water down the sewer is literally money down the drain. This workshop will feature practical brewery case studies, cost implications, and a discussion of water conservation strategies. Suggested conservation projects, along with actual data points, will be presented for all facets of brewery operations from brewhouse through packaging. Audience members will be encouraged to share their own experiences and findings.

Workshop: Running Powerslam: Wrestling Your Maintenance Program into Shape
9:00 – 10:45 a.m. • 551 A/B
Moderators: Vince Coonce, MillerCoors; John Mallett, Bell’s Brewery, Inc.
Are you feeling like brewery maintenance has you in a Reverse Cobra Clutch? Are you ready to turn the tables and unleash a Double Corkscrew Leg Drop? Then join our discussion focusing on opportunities and pitfalls in developing effective maintenance programs in new facilities, installing new maintenance programs in old facilities, dealing with equipment breakdowns, and operating an effective maintenance process. Although the panelists have significant brewery operational experience spanning 500 to 8,000,000 bbls/year, your voice and insight into developing, operating, and improving effective brewery maintenance is critical. Approximately an hour and a half will be available to address specific questions from the audience. Please note: This will not be staged in a “cage match” format.

Save 15% on Select MBAA Titles!
Purchase 5 titles at Brewing Summit and get FREE shipping!

Master Brewers Association of the Americas
Continuing Education
Upcoming Offerings
Brewing and Malting Science Course
October 31–November 11, 2010
University of Wisconsin–Madison
Brewery Packaging Technology Course
May 1–12, 2011
University of Wisconsin–Madison
Tuition includes almost everything
• Accommodations at the class site
• Two meals per day during instruction time
• Educational materials
• Opening and closing banquets
• Tours
MBAA members are eligible to apply for the William A. Hipp scholarship to cover the cost of tuition.
www.mbaa.com/education/education.html
innumerable papers, articles, and books on beer and brewing, as well as written prolifically on soccer. His personal interest in people and matters spiritual presaged the current study.

O-3

A comparison of beer quality attributes between 100% barley malt and barley adjunct beer, with a focus on changes in the protein composition
Presenter: Elisabeth Steiner, TU München, Freising, Germany
Coauthor(s): Andrea Auer, TU München, Freising, Germany; Martina Gastl and Stefan Kreisz, Novozymes A/S, Bagsvaerd, Denmark

The present work provides an overview of the applicability of barley raw material in the brewing process and its influence on beer quality parameters. Beer was brewed with barley malt and with barley adjunct and exogenous enzymes. Barley raw material, malt, kettle-full wort, cold wort, unfiltered beer, and filtered beer were analyzed to investigate changes during the brewing process, the applicability of barley adjunct, and its influence on beer quality attributes (e.g., filterability, flavor stability, foam stability, etc.). We also studied changes in protein composition during the brewing process and how exogenous enzymes influence this composition. All analyses were based on methods described in ASBC, EBC, or MEBAK. To monitor protein changes during the brewing process 2D-PAGE was used. According to the results differences in the chemical composition of the finished beer could be observed. Not only changes in the protein composition, with the help of 2D-PAGE, could be shown, but also differences in the β-glucan content, viscosity, foam stability, and filterability. Although differences could be seen the taste of an adjunct beer was not significantly different than that of 100% malt beer.

Elisabeth Steiner was born in 1981 in Austria. She graduated with a Dipl. Ing. degree at the Universität für Bodenkultur, Vienna, in 2005. In 2006 she has been working as a Ph.D. student at the Institute of Brewing and Beverages Technology in Weihenstephan.

O-4

Profiling a lager fermentation completed using active dried yeast
Presenter: Chris Powell, University of Nottingham, Loughborough, UK
Coauthor(s): David Jenkins, University of Nottingham, Loughborough, UK; Tobias Fischborn, Lallemand Inc., Montreal, Canada; Katherine Smart University of Nottingham, Loughborough, UK

In the brewing industry it is standard practice to propagate a pure yeast culture before inoculating (pitching) the fermentation vessel. Due to the capacity of yeast to be serially repitched, a culture can often suffice for several fermentations. However, yeast is not reused indefinitely, and propagation is required at regular intervals. Propagation requires additional equipment, energy, and water inputs, must be initiated several days before the yeast is required, and typically requires that the yeast to be inoculated soon after it is produced. Active dried yeast offers an alternative method of yeast supply to propagation, but extensive use has often been prohibited in larger breweries by a perception of modified fermentation performance. In this investigation small-scale fermentations were performed using the lager yeast LAL1, in both “wet” (laboratory propagated) and active dried yeast (ADY) form. Both fermentations were compared for lag phase, time to attenuation, yeast cell viability, and budding indices. At pivotal time points throughout each fermentation the assimilation of amino acids and the uptake of fructose, sucrose, maltose, maltotriose, and glucose were monitored. Using these data we discuss the
effects of employing dried yeast for beer fermentations and describe some of the simple precautions to ensure ADY fermentation performance.

Chris Powell obtained a B.S. degree in biology and environmental biology and subsequently moved to Bass Brewers (now Coors UK) in 1997 to work as part of the R&D team. The following year Chris began his Ph.D. studies at Oxford Brookes University, in conjunction with Bass, and received his doctorate in 2001 on the subject of yeast cellular aging 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 moved to Lallemand Inc. in Montreal, Canada, in 2004 and was responsible for the R&D laboratory for the molecular identification and characterization of microorganisms utilized within the food and beverage industries, in addition to continuing research focused on brewing yeast. In February 2010 Chris returned to the United Kingdom to take his current position as lecturer in yeast and fermentation at the University of Nottingham. Chris is also a faculty member of the Siebel Institute of Technology and serves on the ASBC Technical Committee.

O-5
Yeast activity monitoring
Presenter: Michael Bradley, Nalco, Naperville, IL

Yeast is generally recognized to be one of the most difficult elements of the brewing process to correctly manage. Inconsistent yeast management practices can negatively impact the consistency of fermentation and the quality of beer produced. The standard method of yeast analysis by light microscopy and viability staining, however, presents assorted difficulties and limitations in a production setting. As a result, many brewers are forced to operate their process without true information regarding the physiological state of their yeast. Over the years, numerous methods have been developed for measuring brewing yeast activity, but few have found commercial success due to a variety of reasons. A successful yeast activity measurement should be non-subjective, fast, easy, quantitative, and automated, and the resulting data should be relevant to the brewing process. A new laboratory instrument for automated yeast activity measurements is now offered by Nalco Company that meets all of these qualifications. The fundamental basis of the technology is a fast, fluorescence-generating reaction that targets native yeast enzymes. The instrument’s interactive touch-screen computer guides the user through the sample preparation steps, which are performed on a digital balance connected to the instrument and require about 30 seconds of hands-on time. After inserting a rugged, triple-sensor probe directly into the prepared sample an automated series of measurements lasting about 2 minutes follows. Several key features differentiate this new technology from the industry standard practices of microscopic cell counting and viability staining. The sample preparation and reaction monitoring procedures employed are completely non-subjective and automated, meaning that anyone can perform the measurement without introducing operator-to-operator variability. The results are automatically logged by the instrument and made immediately available over a network for integration into reports, databases, and control systems. Finally, the activity levels measured with the system depend on the number of viable cells in the sample, as well as the metabolic activity (vitality) of the population. Examples will be presented of successful application of this technology for optimizing propagation, yeast pitching from a slurry, and fermentation monitoring in the brewing industry.

Michael Bradley lives in the suburbs of Chicago and works as an R&D scientist at Nalco Company, where he develops microbial detection, control, and optimization technologies. Prior to working at Nalco, Mike trained at the University of Chicago and the University of Florida, where his research combined elements of bioinformatics, evolutionary theory, and wet-lab approaches to explore biomolecular structures and functions. Mike received his Ph.D. degree at the University of Illinois – Chicago for his thesis on yeast prion proteins.

O-6
Possible roles of the mitochondria in sulfur dioxide production by lager yeast
Presenter: Eric Samp, MillerCoors
Coauthor(s): Patricia Pratt, MillerCoors

Sulfur dioxide is one of the key lager yeast metabolites that brewers seek to control, as it has multiple effects on the quality of lager beers. It has been widely reported that yeast cells, when fermented in high-glucose worts, are susceptible to producing elevated sulfur dioxide, yet the exact mechanisms may not be fully understood. It is known that utilizing glucose as a primary carbon source to fuel yeast growth negatively affects mitochondrial development, specifically its unique membrane lipid, cardiolipin. In this study, we show the results of incubation experiments aimed at altering cardiolipin formation and mitochondrial development with a stimulator of cardiolipin synthesis (L-thyroxine and glycerol) and an inhibitor (inositol). These results demonstrated significantly lower sulfite levels ($P < 0.05$), adjusted for ethanol production, under conditions promoting cardiolipin formation. In addition, fermentations with respiratory-deficient mutants also revealed significantly lower efficiency in the conversion of sulfate, as measured by the ratio of the amount of sulfite produced to the amount of sulfate taken up, as compared to the parental strain ($P < 0.05$). These findings suggest that this overlooked organelle may have a vital role in sulfite production, which we speculate is related to a key prosthetic group in the enzyme complex, sulfite reductase. This group, namely the [4Fe-4S] iron-sulfur cluster, provides the catalytic site in sulfite reductase electrons to reduce sulfur dioxide to sulfide. We postulate either limitations in mitochondrial ATP availability or export of this cluster to the cytosol is involved. Additional roles for the mitochondria will also be suggested.

Eric Samp is a quality engineer for MillerCoors working in the Manufacturing Quality Organization and focusing on packaging quality issues. He holds a Ph.D. degree in applied statistics from the University of Northern Colorado and CQE and CQM certifications from ASQ and a Dipl. Brewer degree from the IBD. He is also a certified 6s master black belt.

O-7
A fresh look at beer flavor stability
Presenter: Alastair Pringle, Pringle-Scott LLC, St. Louis, MO

Brewers strive to not only manufacture a product that is as close to brewery taste as possible, but also as consistent as is practical. The flavor of packaged beer, as perceived by customers, is the result of many processes in the brewery. Research on beer freshness and the mechanisms by which stale flavors are produced will be reviewed. By applying the principle of Occam’s razor, the key points will be summarized into a new model of beer staling. The model shows that the mechanisms of staling are complex and distributed throughout the beer production, so they cannot be controlled by focusing on a single action. Therefore, freshness can only be improved through a holistic approach where the critical factors are controlled throughout the supply chain from the brewhouse to packaging and into distribution. Examples of practical tools, such as check lists and critical control point measurements, will be discussed that can be applied throughout the brewing process and lead to real improvements in freshness. In addition, a practical means to monitor improvements through specialized panels will be discussed.

Alastair Pringle began his career in the brewing industry in England when he started working in a pub at the age of 18. His interest in brewing motivated him to obtain undergraduate and graduate degrees in microbiology. Alastair joined Anheuser-Busch Inc. in 1984 after five years of postdoctoral experience in the United States and two years as a visiting professor at UCLA. At Anheuser-Busch he held a number of technical management positions, including director of brewing research, in both corporate R&D and brewing technical services. He has worked on all
aspects of brewing, including malting, mashing, fermentation, finishing, and new product development. He is currently principal at Pringle-Scott LLC, a science-based consulting company that serves alcohol-based industries. Alastair is also a visiting professor at DeVry University.

O-8
The influence of unmalted barley on the oxidative stability of wort and the final beer
Presenter: Thomas Kunz, Technische Universität Berlin, Germany

The aim of this study was to investigate the influence of unmalted barley on the brewing process and the quality of the resulting beer-like beverages, with the main focus on oxidative stability, using EPR-spectroscopy (EAP value, T400 value). The use of barley instead of malt is interesting with respect to costs. However, in the cost calculation it is important to consider that barley has a considerable enzyme deficit and requires the addition of technologically produced enzymes during the brewing process. Two series of five different brews containing 0, 25, 50, 75, and 90% barley were produced. Based on laboratory pretrials, a combination of technical enzymes (α-amylase, protease, pullulanase, glucanase, xylanase), depending on the barley content, was used. In general it can be said that beers with a proportion of up to 75% barley in the grain will achieve comparable or lower remaining extract and, thus, higher attenuation of the final beer. Only beer with a proportion of barley of 90% showed a significant reduction of this value. Furthermore, a significant reduction of the colors of wort could be observed with increasing barley proportions. In comparison to pilsner malt, which contains more Maillard products and melanoids caused by the kilning process, barley has fewer coloring compounds. The missing heat exposure of barley and lower oxidative stress resulted in lower values of TBA in wort with increasing amounts of barley. Furthermore, it was observed that an increase of the barley content in the grist leads to a higher oxidative stability (EAP value) and a lower ESR signal intensity (T400 value) as indicators of radical generation in the wort and final beverage. In both series, the beers brewed with a proportion of 50% barley were preferred significantly better for flavor and taste than beer produced with 100% of malt. Only the brews with a barley proportion of 75% or more scored lower in the tasting results than all-malt beer. Although all analytical values were within the normal range according to MEBAK, the slight decrease in total polyphenol content and FAN and an increase in β-glucan caused by the high proportion of barley is unfavorable. In the assessment criteria like mouth-feel, fizziness, and quality of bitterness did not show significant differences. Notably, the beers with a proportion of 50% barley showed superior results in the brewing process and beverage parameters with the same extract yield. This is the case, in particular, for the TBA, stability of foam, EAP value, and ESR signal intensity (T600 value). Further improvement can be achieved by optimizing the concentration of enzyme addition.

After qualifying as a certified technician in preservation engineering (1991–1993), Thomas Kunz completed his basic studies in chemistry at Isny University of Applied Sciences (1994–1995) and his basic studies in food chemistry at Wuppertal University (1995–1998) before studying food technology at Trier University of Applied Sciences (1998–2002). After graduating, he worked as a chartered engineer (Dipl. Ing.) in the field of ESR spectroscopy at the Institute of Biophysics at Saarland University (2002–2004). Since 2005, he has been employed as a Ph.D. student at the Research Institute of Brewing Sciences at Berlin Technical University Berlin. His main research focus lies in analyzing radical reaction mechanisms in beer and other beverages using ESR spectroscopy.

O-9
The role of polyphenols in beer haze and astringency
Presenter: Karl Siebert, Cornell University, Geneva, NY

Polyphenol interactions with proline-rich proteins (PRPs) are involved in both the formation of protein–polyphenol haze and the perception of astringency. The nature of polyphenol interactions with proteins in these phenomena will be reviewed. A polyphenol attachment site has two or more hydroxyl groups on an aromatic ring. When the hydroxyls are adjacent, the binding is stronger. Some polyphenols bind to proteins but do not cross-link two protein molecules together; this does not result in haze or astringency. Cross-linking occurs when a polyphenol has two or more attachment sites and can bridge proteins together; this complex formation can lead to insoluble particles that scatter light, resulting in haze. In the case of the salivary PRPs, polyphenol cross-linking removes the lubrication of oral surfaces that PRPs normally provide, resulting in the sensation of astringency. Larger polyphenol molecules and those with more hydroxyl groups bind more strongly to proteins but are more readily lost during the brewing process. Protein–polyphenol interaction is known to involve both hydrogen bonding and hydrophobic bonding. There is some evidence that the face of a polyphenol ring stacks against the face of a proline ring in the protein and that the adjacent amino acid in the peptide is also involved. This may be related to the finding that glutamine is frequently located adjacent to proline in both barley hordeins and human salivary PRPs; binding to polyphenols appears to be an important function of both these proteins. The adsorbent polyvinylpolypyrrolidone (PVPP) also binds to polyphenols and can be used both to chillproof beer and to reduce its astringency.

Karl Siebert received a Ph.D. degree in biochemistry from Penn State in 1970. He then spent 18 years at the Stroh Brewery Company in Detroit, where he held positions from research associate to director of research. In 1990, Karl joined Cornell University as professor of biochemistry in the Department of Food Science and Technology. He served five years as department chair and now has a predominantly research commitment. Karl is active as a consultant in beverage technology and chemometrics. He twice received MBAA Presidential Awards for papers he presented, and he and his colleague Penny Lynn have received the ASBC Eric Kneen Memorial Award (for the best paper published in the Journal of the American Society of Brewing Chemists in the prior year) three times. Karl received the ASBC Award of Distinction in 1999. He is a member of the ASBC Journal Editorial Board and the ASBC Foundation Board. Karl’s research interests involve foam and haze in beverages, astringency and other flavor perceptions, the application of chemometric methods in food science, and assessment of microbiological risk.

O-10
Impact of fermentation on yeast quality and assessment of fitness to ferment
Presenter: Katherine Smart, University of Nottingham, Loughborough, UK

Optimization and consistency of large-scale fermentations from pitching and dispersal of yeast to product recovery is of critical economic and industrial importance. Efficient fermentation requires conditions appropriate for ensuring high productivity while maintaining yeast viability, vitality, and genetic stability. However, optimal conditions for rapid fermentations can be suboptimal for maintaining yeast quality, leading to inconsistent and even “stuck” fermentations. During industrial fermentation yeast is exposed to fluctuations in oxygen concentration, carbon dioxide, osmotic potential, pH, ethanol concentration, nutrient availability, and temperature. Individually and collectively these stresses can adversely affect yeast potential to perform over time. Over the years a series of methods has been developed in an attempt to assess yeast quality, and while some have clearly provided benefit, others have not been adopted. In part this might be due to the plethora of assays that have been launched in the industry, each with their own merits, but perhaps not
suieted to the rigors of a brewing quality assurance laboratory. Although there is no single test for the illusive characteristic of fermentation potential, many methods have merits. This paper will attempt to identify a toolkit of assays that are “fit for purpose.” Some of the key methods will be mapped to attributes of yeast quality and fermentation performance. This paper will consider the gaps in our knowledge, as well as the real opportunities for innovation.

**Katherine Smart** completed a B.S. (honors) degree in biological sciences at Nottingham University in 1987 and was awarded the Rainbow Research Scholarship to complete a Ph.D. degree in brewing yeast and fermentation at Bass Brewers, Burton-on-Trent. She then moved to Cambridge University to take up an appointment as research fellow in the Department of Plant Sciences, where she worked on bioactive surfaces, biofouling, and bacterial contamination of beverages in collaboration with the beverage packaging company Elopak. In 1992, Katherine became a lecturer in microbiology and fermentation at Oxford Brookes University. By 2000, she had been appointed to Scottish Courage Reader in Brewing Science and became the youngest Fellow of the Institute and Guild of Brewing. In 2005 Katherine moved to the University of Nottingham, where she became the SABMiller Professor in Brewing Science. Katherine has received several awards for her research, including the Institute of Brewing and Distilling Cambridge Prize (1999), the prestigious Royal Society Industrial Fellowship (2001–2003), an Enterprise Fellowship (2002), and the Save British Science Award at the Houses of Parliament in the United Kingdom (2003). She has also recently commenced patent filing for a novel PCR technology. Her core research interests are yeast cell biology, fermentation, and stress responses in yeast.

**O-11**

**Influence of accelerated fermentation on yeast physiology and beer quality**

**Presenter:** Koji Onoda, Kirin Brewery Company, Limited, Yokohama, Japan

**Coauthor(s):** Thomas Kunz and Frank-Jürgen Methner, TU Berlin, Berlin, Germany

Fermentation and maturation are the most time-consuming steps in the production of lager-type beers. There has been extensive research done on decreasing production time; however, it remains difficult to control yeast physiology and beer quality in accelerated fermentation and/or maturation methods. Such methods often cause the deterioration of yeast viability and vitality, so that beer quality tends to be high in fatty acids, low in foam stability, and have insufficient flavor stability. Brewing trials were carried out at the 40-L scale using cylindroconical fermenters. Pressure fermentation (14°C fermentation/14°C maturation with 1 bar of counter pressure), cold fermentation with programmed maturation (9°C/20°C without pressure), cold fermentation–warm maturation (9°C/12°C without pressure), and cold fermentation with forced maturation (9°C/9°C without pressure) were performed, aiming to achieve similar beer parameters. To avoid deterioration of beer quality from the autolyzed yeast, deposited yeast was removed from the tank every 2 to 3 days during forced and programmed maturation, every 2 days during warm maturation, and every day during pressure fermentation during maturation. The level of maturing indicator compounds and aroma compounds in the final beer were determined using gas chromatography (GC). EPR determination of the endogenous anti-oxidative potential (EAP) was carried out. Taste testing was carried out according to the DLG scheme in fresh and forced-aged states. Forced maturation, programmed maturation, and warm maturation showed similar analytical characteristics, including esters, higher alcohols, fatty acids, and foam stability. Although pressure fermentation showed relatively higher acetaldehyde, sulphite, and phenol, yeast alcohol and lower attenuation, it showed almost similar analytical characteristics in the other parameters. EAP was the best in pressure fermentation. The vitality of deposited yeast using the intracellular pH and flow cytometric methods showed few differences in the first cropping yeast. The outcome of tasting trials in fresh and forced-aged beers showed no significant differences. These findings show that the use of accelerated fermentation and maturation methods in beer production, with proper yeast handling and the right fermentation and maturation conditions, has the potential to allow the brewing of sufficiently high-quality beer without problematic deterioration in beer quality.

Koji Onoda is a researcher at the Research Laboratories for Brewing, Kirin Brewery Company, Limited. He graduated from Tokyo Institute of Technology in 1998 with a M.Eng. degree in biotechnology and joined Kirin Brewery. He worked at the Kobe brewery (1998–2003), Kirin distillery (2003–2005), and Marketing Department (2005–2007). From 2007 to 2009 he worked on brewing technology as a guest researcher under the direction of F.-J. Methner, chair of Brewing Science at the Berlin Institute of Technology (TU Berlin).

**O-12**

**The nature and fermentability of last runnings**

**Presenter:** Graham Stewart, ICBD, Edinburgh, Scotland

**Coauthor(s):** John Andrews, Briggs of Burton plc, Burton on Trent, England; Michaela Miedl, ICBD, Edinburgh, Scotland; Richard Taylor, Wells and Young’s Brewing Company Ltd., Bedford, England

Last runnings are traditionally regarded as the final liquid at mash-off flowing into the kettle following the separation of sweet wort from spent grains. As the gravity decreases in the last runnings the major portion of the extract is fermentable sugars. Potentially detrimental substances, such as proteins and polyphenols, have been diluted such that they are not detrimental if added to the kettle. If this material is discharged into the sewer, not into the kettle, the effluent costs because of high COD and BOD concentrations could be high. Wort collection can probably continue as long as the brewer does not mind diluting the wort in the kettle for the sake of a small amount of additional fermentable extract compared to the discharge costs. Although full-scale trials are required, the volume of last runnings from the lauter tun was higher than from the mash filter. However, the composition of the last runnings from the two wort separation systems was similar. This study did not address the question of the organoleptic characteristics of beer under controlled taste panel conditions. However, preliminary taste panel assessment indicates little difference in the beers produced with added last runnings compared with no added last runnings.

Graham Stewart, emeritus professor in brewing and distilling at Heriot-Watt University in Edinburgh, Scotland, was the director and professor of the International Centre for Brewing and Distilling, Heriot-Watt University, from 1994 to 2007. He received his B.S. (honors) degrees in microbiology and biochemistry from the University of Wales, Cardiff, and Ph.D. and D.S. degrees from Bath University. He was a lecturer in biochemistry in the School of Pharmacy at Portsmouth College of Technology (now Portsmouth University) from 1967 until 1969. From 1969 to 1994 he held a number of technical positions with Labatt Brewing Company in Canada and from 1986 to 1994 was its brewing technical director. He was the president of the Institute of Brewing (now the Institute of Brewing and Distilling) in 1999 and 2000. He is a member of ASBC and MBAA. He holds fellowships in the IB, the Institute of Biology, and the American Academy of Microbiology. He has more than 250 publications (books, patents, review papers, articles, and peer-reviewed papers) to his name. On retiring he established a consulting company—GGS Stewart Associates, with an office in Caerphilly, Wales. As well as being awarded the Horace Brown Medal of the IB (2008), he has been presented with the ASBC Award of Excellence (2008), the MBAA Presidential Award (1983 and 1998), and the Charles Thom Award of the Society of Industrial Microbiology (1988).
**O-13**

**Establishment of energy conservation management system at Asahi Beer**

**Presenter:** Toshihiko Nagaoka, Asahi Breweries, Ltd., Ibaraki, Japan

**Coauthor(s):** Taro Kondo and Yuichi Kiwaki, Asahi Breweries, Ltd., Nishinomiya, Japan

Implementing continuous energy conservation initiatives and achieving targets for carbon dioxide emissions requires day-to-day management of utility usage data for processes and facilities. Verifying differences based on process and facility data and implementing improvements to reduce disparities between plants is also necessary. Asahi Breweries deployed a utility management system at all of its plants in order to continuously implement such energy conservation initiatives. Prior to deploying the system, Asahi Breweries conducted energy management between plants based on their overall energy intensity. Due to differences in facility configurations, process-specific management was not implemented between the plants, and energy management was left up to individual plants. This type of organization, however, prevented further energy conservation. The deployment of the energy management system enabled comparison of process-specific data between plants and the implementation of a continuous “plan, do, check, act” (PDCA) cycle. By comparing process-specific data between plants, Asahi Breweries was able to clarify differences compared with plants having low energy intensity, calculate optimum theoretical values, and identify energy conservation strategies to achieve these values (plan). Asahi Breweries then implemented the identified strategies (do) and subsequently, verified the benefits of the executed strategies (check). This process made it possible to establish and then apply (act) a manufacturing configuration for efficiently using energy conservation measures. The energy management system enabled the continuous implementation of energy conservation initiatives while running a PDCA cycle. Energy conservation requires both the implementation of energy conservation strategies and steady, day-to-day management. The energy management system implemented at Asahi Breweries became an optimum tool for running a PDCA cycle. By deploying the system at all of its plants, Asahi Breweries was able to make great strides in improving energy conservation.

Toshihiko Nagaoka joined Asahi Breweries as a plant engineer in 1987. From 1987 to 1991 Toshihiko was involved in the design of beer tanks and piping and managed the construction and organized the initial testing for the renewal and upgrade of the Hakata brewery. From 1991 to 1994 Toshihiko worked as a staff member in the packaging section at the Hokkaido brewery, focusing on quality management and operations efficiency. From 1994 to 1996 Toshihiko was involved in equipment maintenance and operation efficiency and managed the repair and improvement of facilities to save energy and increase productivity as a technical chief at the Ibaraki brewery. From 1996 to 1997 Toshihiko studied packaging in the United States at the School of Packaging at Michigan State University as a visiting scholar. From 1997 to 2000 Toshihiko worked in the packaging section at the Tokyo brewery as a line manager. From 2000 to 2002 Toshihiko worked in the Production Technology Center at the Suita brewery, specializing in energy conservation. From 2002 to 2009 Toshihiko worked in the production section at the Hokkaido brewery as the environmental management representative and significantly contributed to the Hokkaido brewery’s winning of the Minister of Economy, Trade and Industry Award for Factory Energy Management Excellence. Currently, Toshihiko is the chief project engineer for promotion of the 3Rs (reduce, reuse, recycle) at the Production Technology Center.

**O-14**

**Product improvement, cost reduction, and more sustainability with total O2 management**

**Presenter:** Arjen van Zeijst, Norit Haffmans, Venlo, The Netherlands

Oxygen’s negative influence on the quality and shelf life of the product is common knowledge in the brewing industry. Many process controls in a brewery are based on oxygen values. Performing total oxygen management throughout the entire process leads to improved product quality, cost reduction, and a more sustainable production process. By improving quality with more accurate and frequent monitoring you are able to increase reaction time in the process controls. Costs are reduced due to decreased downtime, rework, and product losses, including the labor involved. To be more sustainable is in many cases directly linked to cost reduction. Less re-work and fewer product losses lead directly to decreased energy use and waste of raw materials. All together, total oxygen management will increase efficiency and product quality in the brewery.

Arjen van Zeijst studied electrical engineering at HTS Venlo and finished in 2008. Arjen started at this company as a process control engineer and later worked as a project engineer, was responsible for the Process Control Department, and was an international sales manager. Arjen began at Norit Haffmans BV in 2008 as the product/area manager responsible for quality control equipment in the Americas.

**O-15**

**Sustainability metrics and better practices in the BevBrew sector: Carbon, water, and energy footprints associated with water, waste, and co-product management**

**Presenter:** Raj Rajan, Ecolab, Victor, NY

Factors affecting the costs of energy and environmental management within the BevBrew sector continue to pose significant challenges to profitability. Fossil fuel prices continue to rise, environmental regulations governing off-site disposal of wastes and co-products continue to become more stringent, and the pressure on the animal feed market has increased (from the rapid growth of the fuel ethanol industry and the increasing abundance of distiller’s grain). Water use impacts in stressed areas and withdrawal from long-term stored water sources impose local challenges beyond those that apply to global carbon footprint concerns that are currently being tackled by the industry. The link between water and energy within plants (thermal load to heat or cool aqueous products) is often trumped by the inextricable link between the two in the broader community (embedded water in energy used and embedded energy in water use). Innovative cleaning and sanitation solutions from Ecolab’s Food and Beverage group have had a positive impact on reducing energy and water use within production facilities. Off-the-shelf waste-management solutions, when combined creatively, have helped reduce both carbon and water footprints of BevBrew products. Such solutions include production of a renewable bio-fuel energy source from by-product and waste streams and reuse of treated wastewater to reduce freshwater use within the facility. Case studies of efficient anaerobic waste-to-energy processes implemented in full scale at several food and beverage facilities across the United States by Ecolab’s Water, Energy and Waste Solutions group are illustrated. Benchmark practices and sustainability metrics from the global brewing industry are summarized.

Raj Rajan is vice president, engineering, in Ecolab’s Water, Energy and Waste Solutions group. Raj holds a Ph.D. degree in environmental engineering from the University of Massachusetts. His current focus within the food and beverage industries is waste minimization, bioprocess engineering, control systems, renewable energy integration, and facility-specific documentation and portfolio-wide roll-ups of sustainability metrics. His team provides process support to outsourced industrial waste management and wastewater treatment facilities for major multinational
food and beverage clients. Raj has extensive experience delivering environmental process solutions to the chemical, petroleum, food, paper, utility, and transportation industries. His technical background is in physical, chemical, and biological processing of potable water sources, industrial wastewaters, and impacted groundwaters. Over the past 26 years, Raj has designed, engineered, and executed a variety of wastewater treatment and remediation projects across the United States. He has authored dozens of peer-reviewed publications, several trade journal articles, and technical presentations at national and international conferences. He is active in several professional engineering organizations and is a registered professional engineer in Michigan and Ohio.

O-15a
Integration of solar process heat
Presenter: Johannes Preiß, Krones AG, Neutraubling, Germany

“Just by telling the local media that we are planning to build a solar power plant, there was a perceptible increase of sales” are the first comments of Benno Emslander, the owner of the Hofmühl Brewery, Bavaria, if you ask him about his new solar power plant. The rising environmental consciousness of consumers, even if it’s not predictable, is one result of the integration of a solar power plant. The imminent increase in the price of fossil energy and CO₂ taxation are more or less fixed figures, which we are forced to calculate over the next years. Krones has introduced solar process heat into a brewery as an alternative energy supply. The whole process of this and further projects could be divided into the following steps: concept, analysis, design, and implementation. Each of these steps has to be regarded individually for different applications to provide a reasonable and, in the end, efficient alternative energy supply for breweries or beverage plants. Therefore, Krones developed tools for a consumption data and solar yield forecast to provide a reliable database for the investment calculation. Finally, there should be lower energy costs for the producer in addition to a notable reduction in CO₂ emissions.

Since 2008 Johannes Preiß has worked as a project manager in the Department for Conceptual Engineering of Process Technology at Krones AG. He started his career during his studies of brewing and drinking technologies at the Technical University of Munich in Weihenstephan, Germany, when he worked at the Steinecker plant in the Department of Technology. After Johannes graduated as an engineer, he moved to Krones headquarters in Neutraubling, where he managed several projects in the field of beverage technology. One current project on which he is heading the new lautering technology Pegasus PX. He is also involved in activities at Krones AG regarding the integration of renewable energies into the beverage industry.

O-16
Cutting the carbon footprint of malting by 75%—Achievable or just hot air?
Presenter: Nigel Davies, Muntons plc, UK

Targets for preventing global warming suggest that we need to reduce at least 75% of our carbon emissions by 2050. On a global scale this appears an impossible target, but analyzing the supply chain from barley to malt shows that there are some reasonably straightforward initiatives that could indeed save that amount of carbon. This paper examines the impact of cereal production on the carbon footprint and looks at opportunities to save carbon in the growing of barley and production of malt. The combined effects of legislative pressure, agricultural practice, use of process water, improvements in malting process conditions, and changes in malt specification are shown in concert to make a 75% reduction within our grasp.

Nigel Davies is the manufacturing and technical director of Muntons plc, a U.K.-based malting company and the largest producer of malted ingredients in the world. His remit is directing the manufacture and technical support of malt and malted ingredients at the main board level. After earning his doctorate, he lectured in biological sciences at London University before joining Brewing Research International (BRI). During a 10-year stint in brewing research, he specialized in cereal physiology and pioneered the use of freezing-stage electron microscopy to study many different foods, becoming manager for confidential international malting and brewing projects. He is also experienced in flavor analysis of malts, beers, and wines. He regularly acts as an expert witness in cases where food safety of cereals is at issue.

O-17
The origin of pilsner brewing technology
Presenter: Jens Voigt, Technische Universität München, Freising-Weihenstephan, Germany
Coauthor(s): Andreas Richter, Weyermann Specialty Malt, Bamberg, Germany

Original pilsner brewing technology demands specific processes with regard to water, hops, and especially malt. Historically the bohemian style of pilsner beer differs in color, flavor, and overall character. The process of producing the required higher color malt is very specific and traditionally done in floor malting. Moisturization and germination conditions are controlled by special treatment and turning operations. The malting process is highly sophisticated and requires experience and specific know-how. This malting technology is compared with the modern pneumatic malting system. In brewing typically a triple-decoction program is used, requiring individual brewhouse facilities. This paper describes the malting and brewing process, comparing pale pilsner type malt from modern malting facilities and darker Bohemian style pilsner malt. The resulting beers are both typical pilsner-style beers, but quite different in taste, color, and other properties. The paper shows analytical parameters during production of malt and beer, as well as the analytical values and sensorial analytics of the final beer.

Jens Voigt received a Dipl. Eng. (M.S.) degree in brewing and beverage technology from TU München Weihenstephan, Germany, in 1985. He started his career with A. Steinecker GmbH, Freising, as a technical engineer in brewhouse and fermentation and filtration equipment. He held sales and product manager positions with Steinecker until 1995. From 1988 until 1992 he worked on his doctorate in brewing technology on beer foam from Weihenstephan (under Professor Narziß). In 1996 he joined Doemens Brewing School in Munich, Germany, as managing director. In late 1997 he joined Heinrich Huppmann GmbH, Kitzingen, Germany, as key account manager for brewery equipment and was managing director of brewmaxx, a supplier of software solutions for the brewing industry. Since early 2004 he has been a research associate with Professor Karl Sommer (Chair for Mechanical Engineering and Process Technology) at the WZW (Wissenschaftszentrum Weihenstephan), Center of Life Science, Technische Universität München Weihenstephan, working on brewing and beverage process technology issues. He is a member of MBAA and IBD and of the editorial board of the Journal of the Institute of Brewing, London (JIB).
Especially the behavior of fine particles was investigated very intensively during the last months. The first tests were done with laser diffraction. A method developed at the institute provided the ability to follow the behavior of particle size distribution during the mashing process. Subsequent, trials were done in a microscopical mash tun to define the form factor of these particles. This provided the opportunity to observe in reality what happens to the particles depending on temperature, enzyme input, and others. Additionally there was done a lot of research done on the lautering process. In this step of beer production, it is also possible to use procedural analysis to solve a series of problems. The unknown flow behavior of the wort through the filter cake depends on many influencing factors. This presentation will show which factors are responsible for that. Flow reduction and blocking of the filter cake are just two examples that have to be optimized with a procedural look at the process.

Johannes Tippmann graduated from university in 2004 with a Dipl.Eng. degree in brewing sciences and beverage technology. In 2005 he started work on his Ph.D. thesis with Professor Sommer on solids handling in the brewhouse. He collected many experiences in procedural knowledge of beer production during his studies, performing student research projects and his diploma thesis on this topic. Since 2000 he has worked as a student research assistant in dispensing systems and collected lots of experiences in this subject area. Since 2006 he has been responsible for research issues in dispense systems at the institute. He is also a member of the “Dispensing Systems” Technical Committees of the Government Association for the Food and Catering Industry (BGN) and of the DIN German Institute for Standardization. In addition, he is working for the MEBAK Dispense Work Group and has published a number of papers.

O-19
The influence of different malting and mashing methods on beer characteristics
Presenter: Taichi Maruhashi, Suntory, Osaka, Japan
Coauthor(s): Martina Gastl and Thomas Becker, Lehrstuhl für Brauwissenschaften, Freising, Germany; Ludwig Narziss, TU München–Weihenstephan, Freising, Germany
High molecular proteins contribute not only to beer taste, especially fullness and aftertaste, but also to the foam quality of the finished beer. However, if the proportion of high molecular proteins is too high, unpleasant turbidity can occur. For this reason, control of protein modification in malting and mashing is very important for the brewing process and beer quality. Because it is both easy and economical, it has become popular to use malts with relatively high protein modification. However, this may cause low fullness or an unpleasant aftertaste if the mashing method is not well considered. In this study, different malting and mashing methods were investigated in order to confirm the influence of nitrogen compounds on fullness and aftertaste. Other characteristics, i.e., foam, filterability, haze stability, and flavor stability, were evaluated at the same time. Barley (Marthe, harvest 2008) was germinated in a micro-malting apparatus to obtain three protein modifications at 44.9%, 40.3%, and 37.4%. The degree of cytolysis was nearly equal. These malts were brewed after three different mashing methods with mashing-in temperatures of 40°C, 50°C, and 62°C. It was found that the fullness and aftertaste of the final beer were improved by a combination of low Kolbach index and low mashing-in temperature. By analysis of nitrogen compounds, it was found that the amounts of high and low molecular nitrogen compounds had an influence on fullness and aftertaste. A comparison between the infusion method and decoction method revealed that the former produces better foam quality, filterability, and haze stability. A sensory test, however, showed that the quality of the decoction beer was superior for both fresh and aged beer. Better flavor stability of decoction beer came from fewer heat-derived compounds, 2-furfural, and gamma-nonalacton, in the aged beer.

O-20
Impact of different hop compounds on the overfoaming volume of beer caused by primary gushing
Presenter: Michael Müller, TU München–Wissenschaftszentrum Weihenstephan, Freising, Germany
Coauthor(s): Thomas Becker and Martina Gastl, TU München–Wissenschaftszentrum Weihenstephan, Freising, Germany
When weather conditions favor the growth of molds on barley, beers brewed from the resulting malts often tend to gush. Certain Fusarium species (e.g., *F. graminearum, F. culmorum*) especially may cause this problem. This phenomenon is brought to the attention of maltsters and brewers every few years. Supersaturated with CO₂, a primary gushing beer contains an overcritical concentration of microbubbles that are supposed to be stabilized by *Fusarium*-derived hydrophobins. A lot of research with varying brewhouse parameters has been done to investigate the influenceable factors of primary gushing. As hops are known to contribute a wide range of both gushing-positive and -negative substances to beer, hopping regime emerged as an important aspect. This paper presents the impact of different hop varieties and products on gushing. Hop oils and unsaturated fatty acids are understood to be gushing suppressors. However, compounds like dehydrated humulinic acid can intensify it. The aim of the project is to identify the impact of the hop products used by the application of common hop pellets with a prevalent range of conductometric values (4–1% alpha-acid), as well as pre-isomerized downstream products with differing oil contents. By working with the same “gushing malt,” the spectrum of compounds in the finished beer only differ through the hop product used. The overfoaming volumes of different samples were determined according to the MEBAK guidelines. They were compared with the respective hop oil and fatty acid concentrations (GC method) and isohumulone contents (HPLC method). Also, a chronological sequence of the changing percentages of beer loss is shown.

Michael P. Müller studied brewing and beverage technology at TU München – Wissenschaftszentrum Weihenstephan until 2007. After obtaining his diploma, he started his career as head of the laboratory (10 L) and pilot-scale (60 L) brewery at the Chair for Brewing Technology. Since 2008 he has focused on his Ph.D. thesis “Influence of Brewhouse Operations on the Overfoaming Volume of Primary Gushing Beer.”

O-21
Practical sustainable initiatives during cleaning and packaging operations
Presenter: George Agius, Diversey Inc., Oakville, ON, Canada
Coauthor(s): Doug Funnell, Diversey Inc., Oakville, ON, Canada
Concern for the environment and the escalating costs of energy, water, and materials are forcing brewers to move toward more sustainable practices for every stage of the beer-making process. Clean-in-place of process tanks and lines, package lubrication, and bottle washing can use up to 36% of the total water and 25% of the heat energy consumed by the brewery. Bottle washing and CIP between them use the lion’s share of the water and energy and, therefore, present several opportunities for reductions. This paper explores several proven initiatives implemented in various breweries that are known to reduce the water, energy, and other materials in these areas. Some of the practices reviewed include CIP interface management, rinsing, detergent selection to reduce CIP steps, temperature reduction, substitution of heat sanitation by cold chemical
sanitizers, and bottle-washer rinsing operations. These reductions can amount to between 10% and 50% of the water and energy used and therefore, can lead to a significant effect on a brewery total operational cost. More importantly, these initiatives have been selected because they can be realized without involving major capital investment in new equipment to implement.

George Agius received his M.S. degree in chemistry at the Royal University of Malta and was a lecturer in organic and physical chemistry at the Royal University of Malta between 1971 and 1981. In 1982 he joined Diversey (Canada) as senior chemist in their R&D Department, leading to the position of technical director (1990) with JohnsonDiversey, where he was responsible for new product development, engineering systems, and customer technical support for the North America, Latin America, and Asia-Pacific regions. During that time, George directed the development of synthetic conveyor lubricants, new sanitizers, bottle scuff maskants, low environmental-impact and acidic CIP cleaners, bottle-washing programs, new pasteurizer treatments, flocculant process for the recovery of caustic, and associated engineering systems. George is currently working on ways to improve sustainability during cleaning applications and the development of dry conveyor lubricants for use in the brewing industry. He has contributed a number of papers on various topics to brewing and educational journals. He is a professional member of the Master Brewers Association of the Americas and a member of the Technical Committee for District Ontario. George currently holds the position of global application expert at Diversey Inc. George is married to Joyce and has two daughters, Suzanne and Louise. He enjoys canoeing, photography, astronomy, and reading on the history of science.

O-22
Use and misuse of adenosine triphosphate (ATP) in the brewing industry
Presenter: Chad Thompson, Ecolab, Inc., St. Paul, MN

Are you getting your equipment clean? How do you know? Adenosine triphosphate (ATP) has been used as a troubleshooting tool by brewers for some time to determine the effectiveness of their manual and automated cleaning programs. This presentation will discuss what ATP is, what it is not, and how to use ATP as a tool to evaluate your cleaning program. It will also outline how not to use ATP and common mistakes when implementing a program. The presentation will include “real-world” examples, allowing a variety of brewers to relate to the content.

Chad Thompson has more than 18 years of experience and in 2007 joined the Brewery Group in the Food & Beverage Division of Ecolab, Inc. as their lead scientist. His responsibilities include the development and commercialization of new cleaning, sanitizing, and lubrication products for the brewing industry. He has been brewing for 13 years and has been with Ecolab for 6 years. During his time at Ecolab he has contributed to numerous business segments within the corporation. Chad is a contributing member to the Master Brewers Association of the Americas and received an honorable mention for Best Paper in 2009. He received a degree from Michigan State University in packaging engineering and has been granted three patents for his work.

O-23
Water conservation/reuse in the modern brewery: Advantages and pitfalls to avoid
Presenter: Jack Bland, ChemTreat, Richmond, VA
Coauthor(s): Tom Soukup and Jaclynn Peterson, ChemTreat, Richmond, VA

Global consolidation in the international brewing industry, coupled with recent and sustained high energy costs have spawned renewed efforts at energy and water conservation/reuse in the quest to minimize operating costs while maximizing efficiency in all areas of brewery operation. While these water conservation and reuse initiatives have produced considerable savings, compared to previous operations, there are new potential pitfalls that, if not properly addressed, may lead to consequences not envisioned as part of the effort to deliver water and energy savings. This paper will highlight the successes of the most common water conservation/reuse initiatives in the packaging, utilities, and brewing areas and explain potential pitfalls that may offset any savings from conservation programs. In addition, the paper will highlight potential product quality issues that may arise as a result of misguided reuse of certain process water streams. Specific data gathered from more than 20 U.S. and international breweries will be summarized in order to document the findings listed in the paper. Finally, recommendations will be presented, listing “best practices” to avoid “water and energy conservation pitfalls,” while maximizing savings associated with these programs.

Jack Bland is the director of corporate technical support, Brewery Services Division, of ChemTreat, which is headquartered in Richmond, VA. He has more than 30 years experience in water-treatment programs related to packaging and utilities systems in the brewing industry, and he has authored numerous MBAA papers related to brewery water treatment. Jack has been a member of MBAA District Mid-Atlantic since 1982, and he is responsible for primary technical support for 24 U.S. and Caribbean breweries. In addition to his extensive involvement in the brewing industry, he has also served on the Board of Directors and as past president of the Cooling Technology Institute.

O-24
Impact of different malting parameters on the protein composition of malt, wort, and finished beer
Presenter: Elisabeth Steiner, TU-München, Freising, Germany
Coauthor(s): Elke Arendt, University College Cork, Ireland; Thomas Becker and Martina Gasl, TU-München, Freising, Germany

Beer is a complex mixture of over 450 constituents, and in addition, it contains macromolecules such as proteins, nucleic acids, polysaccharides, and lipids (Briggs, 2004). Out of these constituents, beer contains approx. 500 mg/L of proteinaceous material, including a variety of polypeptides with molecular masses ranging from 100 kDa (Curioni, 1995). These polypeptides, which mainly originate from barley proteins, are the product of the proteolytic and chemical modifications that occur during brewing. Depending on the complexity, problems emerge during the brewing process, hence those problems are as varied as the constituents. Response surface methodology was used to investigate the influence of three malting parameters (germination time, degree of steeping, and germination temperature) on the protein content and composition of malt, wort, and finished beer. All analyses were based on methods described in EBC or MEBAK. To evaluate the protein changes during the malting and brewing process, lab-on-a-chip capillary electrophoresis and 2D-PAGE were used. In this work we want to give insights into the influence of different malting parameters on protein content and composition in wort and finished beer. We monitored the protein size changes through the brewing process to find out which proteins (size ranges) influence the brewing process. With the combination of lab-on-a-chip capillary electrophoresis and 2D-PAGE, protein changes through the brewing process could be followed, and interesting correlations between protein composition and haze formation were established.

Elisabeth Steiner was born in 1981 in Austria. She graduated with a Dipl. Ing. degree at the Universität für Bodenkultur, Vienna, in 2005. In 2006 she worked as a trainee in the Brau Union Österreich AG. Since then she has been working as a Ph.D. student at the Institute of Brewing and Beverage Technology in the field of proteins and their influence on the brewing process with regard to haze formation and filterability.
Micromalting systems are often used to assess barley quality for malting and brewing purposes. Commonly they are applied to evaluate the breeding progress by new varieties and the influence of variety or provenance on quality characteristics and to estimate as soon as possible the quality characteristics, as well as the processability, of barley from a new crop. Pilot-scale malting systems were mostly used for scale-up trials to calculate the processing properties of barley variety and to get helpful information for malting at a technical scale. Malting trials have been performed in micro-scale (1 kg) and pilot-scale equipment (200-kg pilot-drum malting system) to point out the difference in malt quality caused by scale-up. The use of statistical software to design scientific trials, with the opportunity to calculate a model and forecast the behavior of a variety under different conditions (humidity, germination time, temperature), provides an instrument to get maximum information with a manageable number of trials. Response surface methodology was used to find an optimal malting regime for the variety on the one hand and to evaluate the impact of processing parameters on the resulting malt quality on the other hand. To determine the scale-up effect, selected malting programs of the RSM (1-kg scale) were repeated in the 200-kg pilot scale. The malt was analyzed using MEBAK methods. The results provide an informative basis for variety and plant characteristics and include 1) evaluation of the informative value of micromalting systems used as instruments to forecast the processability of a variety in large industrial production scale; 2) system limits of micromalting; 3) drawbacks and opportunities for the use of micromalting systems by selection of barley sample and varieties; 4) instructions for the practical application (performance of industrial malting systems). The results offer breeders, trade, maltsters, and brewers an opportunity to get preliminary information from micro- and pilot-malting in terms of quality characteristics (e.g., barley variety) and malting performance in industrial scale.

Martina Gastl apprentices as a brewer and malster from 1994 to 1996 in Klosterbrauerei Andechs, Germany. She studied brewing and beverage technology at the Technische Universität München-Weihenstephan, Germany. She graduated as an engineer in 2002. From 2002 to 2006 she completed her Ph.D. degree on the “Technological Influence on Lipid Degradation in Terms of Improvement of Beer Flavour Stability.” After graduation in 2002 she worked as a scientific employee and head of the GC/HPLC laboratory at Lehrstuhl für Technologie der Brauerei I (TU München-Weihenstephan) for two years, following the head of the malt laboratory. She is currently assistant professor and head of the raw material research group at the Lehrstuhl für Brau- und Getränke technologie in Weihenstephan. Since 2008 she has been working on her postdoctoral lecture qualification; her research interest involves “Characterization and Interaction of Flavour Active Taste Compounds in Cereal based Beverages Influencing Beverage Harmony.”

Increasing brewery production yield and minimizing waste to reduce operating costs using advanced separation techniques

Maximizing the yield of the brewery and, hence, minimizing waste is a major source of cost reduction and competitive advantage. In an increasingly challenging market it becomes a critical focus. Whilst the subject is considered by all beereries, the best practices and full process implementation of the latest separations techniques can produce significant yield improvements of up to 5%, depending on the size and operating procedure of the brewey. This presentation looks at individual unit operations of the brewey, including primary clarification, beer recovery from fermentation bottom yeast, and finishing, and considers the optimization possibilities and their impact on yield, waste reduction, and cost. Having considered the unit operations, the full improvement possibilities and yield increases are discussed in the context of the entire brewery. Considerations for craft breweries, regional operations, and large (over 1 million hl) beereries are given. Yield improvement options are identified for any brewey. Separation technologies and methodology developed in the last five years are discussed, including options introduced as recently as late 2009.

O-25
New application areas for micromalting systems
Presenter: Martina Gastl, Technische Universität München
Coauthor(s): Florian Schüll and Thomas Becker, Technische Universität München

In today’s market(s) we see a wider array of ultraviolet options than we have ever seen in the past. It has become quite clear that the ultraviolet industry has matured. We are seeing new players enter the industry and mature manufacturers merge, as well as new methods to deliver ultraviolet. In all we have watched the technology of ultraviolet change from the category “other disinfection methods” to a main disinfection method. UV light is used to combat disinfection by-products (DBP), as well as organisms resistant to chlorination, such as Cryptosporidium. Ultraviolet as a means of disinfecting water has been around since 1955 and became a main means of disinfection throughout the 1980s and 1990s, with the number of users increasing annually. We have learned over many years that the best ultraviolet system is a system...
well maintained. From the EPA, International Ultra-Violet Association (IUVA), and other associations, we now have standards of engineering design. The EPA has provided documentation that gives standards from design to suggested service. However, it is still in the hands of the equipment owners to maintain a working system that will meet application specific requirements. Third-party service groups such as Radiant Industrial Solutions, Nalco, and Siemens work with end-users to establish working standards that are site-specific. The focus on-site is to understand the environment conditions and, more specifically, the water quality coming into the ultraviolet vessel from the feed source. Based on this information, a UVT measurement is typically taken on-site to understand the ability or challenges of the ultraviolet system. Each ultraviolet system is designed to a UVT (ultraviolet transmittance) level that is determined by the application process. Further definition of water quality or “what is in the water” will tell us how to maintain the system. As you look at a UV system it is common to ask the question, “How do I know it is working correctly?” The answer is through proper measurement, equipment operation signals, and mechanical inspections. Each of these factors can be measured and used to better understand your system but more importantly to control the system performance. Metering is the one item within a UV system that is always discussed. This is the tattle tale of the system. With a good metering device in a UV system we will have the ability to log data that may affect the performance of UV disinfection. With a logging meter, we can measure and record all of the variables of the system. There are only a few manufacturers that actually record this data, thus leaving the end-user to record the data by hand. Advancements in the field are changing this and providing metering that can record these points within a given UV system. The key to a properly working system is to understand the measurements available per installation.

Troy Smith is the president and owner of Radiant Industrial Solutions, Inc. based in Houston, TX. Troy has been in the ultraviolet water and air markets for more than 20 years. Prior to Radiant Industrial, Troy worked with Trojan Technologies, Aquafine, Technical Connections, and Ultraviolet Systems and Equipment. Troy has been involved with regulatory compliance, as well as organizations that include IBWA, ISBT, Ashrae, SGIA, Radtech, and other technical committees. Over the past 10 years Troy has been involved in product patents, as well as providing training seminars and educational training on the topics surrounding ultraviolet technologies throughout various industries and tradeshows.

O-30
Flexibility beats restrictions—Brewing control at its best
Presenter: Martin Lutz, ProLeIT International GmbH & Co. KG, Herzogenaurach, Germany

Brewers need automation solutions that support them in the best possible way within the specifics of their business—flexible, module-based systems that guarantee production safety, product versatility, and easy enlargement with the growth of the brewery. The lecture will address the following topics: benefits of process automation in general; possibilities within state-of-the-art automation and data management systems for brewers; difference of mere SCADA systems to real process control systems; how easily a system can “grow” with the success of the brewery; advantages of “off-the-shell” brewery-specific modules compared to applications with nonspecific automation products; examples of realized applications. The intention is to give an overview of what is, with a realistic effort, possible and, therefore, reasonable with today’s automation and data management systems for breweries of different sizes and needs. The audience shall be able to judge what makes sense for them in the current stage of their business and what can be the development for them as a final goal. We focus on the benefits of process automation systems with respect to product safety and quality; the flexibility to support a brewmaster’s creativity in finding new tastes or following-up their production with automatic supply of the figures for raw materials consumed and produced amounts of wort and beer; tracking and tracing of production; defining the key performance indicators; and quality statistics, historical analysis, or energy consumption data.

Martin Lutz graduated with a brewmaster degree from Weihenstephan University, Germany. After several years of working in medium- and small-sized breweries, he joined ProLeIT in its business field of brewery automation and manufacturing data management. He has gained profound knowledge of the various aspects of brewery automation and is connecting the requirements of the brewmaster with the possibilities and structures of modern process control systems.

O-31
Inline measurement for process validation—New comprehensive process control tools for milling, mashing, lautering, and boiling
Presenter: Jens Voigt, Technische Universität München Weihenstephan, Freising, Germany
Coauthor(s): Hans-Joerg Menger, Ziemann, Ludwigsburg, Germany; Heinz Dauth and Johannes Tippmann, Technische Universität München Weihenstephan, Freising, Germany

Technical and technological complexity and interdependence between the brewing process steps of milling, mashing, lautering, and boiling, as well as the knowledge of their technical/technological influence on the product quality and plant economy form the basis for research and development of an in-line process validation. The target of the described development is to implement different types of in-line measurements, e.g., particle size measurement during mashing, viscosity measurement during mashing and lautering, conductivity measurement during mashing, particle size measurement during wort boiling, etc., in a complete network unit and to use the collected process data in order to create a self-optimizing process control system. For example, a combination of the data measurement of viscosity and particle size distribution during the mashing process can be used in order to optimize the rest times and temperatures during the mashing process. The grist structure reached during milling, which is responsible for an effective and fast mash filtration—particularly for lautering with lautern tuns—can be used to adapt the particle size of the grist or the amount of added water during conditioning of the malt or the rest time after conditioning if the whole grain-conditioning milling system or a traditional conditioning system is used. This in-line adaptation of the mechanical effect during milling can be used to increase the permeability of endosperm cell walls, as well as the active surface of substrates, which improves the amylolysis, proteinolysis, and cytolysis for the mashing process and the husk structure for the lautering process. Another example is the in-line measurement of the particle size distribution changes during wort boiling. These figures give the possibility to influence the protein size structure or to identify and fix protein size distribution during boiling. All described issues were tested and developed as part of the process chain analysis at TUM Weihenstephan and tested both in the lab and in a 10-hL pilot brewery plant of Ziemann Ludwigsburg GmbH.

Jens Voigt received a Dipl. Ing. (M.S.) degree in brewing and beverage technology from TU München Weihenstephan, Germany, in 1985. He started his career with A. Steinecker GmbH, Freising, as a technical engineer in brewhouse and fermentation and filtration equipment. He held sales and product manager positions with Steinecker until 1995. From 1988 until 1992 he worked on his doctorate in brewing technology on beer foam from Weihenstephan (under Professor Narziss). In 1996 he joined Doemens Brewing School in Munich, Germany, as managing director. In late 1997 he joined Heinrich Huppmann GmbH, Kitzingen, Germany, as key account manager for brewery equipment and was managing director of brevmaxx, a supplier of software solutions for the brewing industry. Since early 2004 he has been a research associate with Professor Karl Sommer (Chair for Mechanical Engineering and Process Technology) at the WZW (Wissenschaftszentrum Weihenstephan), Center of Life Science, Technische Universität München Weihenstephan, working on brewing and beverage process technology issues. He is a
Germany

sensorial and analytical attributes, as well as their behavior during aging
understanding of the conversions occurring during the brewing process.
boiling process. The problem of degradation is even more pronounced if
of beer. Particular attention is paid to the bitterness profiles of fresh and
were done to evaluate the influence of various degradation products on
products were done. The results presented in this paper provide a better
extent. Previous work showed factors affecting the rate of degradation.
improved yield of bitter acids and improved bitter quality are shown!
on the other hand due to iso-alpha-acids that are degraded during the wort
acids contribute to the perception of bitterness as well, but to a lesser
beers. In the brewing process, however, only about 30% of the alpha-acids
of assistant, he started his studies on brewing science at the Technische
received a Dipl.-Ing. degree in brewing and beverage technology from Technische
the Augustiner-Wagner brewery in Munich as an
Sebastian Kappler received a Dipl.-Ing. degree in brewing and beverage
Company, where he is currently the assistant brewmaster. While working
at New Belgium he received his M.S. degree in brewing and distilling from Heriot-Watt University.

O-34
Influence of hopping on beer quality
Presenter: Adrian Forster, German Hop Growers Association, Wolnzach, Germany

Although the influence of hopping on beer quality has been documented intensively, there exist still controversial results. Therefore a simple and concise test series is presented as follows: to 5 beers with low bittering units (approx. 15 mg iso-alpha acids/L) and little specific character ever-increasing amounts of aroma hops were added. The effects on analysis values, sensory results, and costs will be discussed. During the first German Hop Day in Tettmang in 2009, the beers were tested by the participants of the workshop. By using aroma hops, the corresponding clean beer bittered only with isomerized extract could be improved considerably regarding body, palatableness, hop aroma, and harmony of bitterness; this was achieved by moderate additional costs of up to 0.10€/hl beer. As a result, it becomes obvious that even beers with little specific character and low bittering units can be enhanced sensorially by the use of aroma hops.

Adrian Forster attended the Technical University Munich Weihenstephan
and obtained a Ph.D. degree in brewing science in 1972. Until 2003, Adrian was the managing director of one of the world’s leading hop extraction and hop pellet plant, with responsibilities also in research. Adrian has published extensively on hop-related topics and currently works as a hop consultant.

O-35
Influence of various degradation products of isohumulones on resulting beer quality
Presenter: Sebastian Kappler, Technische Universitaet Muenchen, Freising-Weihenstephan, Germany
Coauthor(s): Udo Kattein, Thomas Becker, and Martin Krottenthaler, Technische Universitaet Muenchen, Freising-Weihenstephan, Germany

Iso-alpha-acids are the major contributor to the perception of bitterness in beer. They contribute to over 85% to the overall bitterness of traditional beers. In the brewing process, however, only about 30% of the alpha-acids present in hops are isomerized and transferred into the finished beer. On the one hand losses occur due to alpha-acids that are not isomerized and on the other hand due to iso-alpha-acids that are degraded during the wort boiling process. The problem of degradation is even more pronounced if pre-isomerized kettle extract is used. Degradation products of iso-alpha-acids contribute to the perception of bitterness as well, but to a lesser extent. Previous work showed factors affecting the rate of degradation. It could be shown that about 20% of dosed isohumulones to wort are degraded within 90 minutes of boiling. By varying wort composition and boiling parameters the losses could be reduced. In this work the influence of degradation products on overall beer quality is shown. Pilot-scale trials were done to evaluate the influence of various degradation products on sensorial and analytical attributes, as well as their behavior during aging of beer. Particular attention is paid to the bitterness profiles of fresh and forced-aged beers. Also, trials with reduced amounts of degradation products were done. The results presented in this paper provide a better understanding of the conversions occurring during the brewing process and their influence on beer quality. Suitable approaches toward an improved yield of bitter acids and improved bitter quality are shown!

Sebastian Kappler received a Dipl.-Ing. degree in brewing and beverage technology from Technische Universitaet Muenchen in 2008. He began his employment with the Augustiner-Wagner brewery in Munich as an apprentice to a brewer and maltster in 2000. After achieving the position of assistant, he started his studies on brewing science at the Technische
O-36
Possibilities to influence the hoppy flavor of beer
Presenter: Stefan Hanke, Lehrstuhl fuer Brau- und Getraenketechnologie, Freising, Germany
Coautho(s): Thomas Becker, Werner Back, and Martin Krottenthaler, Lehrstuhl fuer Brau- und Getraenketechnologie, Freising, Germany

A pleasant hoppy flavor of beer is a fashionable way to distinguish a brand from competitors in the market. In order to achieve a perceivable hoppy flavor in beer different methods can be used. Most common are late hop additions at the end of wort boiling or in the whirlpool. From several hundred aroma compounds found in hops only a few are known to have an impact on the hop aroma of kettle-hop aroma. Another method, mainly applied in the craft brewers segment, is hop addition after the main fermentation. This so-called “dry-hopping” imparts flavor impression that are different from the late kettle hop flavor. It is well known that the content of bitter acids in hops is subject to seasonal variations. In general, the hop dosage in the brewery is determined according to the alpha-acid content, which of course can lead to totally different contents of hop aroma substances in the finished beer. This results in different aroma intensities, which can be detected by the consumer. To create a seasonally independent hop aroma, transfer rates of different hop aroma compounds were calculated and verified for the different hopping technologies (late hopping vs. dry-hopping). It can be shown that linalool is a suitable indicator of hoppy flavor when hop addition is done at late stages of wort boiling. Linalool showed very good correlation with the intensity of the hoppy flavor. Other aroma compounds behaved differently. In this study variety depending on transfer rates of aroma compounds will be presented. It is also shown that the concentration of hop volatiles is influenced by fermentation temperature. Additionally the perception of hop aroma is influenced by fermentation by-products. This proves that hops can enhance beer quality, and a dosage according to oil and/or linalool content is the best approach to create hoppy beers.

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. In 2010 he finished his Ph.D. degree, which dealt with the influence of hopping technology on the harmony of beer. During his studies, he worked for and received practical training at several 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 GC/HPLC Laboratory of the institute. His main research topics are the influence of hops on beer drinkability and the influence of beer matrix on bitter taste. Since May 2009 he has been the head of the GC/HPLC Laboratory of the Chair for Brewing and Beverage Technology (Professor Becker).

Val Peacock holds a B.S. degree in chemistry from Iowa State University (1973) and a Ph.D. degree in organic chemistry from the University of Wisconsin (1978). Val was a research associate at Oregon State University from 1978 to 1981, working on the chemistry of hop flavor in beer. From 1981 to 1986, Val was a research scientist with the Philip Morris beverage Research Lab & Seven-Up Company. From 1978 to 1988, Val was a research associate at Oregon State University (hop flavor). From 1988 to 1989, Val was a research chemist for Redd Citrus Flavors (Safety Harbor, FL). From 1989 to 2008, Val was the manager of hop technology for Anheuser-Busch. Currently, Val is the sole proprietor of Hop Solutions Inc. (HSI), a consulting firm serving the brewing and ethanol industries.
WBC 2012

Save the Date
July 28–August 1
Oregon Convention Center
Portland, OR, U.S.A.

www.worldbrewingcongress.org

Hosted by:
American Society of Brewing Chemists
Master Brewers Association of the Americas

With active participation by:
Brewery Convention of Japan
European Brewery Convention
Institute of Brewing & Distilling
P-38  
Comparisons between the requirements of electrical and thermal energies of different wort-boiling systems with regard to the wort aroma profiles  
Presenter: Udo Kattein, TU München, Freising, Germany  
Coauthor(s): Sebastian Kappler, TU München, Freising, Germany  
Besides the mainstream modern wort boiling systems with internal and external heat exchangers, in the last decade a new generation of vacuum plants was established in the brewhouses. As these devices perform evaporation during wort treatment only partly by feeding thermal energy but predominantly by vacuum application, a high saving of energy was promised by the manufacturers. Otherwise an additional amount of electrical energy must be considered to energize the vacuum devices. Furthermore a lower amount of thermal energy can get reclaimed, as these plants have lower evaporation rates and temperatures in the vapors. So it would be of interest to look at these figures in comparable test arrangements. As our research brewery installed all these plants, it was possible to compare the different systems and to monitor the energy inputs under otherwise identical conditions with regard to similar wort qualities. We made the decision to test four different wort boiling systems: internal heater with circulation pump, external heater with circulation pump, “Vario Boil” and “SchoKo.” All brews were performed with identical raw materials and with the normal parameter settings of the particular systems. The complete energy uptakes were monitored and recorded, including the electrical energy requirements of all circulation and vacuum pumps and agitators completed by the thermal inputs of live steam. In former trials it could be proved that the fundamental quality parameters such as coagulable nitroene, TBN, and free DMS were achieved by all these systems. In these investigations, therefore, we looked mainly at the aroma profiles of the finished worts. They were analyzed to these special needs and concentrations of strecker aldehydes, 2-furfural, and DMS were determined. The paper shows the additional installations and parameter settings of the different systems and gives an overview of the first results of the finished worts.

Udo Kattein received a diploma engineer degree from the Technical University of Munich – Weihenstephan in 1972; afterward, he performed an economic study at the University of Munich, finishing a diploma merchandiser degree in 1976. At that time he started work on his doctoral thesis and employment at the TU Munich. He was in charge of the technical leadership of the Trial and Research Brewery Weihenstephan. He served as head brewer and was responsible for production of commercially sold malts and top-fermented beers. In addition to theses, tasks he was involved in the development of new beer types and training students. In 1984 he received a Ph.D. degree in engineering sciences, with a thesis on investigations of sulfur compounds in malt, wort, and beer. Since 2002 he has been responsible for the construction of the new malting ad brewing facilities of the research brewery, which began in 2005.

P-39  
The new Research Brewery Weihenstephan—A universal platform for scientific research, training courses, and technology  
Presenter: Udo Kattein, TU München, Freising, Germany  
Coauthor(s): Martin Krotenthaler, TU München, Freising, Germany  
Scientific research as well as the training of students demand the most modern technical equipment, which must be suitable for the production of high-quality malts and beers at semi-industrial scale. Furthermore the equipment should be able to perform all process engineering that is common in commercial breweries worldwide. To achieve these goals, the new Research Brewery Weihenstephan was constructed and has proved its capabilities. All kinds of plants for processing 200 kg of barley to malt and 150 kg of malt to beer were installed and run without problems. The best facilities are now available for widespread research with regard to malt and beer production through to finished and bottled beers. The malting device has one steeping tub, two germination units, and one kiln dryer. The brewhouse equipment comprises dry and wet malt-milling devices, one mashing vessel that permits hyperbaric boiling of adjuncts as well, a lauter tub, a mash filter, and a wort kettle that is suitable for hyperbaric processing. Two different heating systems and two kinds of vacuum plants complete these highly sophisticated processing facilities. Hot-break separation and further treatment of the wort during fermentation and maturation is built up in a classical shape. Beer filtration can be performed with kieselguhr and sheet filter or via membranes as well; small fully automated devices for filling kegs or bottles complete the brewery equipment. This poster gives an overview of the construction progress during the last few years and the final installation details of the malting and brewing facilities. The whole pattern of available process engineering is described and illustrated. An overview of the practical courses offered to students completes this poster.

Udo Kattein received a diploma engineer degree from the Technical University of Munich – Weihenstephan in 1972; afterward, he performed an economic study at the University of Munich, finishing a diploma merchandiser degree in 1976. At that time he started work on his doctoral thesis and employment at the TU Munich. He was in charge of the technical leadership of the Trial and Research Brewery Weihenstephan. He served as head brewer and was responsible for production of commercially sold malts and top-fermented beers. In addition to theses, tasks he was involved in the development of new beer types and training students. In 1984 he received a Ph.D. degree in engineering sciences, with a thesis on investigations of sulfur compounds in malt, wort, and beer. Since 2002 he has been responsible for the construction of the new malting ad brewing facilities of the research brewery, which began in 2005.

P-40  
Cleaning in place (CIP) in breweries using an acid formulation that is phosphorus-free and respects the environment  
Presenter: Vijay Srinivas, Arkema Inc., King of Prussia, PA  
Coauthor(s): Jean-Alex Laffitte and Bernard Monguillon, Arkema, Lacq, France  
The various tanks employed in breweries need frequent cleaning to remove scale and beerstone. Cleaning in place (CIP) systems using caustic formulations have predominated in the industry for some time. While it is efficient to dissolve organic impurities, there are inherent disadvantages, such as the need to vent carbon dioxide from these tanks prior to introducing caustic detergents, extensive rinsing needed to remove caustic detergents, and significant risks of inefficient scale elimination. Acid-only cleaning has been gaining some ground based on the various advantages, they increase the phosphate and nitrate content in the effluent water. Scaleva solution, developed by Arkema, is a strong acid that is very efficient and has better scale-removal efficiency than phosphoric acid and beerstone removal efficiency equivalent to the currently used mixtures of phosphoric acid and nitric acid. Plant-growth nutrients such as phosphorous in effluent waters need to be reduced now. Eutrophication of lakes and rivers all around the world caused by phosphates and nitrates present in treated wastewater has been recognized as a serious problem. Algal blooms have created “dead zones” in water bodies, where aquatic life is not sustainable due to severely depleted oxygen levels, a condition known as “hypoxia.” One source of aqueous
effluent phosphorus is phosphoric acid-based detergents used to clean tanks in breweries. This puts significant pressure on water-treatment facilities to treat these effluents to reduce the phosphorus content to regulated levels for the specific region. As we know the EPA has set nutrient water quality criteria by ecoregions for lakes and rivers. Nearly half of all U.S. states have enacted phosphate restriction laws. It has also established a National Pollutant Discharge Elimination System (NPDES) permit for discharging pollutants to surface waters. A total maximum daily load (TMDL) has been established by various states, which supports a specific section of the Clean Water Act, allowing the EPA to restore water quality by identifying bodies of water that do not meet these standards as “impaired.” Effluent wastewater generated from the use of Scaleva solution is free of any phosphorus and does not need any special treatment in water-treatment facilities. We will present some comparative data on the efficiency of Scaleva solution for the removal of scale and beerstone and highlight some synergies that could be observed with specially formulated Scaleva solutions. We will also present some data on the stability of Scaleva solution in the presence of commonly used emulsion systems in detergents for the brewing industry.

Vijay R. Srinivas is currently a principal scientist in the Thiochemicals Department of Arkema Inc. He has been involved for more than 25 years in the technical promotion of several thiochemicals in refinery, petrochemical, and polymer markets. Prior to this he was an R&D manager, in charge of new process and product development. Vijay’s graduate work in the United States and at the Indian Institute of Technology was in organic chemistry, with a particular emphasis in heterogeneous catalysis. After completing his post-doctoral training at the University of Chicago, Vijay joined the Thiochemicals Department of Pennwalt Corporation in 1984 (now Arkema Inc.). Early in his career, he worked on the development of new catalysts and processes for the manufacture of various thiochemicals. Several of these are currently in commercial use. In 1997 he was one of the recipients of the Elf Innovation Award for the development and commercialization of a catalyst to make mercaptans, which he shared with a colleague. He is a member of the MBAA, MBAA District Philadelphia, and the American Chemical Society.

P-42
Stainless steel passivation and its importance for the brewery with respect to equipment maintenance and sanitation
Presenter: Dirk Loeffler, Loeffler Chemical Corporation, Atlanta, GA

Stainless-steel equipment requires periodic maintenance, just like any other piece of equipment in the brewery. The importance of stainless steel passivation and its physics are still a mystery for most breweries and sometimes even for equipment manufacturers. This paper discusses the different grades of stainless steel and why only certain grades are suitable for use in equipment that is in contact with beer. It will explain the process of passivation, how it plays a vital role in both maintaining the stainless-steel equipment in a brewery, and how it is often directly related to cleaning problems. The paper also addresses how poorly manufactured equipment can impact the flavor of beer and discusses chemical remedies.

Dirk Loeffler is the technical director for Loeffler Chemical Corporation, a chemical company specializing in cleaning products and technologies for breweries. In his capacity as technical director, he is continuously involved in developing new cleaning technologies and products for breweries. A native of Cologne, Germany, Dirk graduated with a business degree in Cologne, Germany, and started working for Chemische Fabrik Kalk GmbH. In 1990, he joined the family business of Karl Loeffler GmbH and Co. KG as the third generation. In 1992, he came to Atlanta, GA, to lay the groundwork for the start of the U.S. operation of Loeffler Chemical Corporation. He has been a member of MBAA since 1993, and he is also a member of BA and ASBC.

P-43
Use of on-site generated disinfectants in three-step clean-in-place operations
Presenter: Andrew Boal, MIOX Corporation

Clean-in-place (CIP) operations are a critical step in beverage manufacturing, providing necessary cleaning and sanitization of lines that allow for high-quality products to result from the manufacturing process. Traditional CIP cleaning methodologies utilize a five-step process in which a line is rinsed with water, hot detergent, water, a sanitizer solution, and a final water rinse. While highly effective, these five-step processes take up time that could otherwise be utilized for increased production. Recently, MIOX has been investigating the application of on-site generated mixed oxidant solution (MOS) to CIP. In these studies, we have found that MOS can be used as part of a three-step CIP process: water rinse, MOS rinse, and a final water rinse. This three-step process has been found to provide comparable cleaning and disinfection of production lines, but the length of the CIP process could be decreased by as much as 40% compared to traditional five-step processes. In this presentation, we discuss some of the details, challenges, and outcomes resulting from various pilot studies of applying on-site–generated MOS to CIP processes.

Andrew Boal received his doctorate in organic chemistry from the University of Massachusetts in 2002. Since then, he has worked as a post-doctoral researcher at Sandia National Labs, fellow at the NASA Astrobiology Institute at the University of Hawaii, and senior member of the technical staff at Sandia National Labs, accumulating more than 50 peer-reviewed and other technical publications over the years. In 2008, Andrew joined MIOX Corporation in Albuquerque, NM. At MIOX, Andrew’s research is centered on a broad spectrum of topics of interest to the municipal and industrial water sectors. In addition to leading applied research initiatives at MIOX, such as the recently awarded National Science Foundation grant to study chlorine-based advanced oxidation processes, Andrew also leads MIOX’s scientific efforts in the applications of on-site generated disinfectants for the beverage industry.

P-44
Using antifoams in fermentation
Presenter: Dana Johnson, BIRKO Corporation

Brewers are facing ever-increasing economic obstacles and demands that impact the bottom line. Raw materials, energy, packaging, and chemical prices have all increased dramatically in recent years. Maintaining a comfortable profit margin has become a real struggle for brewers, regardless of size. Successful brewers are finding ways to reduce costs, cut down on waste, and improve efficiency. One of the ways brewers are accomplishing this and improving the quality of their beer at the same time is with the use of antifoam. For the purpose of this talk, I will focus on using antifoam in fermentation to reduce loss, improve head retention, and optimize efficiency.

After attending Mesa College in Grand Junction, CO, Dana Johnson joined BIRKO Corporation’s research and development staff in 1979. During his 30 years working in the lab at BIRKO, Dana has been in charge of quality assurance on finished products, managed the Contact-It bacteria detection system, and formulated products for the food processing and brewing industries. A home brewer since 1989, Dana began calling on the brewing industry for BIRKO in 1995. Dana is currently the membership chair for MBAA District Rocky Mountain and MBAA membership co-chair for the Western United States of America.
P-45
Achieving a higher than 99.998% vol. CO₂ purity through removal of non-condensables in a CO₂ recovery system
Presenter: Heiko Grimm, Norit Haffmans, Venlo, The Netherlands

CO₂ recovery systems allow today's brewers to ensure a high-quality product through the recovery, purification, and liquefaction of raw fermentation CO₂ gas. Using state-of-the-art equipment in the brewery results in knowing the source of the CO₂ gas, lower CO₂ costs, a reduction in CO₂ emissions, and, of course, the highest in final liquid CO₂ quality. By recovering and supplying your own liquefied CO₂ from your by-product source, you ensure that it is of the highest quality and purity that will improve the overall shelf life of your products. The reduction of the non-condensable gases in the liquefied CO₂ from fermentation to an extremely low amount of less than 0.002% vol is achievable using a liquid CO₂-stripping system, a part of the liquefaction system in a CO₂ recovery plant. This system takes advantage of the fact that condensed CO₂ gas from fermentation passes through a stripping column counter flow to high pure evaporated liquid CO₂ from the reboiler. Due to the lower partial pressure of the non-condensable gases in the CO₂ gas, the non-condensables present in the liquid CO₂ will vent from this liquid phase, resulting in a final liquid CO₂ purity of better than 99.998% vol (less than 5 ppm O₂).

Heiko Grimm graduated in 2007 from Technische Universität München – Weihenstephan with a master's degree in brewing and beverage technology. Immediately after finishing his, master’s thesis on new beer stabilization methods, Heiko began working for Norit Haffmans BV in June 2007 as CO₂ units product manager. In this position he was responsible for the units and inline business worldwide. In 2010, he transferred to the position of CO₂ systems product manager. He is currently responsible for the U.S., Canada, Mexico, and Caribbean regions for all CO₂ systems sales.

P-46
Design of a utility monitoring system using the example of a brewery
Presenter: Hans-Joerg Menger, Ziemann Ludwigsburg GmbH, Ludwigsburg, Germany
Coauthor(s): Theo de Groen and Tobias Becher, Ziemann Ludwigsburg GmbH, Ludwigsburg, Germany

Thinking about enterprise resource planning, such as a manufacturing execution system (MES), the first step demands steady, compact, and complete data records, which leads to a manufacturing information system (MIS) in the second step. This paper serves as a description of a basic building block for the development of an MIS for a brewery. It contains specific evaluation toward the overall goal of a consistent monitoring system and proposes a systematic way of looking at measuring utilities. Breweries can be segmented in a “utility block,” “hot block,” “cold block,” and “packaging block.” This paper concentrates on these blocks and ignores further logistic and administrative segments. The utility block (UB) can be defined as a functional block where the inputs are the primary utilities and the outputs are primary and secondary utilities. The remaining blocks, hot, cold, and packaging, are then solely users of the utilities provided by the UB. Utilities in the context of this paper consist of energy, water, and other utilities. Energy is delivered to the brewery as electrical or thermal energy, mostly in the form of fossil fuels. Water is either sourced from a municipal source or can come from brewery-owned wells. Other utilities in this context are not energy or water. Utilities can be divided into those sourced from outside the brewery perimeter and those made “in house.” The ones sourced from outside are referred to as primary utilities, e.g., municipal water, natural gas, and electricity. Secondary utilities will be steam, de-aerated water, compressed air, etc. They are all made by converting and combining primary utilities. Where to locate the actual metering devices will be different from brewery to brewery. It depends on many factors, such as the actual utility distribution schematics, device specifications, maintenance considerations, and local safety regulations, just to name a few. So, more important then the physical location is how to go about determining the locations that can be adapted to most breweries. The utility monitoring system introduces a thought pattern that can be easily adapted for this purpose.

Hans-Joerg Menger was awarded a doctor of science degree by the University of Stuttgart-Hohenheim (Germany) in 2003. He started an apprenticeship as a brewer and malster in 1985 and, in 1990, began studying food technology at the University of Stuttgart-Hohenheim, with a special focus on brewing science. In 1998 he started his professional career at Ziemann Ludwigsburg GmbH (Germany) in the Engineering/Technology Department. Since 2000 he has been in charge of patents at the Ziemann Group. In 2003 Hans-Joerg was appointed manager of the Engineering/Technology, Research and Development, and Patents Departments.

P-47
Traditional and novel tools for sizing and specification of beer tanks
Presenter: Jaime Jurado, The Gambrinus Company Breweries, San Antonio, TX

Brewers’ proven rules-of-thumb are reviewed for sizing fermenters, unitanks, aging tanks, and bright beer tanks, because they are a good start to the process of identifying the required right size tank(s). A design methodology is presented, where a driving parameter is defined; the driver could be incremental expansion, minimization of tank surface/volume ratio, optimizing utilization of an available footprint, staging of new tanks for an existing brewhouse while anticipating a newer, larger brewhouse, sizing new tanks while anticipating other later processing area changes, or maximizing tank size in constrained physical boundaries or to process new and novel products. Examples are presented of traditional sizing decisions versus contrasting ones that feature some form of quantifiable plant optimization. Some basic underpinning calculus is presented to illuminate optimality quantification. A brief review of customer tank specifications is included.

For 13 years, Jaime Jurado has served as director of brewing operations for The Gambrinus Company, which brews and packages beer in Texas, Oregon, and California, as well as contracted beer in New York. He has an undergraduate degree in chemical engineering and a master’s degree in electrical engineering (evening courses taken during his tenure as master brewer). He also undertook further postgraduate study and research in medical engineering during three years at Oxford University, and he has worked at large breweries in the United States, as well as in England and Ireland, and a startup in Rajasthan, India. He has served as chair of the MBAA Technical Quarterly Editorial Board. He has been in breweries since 1982. He was president of MBAA in 2005. Jaime is a senior member of the AIChE and ACS, where he has served as a program chair and is currently chair of the San Antonio Section. He has authored a number of publications, including technical papers and an MBAA book chapter. He delivers graduate seminars and undergraduate lectures in chemical engineering departments and in 2009 and 2010 has been busy with invitations and chemical engineering seminars at Columbia, Bucknell, Georgia Tech, UC-Berkeley, UC-Davis Engineering, Drexel, Melbourne School of Engineering, Kansas State, Colorado, Texas, Rice, Minnesota, Cambridge, Oxford University, and others, as well as the AIChE Western Regional Meeting and ACS Southwest Regional Meetings.

P-48
Yeast propagation manager – YPM
Presenter: Helmut Kühnl, Esau & Hueber, Schrobenhausen, Germany
Coauthor(s): Stephan Birle, Munich Technical University, Germany; Markus Fellner, Gimhio mbH, Adelschlag, Germany; Jörg Lehmann and Harald Wening, Germany Spaten-Franziskaner-Löwenbräu GmbH, Munich, Germany; Ernst Potzl, Esau & Hueber, Schrobenhausen, Germany; Thomas Becker, Munich Technical University, Germany
Intensive yet flexible yeast propagation is the basic requirement for successful yeast management. Short propagation cycles and high cell counts with maximum quality and production safety constitute stringent requirements for such a process and its control. This paper presents a highly flexible and user-friendly software solution for the targeted control and optimization of yeast propagation. The product was developed by Gimbio in cooperation with Esau & Hueber and is based on a virtual system manager, the so-called “yeast propagation manager” (YPM). It is already being successfully used at the AB-InBev site in Munich (Franziskaner Wessbier, Löwenbräu, and Spaten). Under normal circumstances, yeast supply is a static, recipe-driven process with isothermal management and continuous or intermittent ventilation. The settings are mostly statically selected or based on values obtained by experience. The process settings, therefore, do not take the current yeast requirements into account. Operating interruptions or changing process conditions, therefore, can be eliminated only by manual sample taking and lab analyses and, therefore, are a time-delayed response of the system operator. Pure yeast culture is a product of a static, recipe-driven process, isothermal management, continuous/intermittent ventilation, and time-delayed response and manual intervention by the system operator. The YPM used at the Esau & Hueber pure culture plant in Munich is based on the virtual expert system developed by Gimbio and the Institute for Brewing and Beverage Technology of TU-Munich in Weihenstephan. It is a software solution that takes over the tasks of a system operator, thus assisting the latter in this task. Unlike previous, rigidly recipe-controlled management systems, the virtual expert is designed for situation-related process management. It constantly and simultaneously monitors all process-related parameters and carries out adjustments in the event of a deviation from the ideal state. The virtual expert does not respond like a conventional control system, i.e., to individual deviations; it optimizes the process after carrying out a linguistic evaluation of the overall process. The required decisions are not taken on the basis of mathematical equations or models but rather on the basis of expert knowledge. The software simply plugs into the current brewery control system and can be linked to all systems. It is installed on a standard PC, which has an interface to the control system. The virtual expert system uses this interface to read all the information available about the process and makes use of the control and setting parameters that influence the process.

Helmut Kühnl, born in 1957, was working his way up from the bottom when he started in 1974 as an apprentice brewer and maltster at Spaten Franziskaner Bräu in Munich. In 1977 he started his studies in brewing technology at the Technische Universität Weihenstephan and received his brewmaster diploma in 1980. Three years later he completed his degree in business economics. After working as a key account/sales manager in the German market for Alfa Laval and APV, he 1998 joined Esau & Hueber as sales director. Under Helmut’s procurement and responsibility Esau & Hueber perfected its yeast management processes during the last decade and has become one of the world’s leading suppliers in this segment. In particular, he was significantly involved in the development of the successful yeast management system Flexi Prop, which allows pure culture propagation and crop yeast revitalization, both in one plant.

P-50
Proper storage and shelf life of concentrated brewing worts and syrups
Presenter: Elizabeth Walston, Briess Malt and Ingredients
Coauthor(s): Robert Hansen, Briess Malt and Ingredients

In today’s flexible manufacturing environment concentrated worts and specialty brewing syrups are finding increased application. These brewing syrups have potential quality and spoilage concerns if stored improperly. Bulk tank, mini bulk totes, drums, pails, and other packaging each have unique storage condition-related problems. The root causes of these problems are the same. These concentrated products are preserved from spoilage by virtue of their low water activities. Fluctuating temperature conditions or refrigeration during storage can cause condensation to form inside the package and allow spoilage to occur. Storing the products at elevated temperatures causes color development and quality problems. The fundamental basis for these problems is examined and their effects quantified. From this analysis best storage practices are recommended.

Elizabeth Walston received a B.S. degree in food science and biochemistry from the University of Wisconsin-Madison. She began her career as a malting intern with Anheuser-Busch and also worked for the USDA Cereal Crops Research Unit in its Malt and Barley Division.
worked in the food industry for the J.M. Smucker Company as a quality supervisor. She is currently a quality assurance chemist with Briess Industries, focusing on malt and ingredient testing, as well as food and brewing applications. Elizabeth is an active member of MBAA and ASBC.

P-52
Evaluation of diseased and damaged hops in finished beer
Presenter: Andreas Gahr, Hopfenveredlung St. Johann, Germany
Coauthor(s): Laura Hansen, MillerCoors LLC, Golden, CO

The purpose of this work is to evaluate if defective, poor quality hops have an effect on the final quality of beer. To evaluate the outcome, one lot of raw hops that was damaged due to disease, vermin, weather, and mishandling was selected, photographed, and analyzed in comparison to premium quality hops of the same variety. Comparing the analytical data of the two lots no differences could be found when applying the standard analyses regarding bitter substances content, as measured by HPLC or hop storage index (ASBC method), which does not meet the expectations from the significant difference in appearance and sensory evaluation of the raw hops. Lager beers were brewed using the two comparative lots in a 2-hL pilot brewery, applying the hops in an early and late addition. The beers were analyzed, and several sensory tests, including triangular and descriptive taste tests, were conducted in order to describe the sensory impact of the spoiled hops on final beer quality, especially the quality of the bitterness and aroma composition.

Andreas Gahr was trained for two years on the job as a brewer and maltster at the Augustiner Brewery in Munich, Germany. He received a brewmaster degree from the Technical University Munich-Weihenstephan in 1994 and worked for another four years at the university for the Chair of Brewing Technology. Since 1998 Andreas has been the head of the Research Brewery St. Johann, which belongs to the hop processing company Hopfenveredlung St. Johann GmbH & Co. KG and deals with all kinds of hop-related trials and product developments, as well as technological and raw material trials for suppliers and the whole brewing industry.

P-53
Disposable kegs—A review on current systems and latest German DIN standards
Presenter: Johannes Tippmann, Technische Universität München - Weihenstephan, Freising, Germany
Coauthor(s): Ulrich Schober, Deutsches Institut für Normung e.V., Berlin, Germany; Klaus Doersam, Berufsgenossenschaft Nahrungsmittel und Gaststätten, Mannheim, Germany; Jens Voigt, Technische Universität München Weihenstephan, Freising, Germany

With the growing export of beer to countries all over the world, breweries have a series of problems that cause high costs. As an alternative cask, disposable kegs have been established in the past years. With this new type of package, new standards were necessary. The German Institute of Standardization (DIN) published a first version in the first years of 2000. With the production and testing of such casks, started in the last few years, the real necessity has been identified. Therefore, the standard DIN 6647-4 has been revised. The institute has collected many experiences on this topic in the past few years. A test method was established and conducted on different types of disposable kegs. Furthermore, a calculation model was created that can be used as a tool to calculate CO₂ emissions, as well as the financial benefit when using disposable kegs. Besides a short overview on the current systems, figures and facts on the subject will be presented.

Johannes Tippmann graduated from university in 2004 with a Dipl. Eng. degree in brewing sciences and beverage technology. In 2005 he started work on his Ph.D. thesis with Professor Sommer on solids handling in the brewhouse. He collected many experiences in procedural knowledge of beer production during his studies, performing student research projects and his diploma thesis on this topic. Since 2000 he has worked as a student research assistant in dispensing systems and collected lots of experiences in this subject area. Since 2006 he has been responsible for research issues in dispense systems at the institute. He is also a member of the “Dispensing Systems” Technical Committees of the Government Association for the Food and Catering Industry (BGN) and of the DIN German Institute for Standardization. In addition, he is working for the MEBAK Dispense Work Group and has published a number of papers.

P-54
Learning from food technology—Future development for draught beer equipment
Presenter: Heinz Dauth, TU München, Freising, Germany

A lot of investigations show that draught beer quality is not only dependent on cleaning intervals and detergents used, but also on the applied equipment. Besides the used material, the design and installation of the process equipment (e.g., surface roughness; drainability; avoidance of crevices, shadow zones, and dead areas; misalignment), as well as the ability to dismantle a component, has a huge effect on cleanability. There is a connection between the hygienic design of the equipment used and the contamination of the system. Food technology has made progress during the last 20 to 25 years in its product quality and has reached a step forward in this field.

Particularly, the design should consider requirements for cleanability to avoid all areas where soil can accumulate and, therefore, be a hazard to the product (e.g., beer). Equipment that is designed hygienically has three key advantages: 1) it ensures that the product is not held up within the equipment, where it could deteriorate (quality); 2) it prevents from substances that could adversely affect the health of the consumer (safety); and 3) it reduces the time required for equipment to be cleaned (cost reduction). Based on the experience and parts used over the past 20 years in draught equipment and system configurations, it is time to make a step forward in this field.

Heinz Dauth graduated as an engineer for food technology and biotechnology from TU München – Weihenstephan in 1993. Afterward he was appointed as a scientific researcher at the Chair of Process Engineering (Professor Sommer) in Weihenstephan. His doctoral thesis was completed in 1999 in the field of mechanical process engineering. Since 2003, he has been a scientific assistant and university lecturer at the Chair of Process Engineering, TU München. His main research interests are bulk solids technology, dispensing technology and hygiene, and process engineering for specific problems in the food and beverage industries. He is also responsible for the institute’s industrial cooperation program. He is also working as an assistant professor at the Weihenstephan University of Applied Sciences, lecturing on mechanical and thermal process engineering.

P-56
Determining malt formula from beer color and predicting beer color from malt formula
Presenter: Daniel Bies, Briess Malt and Ingredients
Coauthor(s): Robert Hansen, Briess Malt and Ingredients

Different malt types (dark roasted, caramel roasted, or kilned) affect the visible spectrum transmittance of beer in distinctly different ways. These effects were studied and quantified for each type of malt. The resulting spectrums have several useful applications. By examining the color spectrum of an individual beer, the percentage of each type of malt in a formula can be determined. Conversely, the percentage and amount of each type of malt in a formula can be used to predict what the final full visible spectrum beer color will be. This spectrum can be input into color generators to show actual visual beer color that will be perceived in a finished beer.
Daniel Bies received his B.S. degree in biology from the University of Wisconsin-Stevens Point. He has worked in manufacturing and environmental laboratories, performing both microbiological and chemical analyses. He is currently a quality assurance chemist for Briess Industries, primarily focusing on ingredient testing and brewing applications. Dan is an active member of MBAA.

P-57
High-resolution QTL mapping of malting quality traits in ‘Mikamo Golden’ × ‘Harrington’ cross
Presenter: Zhou Tian-su, Sr., Sapporo Breweries Ltd., Ota, Japan Coauthor(s): Hirota Naohiko, Kihara Makoto, Iimure Takashi, Hoki Takehiro, and Ichikawa Seiichiro, Sapporo Breweries Ltd., Ota, Japan; Sato Kazuhiro, Okayama University, Kurashiki, Japan

‘Mikamo Golden’ and ‘Harrington’ are barley cultivars traditionally grown in Japan and North America, respectively. The former has a lower Kolbach index and a higher pre-harvest sprouting tolerance than the latter. Variations with respect to characteristics of both agronomic performance and beer quality profile by manufacture were observed in progenies from the cross between these two cultivars. In the present study, a high-resolution linkage map consisting of 556 markers was constructed based on the segregation data on 95 doubled-haploid lines (DHLs). The majority of the markers were single nucleotide polymorphisms from an oligonucleotide pooled assay (Illumina Co.). Other markers included 120 restriction fragment length polymorphisms from our earlier study, and eight expressed sequence tags developed by Okayama University. Genetic factors controlling malt extract, total nitrogen, soluble nitrogen, Kolbach index, and wort β-glucan were detected as quantitative trait loci (QTL), using linkage with markers on the map. A QTL controlling both Kolbach index and soluble nitrogen was particularly interesting and detected significantly (P < 0.05%) on the interval of 45 cM from the terminal of the long arm of chromosome 5H, with high log-likelihood score (24.7) and accounted variance explained (33.1%). Comparisons of the Kolbach index and marker haplotypes around the QTL region among the 95 DHLs indicated that Kolbach index QTL might map in a 4 cM region from the terminal of the long arm of the 5H chromosome. Significant QTL of malt extract, total nitrogen, and β-glucan were also detected on chromosomes 4H, 5H, and 6H, respectively. Surveys of the QTL-related EST markers with their annotation on the databases of HarvEST (www.harvest-web.org) and barley DB (www.shigen.nig.ac.jp/barley/) suggested several candidate genes for the QTL. One of these candidates might control Kolbach index and soluble nitrogen and possibly be useful for marker-assisted selection in breeding. High-resolution mapping and map-based cloning are on the way to determine the function of the locus controlling Kolbach index.

Tian-su Zhou completed his doctorate in botanical science from the University of Tokyo in 1989. He has worked as a scientific researcher for Sapporo Breweries Ltd. since 1990 and began his studies on molecular biology of barley in 2005 as a senior researcher in the Barley R&D Center, Bioresources R&D Department. He is a native of China and has lived in Japan since 1983.

P-59
Microstructural changes in wheat grain (Triticum aestivum L.) during the malting process by using confocal laser scanning microscopy and scanning electron microscopy
Presenter: Andrea Faltermaier, University College Cork, Ireland Coauthor(s): Martin Zarnkow, University College Cork, Ireland; Martina Gastl and Thomas Becker, Technische Universität München, Germany; Elke Arendt, University College Cork, Ireland

Wheat has a long tradition as a raw material used for the production of malt and beer. Nevertheless it has been studied to a much lesser extent than barley. It has been established for a very long time that for the production of good quality malt the variety used, as well as the malting conditions, have an important influence on the malt and beer quality. This experience is especially based on barley. Due to this fact a statistical experimental design was used to vary the malting regime of wheat. To track the differences in the degradation products (e.g., proteins, sugars, nutritional compounds, etc.) and the produced malt quality, these malts were evaluated based on MEBAK and EBC methods. In particular a closer look was taken at the proteins of the wheat kernel. To gain a detailed understanding on the enzyme–protein interactions, they were analyzed using 2D-gel electrophoresis, RP-HPLC, and a bioanalyzer. The bioanalyzer, also referred to as lab-on-a-chip, allows identification of the protein changes, as well as semi-quantitative analysis. The principle behind the bioanalyzer is the use of capillary electrophoresis on a microchip. Diverse malts were compared with each other to achieve an optimized malting process.
Flash pasteurization—A significant influence on the long-term stability of beer

Presenter: Jean Titze, Deloitte Consulting GmbH, Munich, Germany
Coauthor(s): Vladimir Ilberg, University of Applied Science
Weihenstephan-Triesdorf, Freising, Germany; Harun Parlar and Fritz Jacob, Technical University of Munich, Freising, Germany

Due to increased globalization, distribution paths become longer, which requires a guarantee of a good stability regarding microbiological, physico-chemical, and flavor stability within the shelf life of a product. One of the most important quality criteria of beer is its long-term stability, referring to filtered beer being free of haze on the one hand and the preservation of wheat beer hazing on the other hand. The premature hazing of a filtered beer, as well as the clearing of wheat beer results, in a loss of marketability. In this work the influence of a flash pasteurizer on the colloidal stability of different beers (wheat beers and bottom-fermented pale ales) was investigated. For the first time, a complete particle analysis (a particle charge and particle potential analyzing system, as well as particle size measurement) was used to characterize particle behavior in beer. Particle size distribution, particle surface charge, and particle surface potential were specifically analyzed. For this investigation, flash pasteurizer simulation trials, as well as real time tests with a flash pasteurizer in a brewery, were conducted. During the simulation trials the beer was heated up to 60°C, 70°C, and 80°C. In praxis tests the beer was heated up to 80°C, and the pasteurization unit intensity was varied from 400 PU to 600 PU and to 900 PU by adjusting the flow rate. It could be shown that flash pasteurization leads to a significant change in the surface potential of the particles, which means, for example, that particles in a thermally untreated wheat beer with a negative surface potential are shifted to a positive potential. In the simulation trial it was observed that with the increase in pasteurization temperature from 60°C to 70°C to 80°C the surface potential increased as well. The simulated trials and real time tests showed similar results. Also for the bottom-fermented pale ales a significant change in surface potential could be measured. Generally, the physical stability of beer increases with the level of potential (high potential = high stability). With the help of particle size measurement the agglomeration of particles could be analyzed. Due to the particle size distribution it could be shown that the agglomeration rate was dependent on the pasteurization temperature. This was proven by analyzing the agglomeration process using the surface charge titration method. Using particle analysis it could be explained for the first time that the flash pasteurizer has a positive effect on the physico-chemical stability of beer.

Jean Titze studied the technology and biotechnology of food at the Technical University of Munich until 2004. From 2005 to 2008, he worked as a brewery consultant and a scientist at the Research Center Weihenstephan for Brewing and Food Quality. In 2006, he took courses at the Academy of Food Law (Philipps-University, Marburg) specializing in national and European food law. Under the supervision of Professor Harun Parlar (chair for Chemical Technical Analysis and Chemical Food Technology), he is currently completing his Ph.D. degree in the area of beer analysis at the Technical University of Munich. He is focusing his research, together with his partner Vladimir Ilberg (University of Applied Science Weihenstephan-Triesdorf), on physical chemistry and particle analysis, especially with regard to beer and beverages. Since January 2009 he has been working as a senior consultant for Deloitte at the Food and Beverage Center of Expertise in Weihenstephan.
P-67
Next generation depth filter modules—For improved process economics and environmental protection
Presenter: Dirk Weber, Pall GmbH, Bad Kreuznach, Germany

Depth filtration for fine filtration of beer with filter sheet material in general is still going strong, although the market share of membrane technologies is increasing. Depth filtration with filter sheet material can be done either with flat filter sheets or in closed systems with lenticular filter modules. The use of a closed system offers several advantages. The product is no longer exposed to environment, which means higher product safety. Drip losses are a thing of the past and with this also the sticking and molder of flat filter sheets in the filter holder. Pall recently introduced with the SUPRApak filter modules the next generation of depth filter modules using a revolutionary filtration principle—“edge flow” technology. The intention for this new development was a further improvement of the depth filter module technology used for particle and fine filtration of beer downstream of a DE filter. Due to having a higher packaging density, CAPEX, as well as OPEX, should be improved compared with flat filter installations. The flexibility in terms of different flow rate for each module can be achieved by the modular design of the complete system. This is also relevant for fast filter change out and reduction of service and maintenance costs by reducing the number of sealings to be changed. The SUPRApak modules consist of an inner plastic core with depth filter material wrapped around it. The filter material contains separated feed and filtrate channels punched into it. This enables the revolutionary edge flow of the fluid. The use of this new technology results in a higher filtration area incorporated in one module. Due to this, systems can be sized smaller and require a smaller footprint. This ensures a reduction in CAPEX. Due to the modular design, the filters can be changed out quickly and easily. One filter housing contains up to six filter modules that can be installed and uninstalled with a special tool in one step. This reduces the handling time between filtration runs, minimizes labor costs for filter change outs, extends the processing time, and, due to this, reduces OPEX. Reduced system volumes compared to flat filter installations minimize the water and cleaning agent consumption, as well as the energy and time needed for heating up and cooling down the system. The closed system with a low hold-up volume and the possibility of pushing the liquid out of the filter with gas guarantees a dramatic reduction in product losses. Additionally, the costs for the filter housings are only a part of the comparable CAPEX of a sheet filter. The advantages of this new technology were proven in a field test in France, where the OPEX was reduced by 37.5% compared with the previously used flat filter sheet installation. Additionally, the environment is disburdened.

Dirk Weber studied the technology and biotechnology of foods at the Technical University of Munich – Weihenstephan from 1993 to 1999. From 1999 to 2002 he worked on a research project financed by the Federal Ministry of Agriculture in Germany and achieved his doctorate from the Technical University of Munich. From 2003 to 2006 he worked as a product manager for cross-flow filtration and depth filter sheets and modules at Sartorius Food & Beverage. From 2007 to 2008 Dirk worked for Festo as segment manager, food and beverage processing. In 2009 he joined Pall, working as the global marketing manager, beer.

P-68
Energy savings of up to 60% through simultaneity in liquefaction and vaporization
Presenter: Heiko Grimm, Norit Haffmans BV, Venlo, The Netherlands

With increased environmental awareness and a desire to further reduce costs, breweries are focusing on more compact possibilities to reduce energy consumption when they decide to invest in their current or new CO2 storage tanks. LiquiVap systems can be fitted into existing systems, as well as be part of new installations, which will instantly provide energy savings of up to 60%, thereby reducing the total operating costs of the CO2 gas recovery system. In addition to the abovementioned savings, collection efficiency is increased by the colder operating temperatures. Due to the reduced number of hours the cooling plant and vaporizers operate, maintenance is reduced, resulting in significant cost savings. Last but not least, a LiquiVap system enables the brewery to invest in a more highly energy efficient and less costly cooling and vaporization system, due to the fact that the LiquiVap system takes over some of the work load.

Heiko Grimm graduated in 2007 from Technische Universität München – Weihenstephan with a master’s degree in brewing and beverage technology. Immediately after finishing his, master’s thesis on new beer stabilization methods, Heiko began working for Norit Haffmans BV in June 2007 as CO2 units product manager. In this position he was responsible for the units and inline business worldwide. In 2010, he transferred to the position of CO2 systems product manager. He is currently responsible for the U.S., Canada, Mexico, and Caribbean regions for all CO2 systems sales.

P-69
Reducing the environmental impact of beer production with a proline-specific endo-protease (PSEP) demonstrated by comparative life cycle analysis (LCA) screening
Presenter: Jeroen Van Roon, DSM Food Specialties, Delft, The Netherlands
Coauthor(s): Justin Juengel, DSM Food Specialties USA, Inc., Parsippany, NJ

Previous studies have demonstrated that the use of a proline-specific endo-protease (PSEP, commercial name Brewers Clarex) enables shorter cold maturation at elevated temperature, while ensuring efficient colloidal stability and maintaining beer quality. This paper presents the results of the first life cycle analysis (LCA) screening done for a PSEP compared with current synthetic products for beer stabilization in beer production. The LCA study showed that PSEP enables brewers to significantly lessen their CO2 footprint by reducing energy costs, water consumption, and raw materials usage in beer production. In an LCA all emissions released into the environment and resources consumed along the whole life cycle of beer are added up to produce an inventory list of substances. This inventory is translated with the help of an impact assessment methodology into environmental impacts. This study used two widely used methods, Eco-indicator 99 and IPCC 2001, for calculating all the impacts and performing sensitivity analysis, respectively. The results showed that the environmental impact for the production of the beer stabilizer needed to stabilize a set beer volume is about 10 times lower for PSEP compared with current synthetic stabilizers. In a second step the environmental costs of producing PSEP were compared to the savings in environmental impact due to the change in beer process. The study showed that the total environmental impact of the brewer’s beer manufacturing stage is reduced by 5–8% when PSEP is used. In a third step, the environmental impact of the use of PSEP was assessed in the total beer value chain, i.e., from the crops on the land to the recycling of the beer bottle. To this end, the total beer value chain was divided into four main stages: suppliers, beer manufacturing, distribution, and use/disposal. The first two stages account for over 65% of the total environmental impact. This study clearly demonstrates that the use of PSEP lessens significantly the environmental impact of the suppliers and beer manufacturing stages, hence the total environmental impact of the beer value chain. The use of PSEP compared to current synthetic stabilizers reduces by 2% the total environmental impact of the total beer value chain.
After finishing an M.S. degree in bioprocess engineering, Jeroen van Roon received his Ph.D. degree (with honors) for research in the field of biocatalysis at Wageningen University, The Netherlands. In January 2005, he joined DSM Food Specialities in Delft, The Netherlands, where he worked as a 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. He continued his work as the product and application development manager for brewing enzymes, involved in the further development of DSM’s brewing enzyme portfolio and application knowledge in the field of brewing. Currently, Jeroen holds the position of industry manager, beer, and is co-responsible for the DSM brewing business worldwide.

P-71
Development of production technology utilizing a mini-brewery
Presenter: Wataru Hatsumi, Asahi Breweries, Ltd., Ibaraki, Japan
Coauthor(s): Jun Kawai and Yoshihori Ito, Asahi Breweries, Ltd., Ibaraki, Japan

We report on Asahi’s mini-brewery, which lies adjacent to the Asahi Breweries Ibargi brewery, and its utilization. The mini-brewery has a production capacity of 5 KL of beer and is equipped with the same brewhouse vessels, 29 cylindroconical fermentation and storage tanks, filtration equipment, and bottling equipment. The features of the mini-brewery facilities are as follows: 1) automatic control is normally used for each process, but interlock is avoided as much as possible for flexible adaptation to various tests; 2) advanced control, such as raw material bottom-loading and pressure control of fermentation storage tanks in 0.01-MPa units, is possible; and 3) yearly precision gains are achieved through ‘kaizen’ activities in the workplace, such as achieving uniformity of temperature distribution inside fermentation tanks and devising calculation formulas for precise control of the temperature at the start of fermentation. Due to these features, the mini-brewery facilities are capable of reproducing behaviors found within the main brewery and predicting risk points during actual production. The main missions of the mini-brewery are 1) development of brewing technology; and 2) development of new products. For the development of brewing technology, the mini-brewery conducts extreme experiments that cannot be conducted at the main brewery and is used to evaluate the feasibility of deploying new equipment at the main brewery. For the development of new products, the mini-brewery is used to finalize recipes by determining the risk points for production at the main brewery. We describes examples of experiments conducted using the mini-brewery, for both development of brewing technology and development of new products.

Wataru Hatsumi is a deputy manager of the Production Technology Center, Asahi Breweries, Ltd., and he is currently responsible for management of the mini-brewery. He received an M.S. degree in agricultural chemistry from Tokyo University of Agriculture and Technology. He began employment with Asahi Breweries, Ltd. in 1995. He worked in Asahi’s Fuku-shima, Shikoku, and Nagoya breweries as a technician in the brewing section. He also has three years of experience in the laboratory and two years of experience at the Sumidagawa Brewing Company, a craft brewery in downtown Tokyo. In 2009 he transferred to his present section.

P-74
Application of the novel rotary jet mixing technology in breweries: Experience and potential
Presenter: Olav Nielsen, Alfa Laval, Soborg, Denmark
Coauthor(s): Mikkeli Nordkvist, Alfa Laval, Ishoj, Denmark; Chris Boulton, University of Nottingham, Loughborough, UK

Mixing is needed in a number of brewery applications for gas dispersion and/or to ensure homogeneity, e.g., in yeast storage vessels to produce a homogenous yeast slurry for pitching and in yeast propagation for efficient dispersion of air; recently the beneficial effects of employing forced convection during fermentation has also been demonstrated. The patented rotary jet mixing technology is a new technology that has already demonstrated its capabilities in a number of brewery applications. The technology is based on mixing by rotating liquid jets. In this system, liquid is withdrawn from the bottom of a tank, circulated through an external loop, and re-injected into the bulk liquid in the tank through the two or four nozzles of a rotary jet mixer, thereby ensuring more efficient mixing than in simple pump loop systems known from both propagation and storage vessels. Liquid, particulate solids, or gas feed can be added to the recirculation loop, and heat exchange can be performed in a heat exchanger installed in the loop. The rotary jet mixer is also ideal for CIP between batches since it was developed for mixing from that original area of application. Results from full-scale installations show that the application of the mixing process during fermentation leads to a faster fermentation process, thus offering a very cost-effective solution for increasing capacity. In addition a more consistent fermentation both in terms of process time and residual extract level is realized. Furthermore, trials have shown that the system offers potential advantages for homogenizing harvest yeast and aerating propagation vessels.

Olav Nielsen was born in 1951 and graduated from the Technical University of Denmark with an M.S. degree in biochemical engineering. Olav worked for many years in other bioengineering fields before joining Scandi Brew in 1996. At Alfa Laval Scandi Brew, Olav holds a position as application engineering manager for yeast, which is a core product of the company. Olav’s work has concentrated on developing aeration aggregates for yeast propagation plants and mixers for yeast storage plants, with a focus on efficiency and low-stress conditions. Olav’s earlier work involved propagation tests verifying the influence of the Crabtree effect on yeast propagation and investigating measurable stress as a result of mechanical impact on propagated yeast caused by agitation and aeration. Olav’s previous work was published at IGB 2003, EBC 2003, 4th BYFPC 2003, WBC 2004, WBC 2008, and MBAA 2009. Olav’s planned work involves optimal oxygen supply, use of the fed-batch process during propagation, and further research into minimizing viability and viability loss during storage.

P-73
Manufacturing execution systems in the brewing industry
Presenter: Michael James, MESA Europe, Haarlem, The Netherlands

A manufacturing execution system (MES) is a dynamic information system that drives effective execution of manufacturing operations. Using current and accurate data, MES guides, triggers, and reports on plant activities as events occur. MES is a set of functions that manages production operations from the point of order release into manufacturing to the point of product delivery of finished goods. This paper describes how Carlsberg Breweries in Europe arrived at the decision to implement MES and the impact it had on the organization. The MES has now been implemented at four breweries and is said to be improving response to market demand. This report has been reviewed, and permission has been granted by Carlsberg Breweries to present a live demonstration of the system. The system includes at-line quality checks, environmental reporting such as CO₂ and energy use, as well as traceability to meet regulatory requirements.

Mike James gained his first international experience with Allen-Bradley’s Controls Division and then moved to The Netherlands to lead Allen-Bradley’s expansion into Europe. ATS was founded in 1986. As a co-founder, Mike has been instrumental in growing ATS into a global independent solution provider and has worked across a wide range of industries at major breweries such as Heineken, but also at small, specialized breweries. Mike is a board member of MESA EMEA, a non-profit organization developing technical standards for manufacturing execution systems (MES) and development of MES awareness. Mike is a member of the MES governance boards at Rolls-Royce Aerospace and Carlsberg Breweries. In 2002 he became the first person to receive the Entrepreneur of the Year Award in two countries simultaneously.
The use of dry yeast for bottle conditioning
Presenter: Sylvie Van Zandycke, Lallemand Brewing, Milwaukee, WI
Coauthor(s): Tobias Fischborn, Lallemand R&D, Montreal, QC, Canada

The popularity of dry yeast in brewing applications is increasing due to the high quality and consistency of the product. This is the result of implementation of extensive quality control and plant sanitation for dry beer-yeast production. It is believed that the quality of dry yeast is equivalent to liquid yeast, with all the advantages of a dry product: flexibility, consistency, extended shelf life, and non-refrigerated shipping. Bottle conditioning is one of the applications that generated recent interest because of the large selection of yeast strains available in dry form (brewing, wine, distilling yeast), easy dosage, and yeast performance. In order to be able to sustain the stresses occurring in beer, with sometimes a large amount of alcohol present, the quality of the yeast culture is important. The requirements for refermentation would be a healthy culture in terms of viability and vitality and cell membranes conditioned in unsaturated acids and sterols to assimilate sugars rapidly and efficiently. These two parameters and many more make dry yeast an ideal choice for a process that has been used for many centuries as a method of carbonation. The practical use of dry yeast in a brewery to achieve adequate and consistent results in bottle conditioning will be demonstrated, and the differences in beer characteristics that can be achieved by using different strains will also be highlighted.

Sylvie Van Zandycke studied biochemical engineering and fermentation at the Institute Meurice (Brussels, Belgium); she completed her degree in September 1996. During that time, she obtained an Erasmus Studentship for a 6-month project on brewing yeast cell aging at Oxford Brookes University. She obtained her Ph.D. degree on oxidative stress and aging in Saccharomyces cerevisiae in July 2000 at Oxford Brookes University. From March 2000, Sylvie was employed as project manager for SMART Brewing Services. She was involved in contract research, microbiological analysis, and development of methods and kits for the brewing industry. She also took part in organizing international courses, symposia, and congresses for the brewing industry. In 2004 Sylvie left the United Kingdom for Canada and accepted a post at Lallemand Inc. as project manager for their Genetic Identification Laboratory. She was involved with both yeast and bacteria QC and R&D, and her main focus in research was developing new methods for microorganism identification and characterization, as well as detection of contaminants in alcohol production processes. Since February 2007, Sylvie has occupied the position of brewing fermentation manager and, more recently, technical sales manager for Lallemand to service and support the brewing industry worldwide with dry yeast and nutrition products.

MBAA Author Index

The number following an author’s last name refers to the number of the author’s abstract and indicates the order of that presentation in the program and in the printed abstracts. The “O” preceding the number refers to an oral presentation. The “P” preceding the number refers to a poster presentation.

Agius, G., O-21
Andrews, J., O-12
Arendt, E., O-24, P-59, P-60
auer, A., O-3
Back, W., O-36
Bamforth, C., O-2
Becher, T., P-46
Becker, T., O-1, O-19, O-20, O-24, O-25, O-35, O-36, P-48, P-59, P-60
Bies, D., P-56
Birle, S., P-48
Blind, J., O-23
Boal, A., P-43
Bouton, C., P-74
Bradley, M., O-5
Dauth, H., O-31, P-54, P-61
Davies, N., O-16, O-26
de Groen, T., P-46
Doersam, K., P-53
Elvig, N., P-49
Faltermaier, A., O-31, P-54, P-61
Fellerer, M., P-48
Fischborn, T., O-4, P-75
Forster, A., O-34
Fratianii, A., O-28
Funnell, D., O-21
Gahr, A., P-52
Gast, M., O-3, O-19, O-20, O-24, O-25, P-59, P-60
Grimm, H., P-45, P-68
Hanke, S., O-36
Hansen, L., P-52
Hansen, R., P-50, P-56
Hatsumi, W., P-71
Heldt Hansen, H., P-49
Henke, S., O-18
Hull, G., O-33
Iberg, V., P-66
Ito, Y., P-71
Jacob, F., P-66
James, M., P-73
Jenkins, D., O-4
Johnson, D., P-44
Juengel, J., P-69
Jurado, J., P-47
Kappler, S., O-35, P-38
Kattein, U., O-35, P-38, P-39
Kawai, J., P-71
Kazuhiko, S., P-57
Kiwiki, Y., O-13
Kondo, T., O-13
Krahl, M., O-1
Kreiz, S., O-3, P-49
Kroghenthaler, M., O-35, O-36, P-39
Kuehni, H., P-48
Kunz, T., O-8, O-11
Lafitte, J., P-40
Lehmann, J., P-48
Loeffler, D., P-42
Lutz, M., O-30
Makoto, K., P-57
Maruhashi, T., O-19
Mato Gonzalez, D., O-8
Menger, H., O-31, P-46
Methner, F., O-8, O-11
Miedl, M., O-12
Monguillon, B., P-40
Moser, D., O-32
Muller, M., O-20
Nagaoka, T., O-13
Narvillo, H., P-57
Narziss, L., O-19
Nielsen, O., P-74
Nordkvist, M., P-74
Onoda, K., O-11
Parlar, H., P-66
Peacock, V., O-37
Peterson, J., O-23
Potz, E., P-48
Powell, C., O-4
Pratt, P., O-6
Preiss, J., O-15a
Pringle, A., O-7
Rajan, R., O-15
Richter, A., O-17
Samp, E., O-6
Schober, P., O-53
Schuller, O-25
Seichiro, T., P-57
Siebert, K., O-9
Smart, K., O-4, O-10
Smith, T., O-29
Sommer, K., O-18
Soukup, T., O-23
Srinivas, V., P-40
Steiner, E., O-3, O-24
Stewart, G., O-12
Takashi, I., P-57
Takehiro, H., P-57
Taylor, R., O-12
Thompson, C., O-22
Tian-su, Z., P-57
Tippmann, J., O-18, O-31, P-53, P-61
Titze, J., P-66
Van Roon, J., P-69
Van Zandycke, S., O-75
van Zeijst, A., O-14
Voigt, J., O-17, O-18, O-31, P-53, P-61
Walston, E., P-50
Wasmuth, K., O-15a
Weber, D., P-67
Wening, H., P-48
Zarnkow, M., P-59
Benefits of Membership

Invitations to local District meetings and conferences

Access to *Technical Quarterly* papers dating back to 1964

Technical support through MBAA and fellow members

Access to member and vendor directories

Subscription to *The MBAA Communicator*

Connection to a worldwide network of members

Discounts on
Conventions
Educational and training opportunities
Books, CDs, and other products

IBD membership

---

Join Today—Visit the Registration Desk

[www.mbaa.com/membinfo](http://www.mbaa.com/membinfo)
Brewing Summit 2010

Program Book Supplement

ASBC and MBAA Meet Back-to-Back

Rhode Island Convention Center
Providence, RI, U.S.A.
June 15–20, 2010

Table of Contents

Convention Center Floor Plan .......... 2
General Summit Information .......... 3
Program Changes ......................... 3
Posters ...................................... 4
Exhibits .................................... 6

Thank You Brewing Summit 2010 Sponsors

Gold Sponsors
Cargill (Corn Milling NA, Cargill Malt, Cargill Flavor Systems)
Novozymes
Malteurop North America, Inc.

Silver Sponsors
ICC, Inc.
MBAA New England District
Ziemann Ludwigsburg GmbH

Bronze Sponsors
Cargill Flavor Systems
China-Germany Brewing Technical Service Center
S.S. Steiner, Inc.
White Lab/Frings America

Beer Donors
Anheuser-Busch, Inc.
Boston Beer Co.
Boulevard Brewing Co.
Harpoon Brewery
IBU - Magic Hat Brewing Co.
Kona Brewing Co.
Long Trail Brewing Co.

Silver Donors
MillerCoors
Pabst Brewing Co.
Redhook Ale Brewery
Sierra Nevada Brewing Co.
Stone Brewing Co.
Widmer Brothers Brewing

Coffee Donors
American Tartaric Products, Inc.
John I Haas, Inc.
Kalsec Inc.
Malteurop North America, Inc.
Siebel Institute/World Brewing Academy
PureMalt Products Ltd.
Rahr Malting Co.
Convention Center Floor Plan
General Summit Information

Registration Desk
5th Level Lobby
Tuesday, June 15  3:30 – 6:45 p.m.
Wednesday, June 16  7:30 a.m. – 5:00 p.m.
Thursday, June 17  7:30 a.m. – 6:00 p.m.
Friday, June 18  8:00 a.m. – 4:00 p.m.
Saturday, June 19  7:45 a.m. – 4:00 p.m.
Sunday, June 20  7:15 – 11:30 a.m.

Brewing Summit 2010 Proceedings CD
Take home the research presentations from the ASBC Annual Meeting and the MBAA Convention! Your copy is available at the registration desk for the discounted price of $65.

Summit Attire
Business casual dress is encouraged for all summit events.

Photo Release
ASBC and MBAA staff will take photos throughout the summit for use in promotional materials. By virtue of your attendance, you agree to ASBC’s and MBAA’s use of your likeness in promotional materials.

Open Meeting Room
There is a small meeting room available for use throughout the summit. Stop by the Registration Desk to check availability and room location and to reserve a meeting time.

Emergency Procedures
The Rhode Island Convention Center, Westin Providence, and Hilton Providence are fully prepared to handle different types of situations to assist guests. The following is information on their emergency procedures.

Program Changes

Poster Presentations
Additions
ASBC P-70a
FT-NIR Analysis of Czech Republic Beer: A Qualitative and Quantitative Approach
G. Budinova (1), I. Dominak (1), T. Strother (1)
(1) Thermo Fisher Scientific, Madison, WI
Analysis of beer is required for proper reproducible production and labeling. Conventionally, a separate instrument is required for the analysis for each component in beer. Fourier transform near infrared (FT-NIR) spectroscopy is a much more rapid technique and was performed on beer samples from Czech Republic breweries to demonstrate its capacity to rapidly and accurately measure and predict multiple components simultaneously. An Antaris FT-NIR analyzer was used for the analysis of beer samples using a transmission cell module. Qualitative measurements successfully classified the beer samples as 10°, 11°, or 12°. Quantitative analysis reported highly predictive measurements for original gravity, real extract, apparent extract, and alcohol content.

Presenter Changes
MBAA P-67
Now presented by Ronald Johnson, Pall Corp., Chapel Hill, NC

Withdrawals
ASBC P-48

Workshop and Technical Sessions
Presenter Changes

MBAA Workshop: Practical Malt Quality
Friday, June 18  3:50–5:00 p.m.  551 A/B
Updated Presenters: Dan Bies, Briess Malt & Ingredients; Nigel Davies, Muntons PLC; Mary-Jane Maurice, Malteurop North America, Inc.
Updated Moderator: Matt Brynildson, Firestone Walker Brewing Co.

ASBC O-19
Now presented by Trevor Cowley, University of Nottingham, United Kingdom

MBAA O-4
Now presented by David Jenkins, University of Nottingham, United Kingdom

MBAA O-10
Now presented by Chris Powell, University of Nottingham, United Kingdom
New title and abstract to be announced
Speakers may review their presentations the day before their scheduled talk at the Speaker Ready Kiosk located at the Registration Desk. Presentations will not be available for review on the day the presentation is scheduled. The kiosk will be open during registration hours.

ASBC Poster Presentations

P-44 Brian R. Gibson. A role for the COMPASS complex as determinant of brewing yeast fermentation performance?
P-45 Mark Libardoni. Analysis of volatile components in beer using automated solid-phase microextraction (SPME) and high-speed GC×GC-TOFMS.
P-46 Aaron MacLeod. Application of ultra performance liquid chromatography for the determination of amino acids in wort and beer.
P-47 Sylvie M. Deckers. Are magnetic fields a technical opportunity to influence the structure of CO₂ nanobubbles responsible for primary gushing in beer?
P-48 Yin Li. Assessing the impact of extraction condition and grist particle size on the phenolic acids composition and antioxidant activity of malt.
P-50 Tobias Fischborn. Characterization of dry Nottingham ale yeast under different fermentation conditions.
P-51 Leif A. Garbe. Determination of bisphenol-A (BPA) in polycarbonate plastic bottles by SIDA.
P-52 Femke L. Sterckx. Determination of volatile monophenols in beer using solid-phase microextraction combined with GC-MS.
P-54 Cynthia A. Henson. Differential RNA expression of Bmy1 during late seed development in wild and cultivated barley and the association with -amylase activity.
P-55 Takuya Hatanaka. Effect of lather turbidity on the brewing process and beer quality.
P-56 Dave Barr. EPR-detected free-radical formation following photoactivation of a commercial hop oil product.
P-57 Barry Ziola. Ethanol tolerance of lactic acid bacteria.
P-58 Urs Wellhoener. Experiences with a special circulation system in a rectangular nonpressurized fermenter.
P-59 Marcia A. Browsers. Factors influencing free-radical development in malt, as measured by EPR.
P-60 Florian A. Schuell. High gelatinization temperatures of barley starch—Effects on malt and beer quality.
P-61 Moritz Krahli. Influence of the melting process on the content of bioactive compounds in malt.
P-62 Caroline Scholtes. Innovative yeast extract as nutrient and natural antioxidant during propagation.
P-64 Makoto Kanauchi. Levels of -glucan and pentosan and their degradation products in beer.
P-65 Thomas Kunz. Pro- and antioxidative effects of the Maillard reaction products in malt on oxidative beer stability.
P-66 Joyce E. Carr. Reduction of hazardous solvent usage in the hops laboratory.
P-68 Cynthia A. Henson. Studies on the utility of -amylase I intron III sequences as markers for -amylase activity and thermostability, diastatic power, and malt quality.
P-70 Thomas Kunz. The influence of metallic ion oxidation states and pH value on haze formation in beer.
P-70a

ASBC New Products and Services Poster Sessions

P-72 Richard A. Boughton. Real-time tasting systems.
P-73 Philip Thonhauser. Real-time verification technology based on persulphate.
MBAA Poster Presentations

P-38 Comparisons between the requirements of electrical and thermal energies of different wort-boiling systems with regard to the wort aroma profiles. UDO KATTEIN, Sebastian Kappler

P-39 The new Research Brewery Weihenstephan—A universal platform for scientific research, training courses, and technology. UDO KATTEIN, Martin Krotenthaler

P-40 Cleaning in place (CIP) in breweries using an acid formulation that is phosphorus-free and respects the environment. VIJAY SRINIVAS, Jean-Alex Laffitte, Bernard Monguillon

P-41 Ozone applications in breweries: Increase profits and improve product quality. JOHN MCCLAIN

P-42 Stainless steel passivation and its importance for the brewery with respect to equipment maintenance and sanitation. DIRK LOEFFLER

P-43 Use of on-site generated disinfectants in three-step clean-in-place operations. ANDREW BOAL

P-44 Using antifoams in fermentation. DANA JOHNSON

P-45 Achieving a higher than 99.998% vol. CO₂ purity through removal of non-condensables in a CO₂ recovery system. HEIKO GRIMM

P-46 Design of a utility monitoring system using the example of a brewery. HANS-JOERG MENGER, Theo de Groen, Tobias Becher

P-47 Traditional and novel tools for sizing and specification of beer tanks. JAIME JURADO

P-48 Yeast propagation manager—YPM. HELMUT KUEHNL, Stephan Birle, Markus Fellner, Jorg Lehmann, Harald Wening, Ernst Potzl, Thomas Becker

P-49 Flavor and taste of beers made with 100% barley brewing technology. STEFAN KREISZ, Niels Elvig, Hans-Peter Heldt-Hansen

P-50 Proper storage and shelf life of concentrated brewing worts and syrups. ELIZABETH WALSTON, Robert Hansen

P-52 Evaluation of diseased and damaged hops in finished beer. ANDREAS GAHR, Laura Hansen

P-53 Disposable kegs—A review on current systems and latest German DIN standards. JOHANNES TIPPMANN, Ulrich Schober, Klaus Doersam, Jens Voigt

P-54 Learning from food technology—Future development for draught beer equipment. HEINZ DAUTH

P-55 A study of the agronomic benefits of growing spelt grain (Triticum spelta) and an investigation into its suitability for use in the brewing industry. DANIEL MACKINNON

P-56 Determining malt formula from beer color and predicting beer color from malt formula. DANIEL BIES, Robert Hansen

P-57 High-resolution QTL mapping of malting quality traits in ‘Mikamo Golden’ × ‘Harrington’ cross. ZHOU TIAN-SU, SR., Hirota Naohiko, Kihara Makoto, Isimre Takashi, Hoku Takehiro, Ichikawa Seichi, Sato Kazuhiro

P-58 Marketing, uses, and distribution of spent grain for large and small breweries. KENNETH GODINHO

P-59 Microstructural changes in wheat grain (Triticum aestivum L.) during the malting process by using confocal laser scanning microscopy and scanning electron microscopy. ANDREA FALTERMAIER, Martin Zarnkow, Martina Gastl, Thomas Becker, Elke Arendt

P-60 Optimization of the malt quality, nutritional compounds, and protein changes taking place during the malting of wheat (Triticum aestivum L.) monitored with RSM-based designs. ANDREA FALTERMAIER, Thomas Becker, Elke Arendt, Martina Gastl

P-61 “A flush a day” as an improvement for tap hygiene and draught beer quality! HEINZ DAUTH, Johannes Tippmann, Jens Voigt

P-62 Taking the technical to the consumer: The development of a consumer beer lexicon. GINGER JOHNSON

P-66 Flash pasteurization—A significant influence on the long-term stability of beer. JEAN TITZE, Vladimir Ilberg, Harun Parlar, Fritz Jacob

P-68 Energy savings of up to 60% through simultaneity in liquefaction and vaporization. HEIKO GRIMM

P-69 Reducing the environmental impact of beer production with a proline-specific endo-protease (PSEP) demonstrated by comparative life cycle analysis (LCA) screening. JEROEN VAN ROON, Justin Juengel

P-71 Development of production technology utilizing a mini-brewery. WATARU HATSUMI, Jun Kawai, Yoshinori Ito

P-73 Manufacturing execution systems in the brewing industry. MICHAEL JAMES

P-74 Application of the novel rotary jet mixing technology in breweries: Experience and potential. OLAV NIELSEN, Mikkel Nordkvist, Chris Boulton

P-75 The use of dry yeast for bottle conditioning. SYLVIE VAN ZANDYCKE, Tobias Fischborn
Exhibits

Exhibit Hours
Ballroom/Exhibit Area

Wednesday, June 16
2:00 – 6:00 p.m.  Exhibit Set Up

Thursday, June 17
7:30 – 9:00 a.m.  Exhibit Set Up
11:30 a.m. – 2:00 p.m.  Exhibits and Lunch

Friday, June 18
8:30 – 10:00 a.m.  Exhibits and European Continental Breakfast
11:30 a.m. – 2:00 p.m.  Exhibits and Lunch

Saturday, June 19
11:30 a.m. – 2:00 p.m.  Exhibits and Lunch
2:00 – 5:00 p.m.  Exhibit Take Down
<table>
<thead>
<tr>
<th>Exhibitor Listing</th>
</tr>
</thead>
<tbody>
<tr>
<td>101 Skalar, Inc.</td>
</tr>
<tr>
<td>103 MIOX Corporation</td>
</tr>
<tr>
<td>105 AFTEK, Inc.</td>
</tr>
<tr>
<td>106 PerkinElmer</td>
</tr>
<tr>
<td>107 Lallemand Brewing/Ethanol Technology</td>
</tr>
<tr>
<td>108 Wayne Chemical Inc.</td>
</tr>
<tr>
<td>109 GKD-USA Inc.</td>
</tr>
<tr>
<td>110 EMD Chemicals</td>
</tr>
<tr>
<td>111 Endress+Hauser Inc.</td>
</tr>
<tr>
<td>113 Munktell Inc.</td>
</tr>
<tr>
<td>200 &amp; 202 Siemens Industry, Inc.</td>
</tr>
<tr>
<td>201 &amp; 203 Briggs of Burton</td>
</tr>
<tr>
<td>204 Norit Haffmans</td>
</tr>
<tr>
<td>206 Weyermann Specialty Malts</td>
</tr>
<tr>
<td>208 The University of Nottingham-Brewing Science</td>
</tr>
<tr>
<td>209 Nexcelom Bioscience</td>
</tr>
<tr>
<td>210 Trau Welt (Fachrenlac Hanscarl)</td>
</tr>
<tr>
<td>211 VitalSensors Technologies</td>
</tr>
<tr>
<td>212 EMG International</td>
</tr>
<tr>
<td>213 Pursuit Dynamics, Inc.</td>
</tr>
<tr>
<td>300 &amp; 302 Airborne Labs International</td>
</tr>
<tr>
<td>301 optek-Danulat, Inc.</td>
</tr>
<tr>
<td>303 GF Piping</td>
</tr>
<tr>
<td>305 &amp; 307 Gusmer Enterprises</td>
</tr>
<tr>
<td>308 Steinfurth, Inc.</td>
</tr>
<tr>
<td>309 IBD Trading</td>
</tr>
<tr>
<td>310 Rochester Midland Corp.</td>
</tr>
<tr>
<td>311 ProLeiT AG</td>
</tr>
<tr>
<td>312 INVISTA</td>
</tr>
<tr>
<td>400 SPX Flow Technology, Waukesha Cherry-Burrell, and APV brands</td>
</tr>
<tr>
<td>401 DSM Food Specialties USA, Inc.</td>
</tr>
<tr>
<td>402 Anton Paar USA</td>
</tr>
<tr>
<td>403 Krones</td>
</tr>
<tr>
<td>404 &amp; 406 Ziemann Ludwigsburg GmbH</td>
</tr>
<tr>
<td>408 PureMalt Products</td>
</tr>
<tr>
<td>409 VLB Berlin</td>
</tr>
<tr>
<td>410 Ecolab</td>
</tr>
<tr>
<td>411 EUWA Water Treatment Plants</td>
</tr>
<tr>
<td>500 Pall Corporation</td>
</tr>
<tr>
<td>501 Albert Handtmann Armaturenfabrik GmbH &amp; Co. KG</td>
</tr>
<tr>
<td>502 S.S. Steiner, Inc.</td>
</tr>
<tr>
<td>503 Esau &amp; Hueber GmbH</td>
</tr>
<tr>
<td>505 LECO Corporation</td>
</tr>
<tr>
<td>507 Buhler Inc.</td>
</tr>
<tr>
<td>508 Symbiont</td>
</tr>
<tr>
<td>509 Tyco Flow Control</td>
</tr>
<tr>
<td>510 Cargill</td>
</tr>
<tr>
<td>511 Butterworth, Inc.</td>
</tr>
<tr>
<td>600 GEA Tuchenhagen North America</td>
</tr>
<tr>
<td>601 Kagetec</td>
</tr>
<tr>
<td>602 GEA Brewery Systems</td>
</tr>
<tr>
<td>603 VTT Technical Research Centre of Finland</td>
</tr>
<tr>
<td>604 GEA Westfalia Separator</td>
</tr>
<tr>
<td>606 PQ Corporation</td>
</tr>
<tr>
<td>608 Astoria-Pacific International</td>
</tr>
<tr>
<td>609 American Tartaric Products, Inc.</td>
</tr>
<tr>
<td>610 Nalco</td>
</tr>
<tr>
<td>611 Profamo Inc.</td>
</tr>
<tr>
<td>613 Newlands Systems, Inc.</td>
</tr>
<tr>
<td>700 Anderson Instrument Company, Inc.</td>
</tr>
<tr>
<td>701 3M Purification Inc.</td>
</tr>
<tr>
<td>702 Mettler-Toledo Ingold Inc.</td>
</tr>
<tr>
<td>703 Ashland Hercules Water Technologies</td>
</tr>
<tr>
<td>705 Siebel Institute/World Brewing Academy</td>
</tr>
<tr>
<td>707 White Lab/Frings America</td>
</tr>
<tr>
<td>708 Parker domnick hunter</td>
</tr>
<tr>
<td>709 Enzyme Development Corp.</td>
</tr>
<tr>
<td>710 Filtrox North America</td>
</tr>
<tr>
<td>711 Hach Company</td>
</tr>
<tr>
<td>712 Radiant Industrial Solutions, Inc.</td>
</tr>
<tr>
<td>713 Beckman Coulter, Inc.</td>
</tr>
<tr>
<td>800 Flottweg Separation Technology, Inc.</td>
</tr>
<tr>
<td>802 Diversey Inc.</td>
</tr>
<tr>
<td>803 Can Lines Engineering</td>
</tr>
<tr>
<td>804 Advanced Chromatography Systems</td>
</tr>
<tr>
<td>805 Tg-Pro Inc.</td>
</tr>
<tr>
<td>807 ChemTreat Inc.</td>
</tr>
<tr>
<td>808 &amp; 810 Centec LLC</td>
</tr>
<tr>
<td>809 Wyeast Laboratories Inc.</td>
</tr>
<tr>
<td>811 Briess Malt &amp; Ingredients Co.</td>
</tr>
<tr>
<td>812 Loeffler Chemical Corporation</td>
</tr>
</tbody>
</table>
Brewing Summit 2010 Exhibitor Descriptions

3M Purification Inc., 400 Research Pkwy., Meriden, CT 06450; Telephone: +1.203.237.5541, Website: www.3Mpurification.com. 3M Purification Inc. (formerly CUNO) provides a wide range of filtration products for the brewing industry. Brewers rely on 3M Purification for clarification, sterile filtration, DE trap filtration, water filtration, and air and gas filtration. Featured products include Zeta Plus(TM) depth filter cartridge systems for clarification and significant reduction of spoilage yeast and bacteria.

Advanced Chromatography Systems, 1941 Savage Rd., Ste. 500 E&F, Charleston, SC 29407; Telephone: +1.843.559.4889, Fax: +1.843.559.4881, Website: www.advancedlegcs.com. ACS is a manufacturer of specialty scientific instruments focusing on Fast Chromatography and High Sensitivity Detection. We provide one-of-a-kind liquid chromatography (LC) and gas chromatography (GC) systems. Our feature products are the 800 Series TEA Organic Nitrogen Detector for analysis of NDMA in malt, the 300 Series Fast GC with Automatic Column Installation, and the LC/FID which mixes LC and GC technologies creating a brand new detection technique. Other products include the EZ Flash II Fast GC Accessory and the 200 Series Compact GC which targets system customization for problem application areas that in the past did not have a solution. All products are manufactured at our locations in the United States and the United Kingdom.

Albert Handtmann Armaturenfabrik GmbH & Co. KG, Arthur-Handtmann-Strasse, 11, 88400 Biberach/Riss, Germany; Telephone: +49.7351.342.4542, Fax: +49.7351.342.4465, Website: www.handtmann.de. Handtmann Armaturenfabrik is a leading supplier of valves, fittings, and complete process equipment for the beverage industry. The deep-bed filter MultiMicroSystem for secure and economical sterile filtration of beer and the Combined Stabilizing System CSS for beer stabilization demonstrate Handtmann’s innovative expertise in realizing new ideas for the benefit of the brewer.

AFTEK, Inc., 710 Driving Park Ave., Ste. H, Rochester, NY 14613; Telephone: +1.585.458.7550, Fax: +1.585.458.7476, Website: www.aftekfilters.com. AFTEK is the leader in providing beer, CO2, and water filtration solutions, while servicing the brewing industry. AFTEK represents the highest standards of products including Begerow (BECOPAD, the world’s only mineral and DE free filter sheet), Alfa-Laval centrifuges, yeast propagation systems, heat transfer equipment, domnick hunter CO2 polishers and chillers.

Airborne Labs International, 22C World’s Fair Dr., Somerset, NJ 08873; Telephone: +1.732.302.1950, Fax: +1.732.302.3035, Website: www.airbornelabs.com. We provide certified CO2 purity lab-testing services, rugged, turn-key CO2 purity monitoring systems, technical training, R&M support, discount supplies and quality solutions to the international brewing industry. Our services and products allow brewers to quickly check the quality of a CO2 delivery, identify odors and determine the purity of captured/re-purified CO2 intended for in-house use or outside ISBT-grade sale. We offer convenient No-Haz sampling kits for easy shipping and rapid testing of your gaseous samples. Our versatile analyzer systems are used at both large and small brewing facilities and are designed to meet your specific requirements and budget.

American Tartaric Products, Inc., 1865 Palmer Ave., Larchmont, NY 10538; Telephone: +1.914.834.1881 or +1.815.357.1778, Fax: +1.815.357.6221, Website: www.americantartaric.com. ATP is the largest supplier to the wine industry and is proud to present a range of products to the brewing industry. Our product range includes brewing process aids, anti-foams, clarifiers, filtration aids, stabilizers, filter sheets, cartridges, filtration equipment, pasteurizers, packaging equipment, and analytical equipment. ATP represents well respected and established companies such as AlfaTek, Begerow, Birko, EP Minerals, Hanna, ISP, Nirva-MecSens, and Padovan and Seital.

Anderson Instrument Company, Inc., 156 Avriesville Rd., Fultonville, NY 08873; Telephone: 1.800.803.0081, Fax: +1.518.922.8907, Website: www.andinst.com. The Anderson Instrument Company operates in the U.S. market as Anderson Instrument and in Europe as Negele Messtechnik. Together the companies offer a full line of sanitary process instrumentation. Negele maintains an excellent reputation in the brewery market in Europe and has created a presence in the U.S. by way of importation of brewing equipment. Together these companies have a portfolio including temperature, level, pressure, flow, conductivity, and turbidity sensors. Both branches of this company grew up in the sanitary market and play true to their roots offering products designed to survive in the demanding food, beverage, and pharmaceutical industries.

Anton Paar USA, 10215 Timber Ridge Dr., Ashland, VA 23005; Telephone: +1.804.550.1051, Fax: +1.804.550.1057, Website: www.anton-paar.com. Ensuring the highest quality in production is the number one priority of beer manufacturers around the world. This can be achieved by combining laboratory testing and monitoring the beer directly in the production line. Visit booth #402 to learn about comprehensive solutions for beer analysis in the laboratory and for direct monitoring of beer in the main line offered by Anton Paar. All systems are designed and built with an emphasis on high precision and ease of use. For more information, visit the Anton Paar website: www.anton-paar.com.

Ashland Hercules Water Technologies, 1313 N. Market St., Wilmington, DE 19894; Telephone: +1.302.594.5000, Fax: +1.302.594.6890, Website: www.ashland.com. Ashland Hercules Water Technologies, a commercial unit of Ashland Inc., is a leading specialty chemical supplier to a number of the world’s most essential industries. The chemistries offered are used by customers to improve their operational efficiencies, to enhance the quality of their products, to protect their plant assets, and to minimize their impact on the environment. For the brewing industry, Ashland offers a variety of technologies for influent, boiler water, cooling water, wastewater, and pasteurization applications. These technologies include biocides, coagulants, corrosion inhibitors, defoamers, deposit control agents, flocculants, membrane treatments, metal passivators, odor inhibitors, oxygen scavengers, scale inhibitors, and sludge dewatering polymers.

Astoria-Pacific International, PO Box 930, Clackamas, OR 97015; Telephone: 1.800.536.3111, Fax: +1.503.655.7367, Website: www.astoria-pacific.com. Astoria-Pacific was established in 1990 with the purpose of maximizing laboratory
and production efficiency by offering automated analysis solutions. We are an American company that designs, produces, markets and services analytical instrumentation and reagents to automate analytical chemistries. Our Astoria® and Astoria®2 flow analyzers and Astoria® Discrete analyzer rapidly and accurately measure alpha amylase, beta glucans, bitterness, diastatic power, diacetyl, free amino nitrogen, polyphenols, proteins (e.g., BSA) and more in beer and malt production processes.

Beckman Coulter, Inc., 250 S. Kraemer Blvd., Brea, CA 92821; Telephone: +1.714.961.3270, Fax: +1.714.961.3111, Website: www.beckmancoulter.com. Beckman Coulter develops, manufactures and markets products that simplify, automate and innovate complex biomedical testing. Scientists use our life science research instruments to study complex biological problems including causes of disease and potential new therapies or drugs.

Brauwelt (Fachrenlac Hanscarl), Ander Nacher Str. 33.9, Germany, 90411; Telephone: +49 0 911 952 85 0, Website: www.brauwelt.de & www.hanscarl.com. The specialist publisher Hans Carl has been working in and for the beverage and brewing industry since 1861 with a total of seven trade journals, customer publications and a range of specialist books. The trade periodicals Brauwelt and Brauwelt International belong to the world’s leading journals in this sector. The online archives provide information about everything concerning beer production, non-alcoholic beverages and the development of the international market. The scientific journal BrewingScience provides an insight into the latest trends of research completing at highest level the publisher’s portfolio. More detailed information is available under: www.brauweltinternational.com, www.brauwelt.de and www.brewingscience.de.

Briess Malt & Ingredients Co., 625 S. Irish Rd., PO Box 229, Chilton, WI 53024; Telephone: +1.920.849.7711, Fax: +1.920.849.4277, Website, www.brewingwithbriess.com. Brew consistently great beer with consistently high quality malts from Briess. Made fresh in the U.S.A., Briess malts are carefully handcrafted using specialized equipment to develop exceptional flavors and aromas. And because Briess produces more styles of malts than any malting company in the world, you can streamline ordering and receiving by purchasing all of your malt, malt extracts, and brewers flakes from Briess. Staffed by veteran maltsters, brewers, microbiologists, and agronomists, Briess offers unparalleled support and service to help you brew more efficiently and solve malt handling and brewhouse challenges that may arise. Certified organic since 1990. Family owned since 1876.

Briggs of Burton, 400 Airpark Dr., Ste. 40, Rochester, NY 14624; Telephone: +1.585.426.2460, Fax: +1.585.426.0250, Website: briggsplc.com.uk. Briggs are experienced process engineers, operating in the brewing and distilling sector since 1732 and responsible for some of the most high-profile work of the last decade. This includes the most recent large-scale brewhouse in North America, a near doubling of capacity at Diageo’s largest grain spirit distillery, the world’s first demonstration-scale lignocellulosic ethanol facility and a brewhouse for Carlton United in Brisbane, Australia, where CUB still claim the world benchmark for water efficiency. Briggs now have eyes set firmly on the future, with a highly developed suite of process engineering tools in the Briggs A Frame toolbox.
boiler water products, as well as pretreatment services, boiler water services, cooling water services, influent/effluent water services, odor control services, air stripper treatment, customer service laboratory, automation control and monitoring, and automation programs. It also provides services for pretreatment equipment selection and sizing calculations; boiler and cooling system operations and equipment troubleshooting; chemical treatment product selection and product feed calculations; chemical control, product feed, and control system instrumentation; regulatory and environmental issues; and field training and operator seminars on various aspects of water treatment. The company offers its services for industries including automotive, cogeneration, brewery, food, electronics, glass, utility, textile, chemical, and primary metals. It has operations in North America, South America, the Caribbean, and the Asia/Pacific. The company was founded in 1968 and is headquartered in Glen Allen, Virginia. As of July 2, 2007, ChemTreat, Inc. is a subsidiary of Danaher Corp.

**Real Time PCR (RT PCR) based rapid pathogen detection**

**EMD Chemicals Inc.**

480 S. Democrat Road, Gibbstown, NJ 08027; Telephone: +1.856.599.6694, Fax: +1.800.599.6763, Website: www.emdchemicals.com. EMD Chemicals represents the North American chemical sector of Merck KGaA, Darmstadt, Germany. EMD Chemicals is featuring Real Time PCR (RT PCR) based rapid pathogen detection kits in addition to their impressive line of microbiology products. All Foodproof® pathogen detection kits are probe-based molecular tests that are designed to amplify sequence specific DNA targets allowing both real time visualization and confirmation of presence or absence of target organism within 60–90 minutes. Foodproof® pathogen detection kits offer a clear advantage of both specificity and speed when it comes to detection of beer spoilage organisms.

**Endress+Hauser Inc.**

2350 Endress Place, Greenwood, IN 46143; Telephone: +1.317.535.2134, Website: www.us.endress.com/foodinfo. Endress+Hauser is a privately owned manufacturer of instrumentation and automation solutions. See us for support on energy conservation, beer loss reduction and calibration services. Our products include flow level, pressure temperature, Plato, liquid analysis and optical transition monitoring.

**Enzyme Development Corp.**

360 W. 31st St., Ste. 1102, New York, NY 10001-2727; Telephone: +1.212.736.1580, Fax: +1.212.279.0056, Website: www.enzymedevelopment.com. Enzyme Development Corporation has been serving the needs of enzyme users since 1953. Team members are stationed across the country with the head office in New York City and primary production in Scranton, PA. Our people provide technical analysis to help you select the best options. Whether you need multiple truckloads or only a few kilograms, the care, the attention and the commitment are the same. We offer a full range of enzyme solutions for enhanced brewing performance.

**Esau & Hueber GmbH**

Kapellenweg 10, Schobenhausen, Germany 86529; Telephone: +49 8252 898533, Fax: +49 8252 898515, Website: esau-hueber.de. ESAU & HUEBER supplies a large range of special systems and services to the brewing industry. TURBO AIR JETS are accepted as best practice installations exceeding 800 units worldwide either for wort aeration and oxygenation, carbonation or nitrification. FLEXIPROP yeast management systems combine the benefits of yeast propagation and revitalization in one plant layout. The TURBO AIR yeast aerator within the external circulation loop is the key to more cells in a shorter time than any other system.

**EUWA Water Treatment Plants**

Daimlerstrasse 2-10, Gartringeo, Germany 71116; Telephone: +49 7034 27539, Fax: +49 7034 27590; Website: www.euwa.com. EUWA is the leading specialist in the field of brew water treatment and looks back to more than 40 years of experience. We offer our customer tailor-made solutions around water treatment, which include all modern membrane applications like reverse osmosis, ultrafiltration and membrane deaeration systems as well as the classical treatment methods such as lime treatment and renewable energy. Together, they provide an integrated, full-service engineering and construction solution. EMG’s innovative technology, combined with Pizzagalli’s extensive construction experience in the industrial market, provide the knowledge, technology, and tools to meet the waste stream treatment needs of the brewing industry. The efficient, compact, cost-effective system reduces costs and produces energy while ensuring compliance with environmental permits and regulations.
precipitation, ion exchange, sand and activated carbon filters and disinfection. High emphasis is put on the development of in-house technology in water saving, consulting and water recycling, which are often protected by patents. EUWA plants are used in more than 90 countries on 5 continents.

710 Filtrox North America, 9805 NE 116th St., A-200, Kirkland, WA 98034; Telephone: +1.425.820.4850, Fax: +1.425.820.2816, Website: www.filtrox.com. Stop by our booth and talk to a filtration expert! FILTROX—a leading manufacturer of depth filter media and equipment; a tradition of more than 70 years! We provide solutions for your challenges in filtration. Our product range comprises FIBRAFIX® filter pads, FILTRODISC® lenticular modules, as well as the appropriate sheet filters (NOVOX®), and housings (DISCSTAR®) in all dimensions.

800 Flottweg Separation Technology, Inc., 10700 Toebben Dr., Independence, KY 41051; Telephone: +1.859.448.2300, Fax: +1.859.448.2333, Website: www.flottweg.com. Headquartered in Vilsbiburg, Germany, near Munich, Flottweg specializes in manufacturing a wide range of separation equipment. As a Bavarian company, Flottweg strives to deliver its very best quality products to the brewing industry to ensure high quality beer production. Its portfolio includes sedicators for beer recovery from spent yeast, high-speed separators for green beer clarification and beer pre-Kieselghur clarification, decanters for hot water separation from trub and belt presses for spent grain dewatering for combustion. Flottweg has subsidiaries and branch offices worldwide. Its North American headquarters are located in the greater Cincinnati metro area.

602 GEA Brewery Systems, 1600 O’Keefe Rd., Hudson, WI 54016; Telephone: +1.715.386.9371, Fax: +1.715.386.9376, Website: www.gea-brewery.com. GEA Brewery Systems provides brewery technology from a single source. We develop innovative solutions that are specifically tailored to your specific requirements. We supply individual process units, complete brew houses and cells, process automation and utilities, training and consulting as well as complete turnkey plants. For many years, many international brewing groups, large breweries and also many medium-sized breweries have been relying on our know-how and comprehensive service. Now we have expanded our scope of supply to include complete craft brewery solutions. The competence and technology of GEA Brewery Systems have always been the basis for the production of great beers.

600 GEA Tuchenhagen North America, 90 Evergreen Dr., Portland, ME 04103; Telephone: +1.207.797.9500, Website: www.tuchenhagen.us. GEA Tuchenhagen is a global leader in the manufacture of a wide range of sanitary flow components, including mixproof, single-seat, divert, modulating, butterfly, pressure relief and sample valves, valve control technology, inline instrumentation, cleaning devices, vessel protection and cleaning systems, and the innovative and cost-effective ECO-MATRIX® piping system. We also offer services for manifold design and application concept development, after-sales service and support. For our customers’ convenience, in partnership with our nationwide distribution network, spare parts are available overnight or same day to any location in the U.S. and Canada.

604 GEA Westfalia Separator, 100 Fairway Court, Northvale, NJ 07647; Telephone: +1.201.767.3900, Fax: +1.201.767.3416, Website: www.wsus.com. GEA Westfalia Separator is a leading manufacturer and distributor of high-quality centrifuges and ceramic membranes for a wide variety of applications within the beverage industry. The company also offers PROF®3, a DE-free technology that combines centrifugal separation with membrane filtration for use in beer production. With full-service repair facilities on the East and West Coasts, GEA Westfalia Separator offers a complete maintenance, testing, engineering, training, repair and spare parts capability. The company has been manufacturing centrifuges since 1893.

303 GF Piping, 2882 Dow Ave., Tustin, CA 92780-7258; Telephone: +1.714. 368.4112, Fax: +1.714.368.4113, Website: www.gfpiping.com. COOL-FIT® ABS Plus is a complete pre-insulated plastic piping system for glycol and secondary cooling piping systems. The system is based on GF Piping Systems’ COOL-FIT ABS piping system, which contains pipe, fittings, valves, and transition fittings. It is UV resistant, vapor-tight and 100% water-tight. The top-quality energy-efficient system requires minimum installation time. This piping system is maintenance-free with a life span of 25+ years. It is also very environmentally friendly; a TEWI report is available on request. Installation training is provided free of charge. COOL-FIT® comes with a full range of actuated valves, measurement and instrumentation.

109 GKD-USA Inc., 825 Chesapeake Dr., Cambridge, MD 21613; Telephone: +1.410.221.0542, Fax: +1.221.0544, Website: www.gkdusa.com. For over 75 years, GKD has enjoyed a reputation for precision weaving and extensive knowledge of industrial filtration processes. Our filter media, woven on our innovative looms, woven on our innovative looms, weaves to produce the highest quality filter cloth available on the market. These same quality and superior standards apply to the design and fabrication of our NeverLeak® filter leaf, developed to clearly out-perform ordinary filter leaves. The NeverLeak pressure filter leaves provide dependable filtration for industrial process of beer/malt beverage, juice, and wine/spirits; edible oils and other foods; and chemicals and pharmaceuticals.

305 & 307 Gusmer Enterprises, 1165 Globe Ave., Mountainside, NJ 07092-2903; Telephone: +1.715.258.5525, Fax: +1.715.258.8488, Website: www.gusmerbeer.com. For 86 years, Gusmer has taken a revolutionary approach to serving the brewer’s vision. It’s why we have developed our extensive R&D and Application Support Labs, offer the most advanced products, and provide a ready resource for problem-solving. Gusmer manufactured goods are skilfully developed, made in the U.S., and created from the highest quality raw materials. We also distribute a variety of carefully selected, high-quality products from superior suppliers. Gusmer team members possess actual brewing experience and can match specific products to the needs of your brewery. Gusmer has what you need for your brewery.

711 Hach Company, PO Box 389, Loveland, CO 80539-0389; Telephone: 1.800.227.4224, Fax: +1.970.609.2932; Website: www.hach.com. Hach Company provides the most comprehensive portfolio of analytical solutions to ensure water and product quality. We design, manufacture, and distribute reagents, test kits, and instrumentation for testing water and product quality in a variety of brewery applications including incoming water, fermentation, maturation, packaging, and
effluent water treatment. Our products cover a wide variety of parameters including dissolved oxygen, carbon dioxide, nitrogen, chlorine, turbidity, organics, and microbiology. They can be used in-line or in the lab, from spectrophotometry to complete package analysis. Convenient on-site service contracts available.

309  **IBD Trading**, 33 Clarges St., London, United Kingdom, W1J 7EE; Telephone: +44 0 20 7499 8144, Fax: +44 0 20 7499 1156, Website: www.ibd.org.uk. The Institute of Brewing & Distilling (IBD) is a members’ organisation and registered educational charity. The IBD’s Vision Statement is: “The advancement of education and professional development in the science and technology of brewing, distilling and related industries.” The IBD is a leading global provider of professional qualifications. It also produces two highly respected publications—*Journal of the Institute of Brewing and The Brewer & Distiller International*.

312  **INVISTA**, One Lake Point Plaza, 4th Fl., 4235 S. Stream Blvd., Charlotte, NC 28217; Telephone: 1.888-6INVISTA, Fax: +1.704.586.7564, Website: www.INVISTA.com & polyshield@ INVISTA.com. PolyShield® resin monolayer PET barrier technology was designed for shelf life and barrier requirements of oxygen-sensitive food and beverages, including beer. PolyShield® resin prevents oxidation of the product, which can affect taste, and provides more than one year of shelf life. This resin features oxygen scavenging and passive carbonation barrier when combined with MXD6 and provides outstanding clarity for tinted bottles. PolyShield® resin-MXD6 blends can be processed on standard PET manufacturing equipment with only minor changes and minimal investment. INVISTA is one of the world’s largest integrated producers of polymers and fibers, primarily for nylon, spandex and polyester applications.

601  **Kagetec**, 309 Elm Ave. SW, Montgomery, MN 56069-1233; Telephone: +1.612.298.8838, Fax: +1.612.435.7643, Website: www.kagetecusa.com. Kagetec is the world leader in chemical-resistant, hygienic, industrial flooring systems consisting of slip-resistant tile and integrated stainless steel drains. We have more than 20 years of experience in the brewing industry and take pride in maintaining the highest quality floors by performing the installation ourselves.

403  **Krones**, 9600 S. 58th St., Franklin, WI 53132; Telephone: +1.414.409.4000, Fax: +1.414.409.4100, Website:www.krones.com. Krones will feature its brewing process systems technology, which covers all aspects of brewing, from malt intake to filtered beer, including brewhouse and filter plants, as well as fermentation and storage cellars. ShakesBeer, Pegasus, Stromboli, Merlin, Whirlpool Calypso, Twin Flow System filters, and beer flash pasteurization rank among their best-known brewing innovations.

107  **Lallemand Brewing/Ethanol Technology**, 6120 W. Douglas Ave., Milwaukee, WI 53218; Telephone: +1.702.481.8735, Website: lallemandbrewing.com. Lallemand Brewing specializes in dry yeast and nutrients. Dry yeast represents an alternative to liquid yeast not only for primary fermentation but also for bottle conditioning. Four strains are available in dry form: Nottingham Ale Yeast, Windsor British Type Beer Yeast, Munich Wheat Beer Yeast and Diamond Lager Yeast. All can be reused and/or propagated. Dry yeast offers the advantage of flexibility, long shelf-life and easy storage/shipping. Nutrition products include complete nutrients mix and the zinc-enriched yeast Servomyces recommended for propagation, high-gravity brews and serially repitched yeast.

505  **LECO Corporation**, 3000 Lakeview Ave., St. Joseph, MI 49085; Telephone: 1.800.292.6141 or +1.269.983.5531, Website: www.leco.com. For over 70 years, industries around the world have trusted LECO to deliver technologically advanced products and solutions for analytical science. Today’s technologies for separation science resolve complex samples and pioneer high sample throughput using GCxGC, GCxGC-TOFMS, and GC-TOFMS. A unique combination of easy-to-use software and advanced instrumentation provides an innovative solution for today’s most demanding applications, including food and beverage quality, and flavor/fragrance, environmental, and metabolomics.

812  **Loeffler Chemical Corporation**, 5700 Busknell Dr., Atlanta, GA 30336; Telephone: +1.404.629.0999, Fax: +1.404.629.0650, Website: www.loefflerchemical.com. The Loeffler Chemical Corporation offers a complete line of cleaning and sanitizing products for all brewery applications, including caustic and acid CIP and foam cleaners, line lubricants, specialty products as well as sanitizers and disinfectants. We manufacture customized industrial-grade chemical automation equipment for a wide variety of applications including, but not limited to, chemical dosing and monitoring, CIP, water treatment and bottle washing. Loeffler also offers a line of specialty enzymes for brewing applications and the only chemical/mechanical beerline cleaning system currently available in the United States.

702  **Mettler-Toledo Ingold Inc.**, 36 Middlesex Turnpike, Bedford, MA 01730; Telephone: +1.781.301.8802, Fax: +1.781.271.0681, Website: www.mt.com. Mettler-Toledo Ingold, Inc. is the leading producer of in-line process analytics worldwide. We offer innovative and unique solutions in pH, dissolved oxygen, gaseous oxygen, conductivity, and turbidity measurements. Please join us to learn more about our “whole loop ownership” concept, long-life electrodes, and fully automated cleaning and calibration systems.

103  **MIOX Corporation**, 5601 Balloon Fiesta Pkwy. NE, Albuquerque, NM 87113; Telephone: +1.505.343.0090, Fax: +1.505.343.0093, Website: www.miox.com. The Vault™ uses an efficient and cost-effective clean-in-place (CIP) technology for cleaning the interior surfaces of beverage production equipment without disassembly, reducing production downtime and increasing plant efficiency. The self-cleaning Vault uses only salt, water, and power to safely generate a dilute chlorine-based solution on-site, on demand. The environmentally benign and single component solution replaces 4- and 5-step CIP processes with a rapid, non-thermal, 3-step process consisting of rinse, treatment, and final rinse.

113  **Munkell Inc.**, 7517 Precision Dr., Ste. 112, Raleigh, NC 27617; Telephone: +1.919.226.0752, Fax: +1.919.226.0758, Website: www.munkell.com. Munkell was founded in 1815 as the first company ever to manufacture analytical filter paper and today we are one of the world-leading companies within macro filtration and today. Headquartered in Falun, Sweden, we have a global presence with subsidiaries in Germany and the USA. We offer pleated/flat filter papers, membranes, syringe filters, and other types of specialized filtration products for the brewery industry. Munkell is ISO 9000 certified and our products are manufactured according to MEBAK and EBC standards.
Nalco, 1601 W. Diehl Rd., Naperville, IL 60563; Telephone: +1.630.305.2947 or +1.630.305.1239, Fax: +1.630.305.1239 or +1.603.305.2947, Website: www.nalco.com. Nalco is the world’s leading water treatment and process improvement company, delivering significant environmental, social and economic performance benefits to our customers. Our brewing team is the leader in water and energy management. Only Nalco brings you the technologies that will detect system conditions, automatically determine appropriate response and deliver unprecedented water and energy savings while protecting your equipment assets: 3D TRASAR® technology for cooling water, 3D TRASAR technology for boilers, 3D TRASAR technology for reverse osmosis, 3D TRASAR technology for pasteurizers. Ask us about our process programs for breweries: the Nalco yeast activity monitor consistently measures metabolic activity rates in under 3 minutes.

Newlands Systems, Inc., 602 - 3073 Simpson Rd., Abbotsford, British Columbia, Canada, V2T 6Y7; Telephone: 1.877.855.4890, Fax: +1.604.850.7909, Website: www.nsibrew.com. Over the last 23 years, Newlands has distinguished itself as being the premiere brewing equipment supplier in North America. Through the use of state-of-the-art technologies in design, engineering, and fabrication, Newlands creates highly innovative and expertly crafted products. Providing a comprehensive array of products and services, including everything from project conception through installation and commissioning, Newlands is your single source for brewing expertise. A true world-class manufacturer, utilizing an ISO:9001 and ASME certified facility, Newlands produces complete systems ranging in size from 2-barrel pilot breweries up to large-scale regional breweries.

Nexcelom Bioscience, 360 Merrimack St., #9, Lawrence, MA 01843; Telephone: +1.978.327.5340, Fax: +1.978.327.5341, Website: www.nexcelom.com. Nexcelom is a leading manufacturer of automated cell counting and analysis equipment. Their Cellometer line of simple-to-use cell counters is designed to automate manual cell counting and analysis by obtaining accurate concentration, viability, and cell sizes of yeast. The system also automates sample tracking and data capture. Cellometer easily integrates into existing manual counting work flows, with the potential to increase sample throughput and leading to more consistent fermentation. Please stop by our booth to learn more or visit www.nexcelom.com.

Norit Haffmans, 1330 Anvil Dr., Rockford, IL 61115; Telephone: +1.815.639.0322, Website: www.norithaffmans.nl. Norit Haffmans is a leading supplier of total CO₂, O₂ management systems, offering a wide range of quality control equipment, water deaeration systems, and blending and carbonation units. Norit Haffmans’ quality control equipment measures CO₂, O₂, foam, and turbidity and monitors pasteurization. As your O₂ management measuring specialist, Norit Haffmans measures O₂ from wort production through filling, allowing you to track this important measuring point through the process. Norit Haffmans’ CO₂ recovery technology, including brewery-type CO₂ recovery plants, liquid CO₂-stripping systems, and LiquiVap, the energy-efficient heat recovery system, allows you to recover CO₂ from fermentation sources.

Pall Corporation, 25 Harbor Park Dr., Port Washington, NY 11050; Telephone: +1.516.484.3600 or 1.866.905.7255, Fax +1.516.801.9711, Website: www.pall.com. For the food and beverage industries, Pall Corporation has developed filtration and advanced filtration systems that meet market needs for reliability and cost effectiveness. Easy to install and simple to use, the space-saving systems satisfy a wide variety of filtration requirements. Pall filters remove particulate contamination, ensure the absence of spoilage microorganisms and provide high-quality air and gases. Membrane processes can additionally concentrate products without heat, purify and clarify, selectively remove components, and deal with process effluent.

PerkinElmer, 710 Bridgeport Ave., Shelton, CT 06484; Telephone: 1.800.762.4000, Website: www.perkinelmer.com. PerkinElmer is a global scientific leader providing an extensive range of technology solutions and services to address the most critical issues facing humanity. From critical research and prenatal screening to environmental testing and industrial monitoring, we’re actively engaged in improving health and enhancing quality of life all around the world. PerkinElmer’s proud history dates back to the 1930s. Our legacy of scientific advancement, operational excellence and continual expansion, from Boston to Beijing, is the foundation of our mission to improve human and environmental health. Collaborating with customers to identify risks, discover and monitor the things that matter most—from safer drinking water to cleaner air, faster research to healthier babies—is imperative to executing our mission. Encouraging ingenuity and exploration, integrity and generosity, and teamwork and employee development is essential to living our mission, every day.

PQ Corporation, PO Box 840, Valley Forge, PA 19482-0840; Telephone: +1.610.651.4200 or 1.800.944.7411, Fax: +1.610.251.5249, Website: www.pqcorp.com. PQ’s BRITESORB® silica gels meet the needs of brewers the world of product color, turbidity, haze, and constituent concentration for real-time results. Our inline UV-VIS-NIR absorption-based photometers, insertion probes, and scattered-light turbidity meters monitor and control fermentation, filtration, separation, yeast pitching, wort color and clarity, DE and PVPP dosing, sanitizer concentrations and more. In addition, optek recently introduced the Haze Control series of dual-angle lab and process turbidity meters for QA/QC, as well as NIST calibration solution standards. Optek helps brewers achieve uninterrupted processing for the best possible product with reduced product loss, improved profitability, and greater efficiency—from line to lab.

Parker domnick hunter, 5900 Northwoods Pkwy., Ste. B, Charlotte, NC 28269-3738; Telephone: +1.704.921.9303, Fax: +1.704.921.1960, Website: www.domnickhunter.com. Parker domnick hunter & Parker’s Process Advanced Filtration Division are supported by innovative products, state-of-the-art technical facilities and a specialized international team. Our capability is based on understanding the specific needs of your business and providing total system solutions. We offer CO₂ polishers for both plant-scale and retail dispense applications, nitrogen gas generators, process water chillers, compressed air treatment plus a full line of filtration products which assist beverage processors in achieving the characteristics consumers demand—clear, sparkling products free of spoilage organisms and other contaminants.

Optek-Danulat, Inc., N118 W 18748 Brusen Dr, Germantown, WI 53022; Telephone: 1.800.371.4288, Fax: +1.262.437.3682, Website: www.optek.com. Optek’s process control instrumentation provides advanced and precise inline analysis of product color, turbidity, haze, and constituent concentration for real-time results. Our inline UV-VIS-NIR absorption-based photometers, insertion probes, and scattered-light turbidity meters monitor and control fermentation, filtration, separation, yeast pitching, wort color and clarity, DE and PVPP dosing, sanitizer concentrations and more. In addition, optek recently introduced the Haze Control series of dual-angle lab and process turbidity meters for QA/QC, as well as NIST calibration solution standards. Optek helps brewers achieve uninterrupted processing for the best possible product with reduced product loss, improved profitability, and greater efficiency—from line to lab.
over and provide selective chillproofing performance with excellent filtration characteristics. The gels remove only the proteins that cause chill-haze, not those that stabilize foam. BRITESORB® beer stabilizers are manufactured in PQ’s state-of-the-art production facilities to meet all regulatory requirements for food-grade silica and maintain consistent high quality and performance batch after batch, order after order. PQ BRITESORB® beer stabilizers: the clear choice for world-class beer.

611 Profamo Inc., 7506 Albert Tillinghast Dr., Sarasota, FL 34240-8688; Telephone: +1.941.379.8155, Fax: +1.941.379.8699, Website: www.profamo.com. Profamo Inc. is pleased to present at Brewing Summit 2010 the (Nirva) MecSens line of equipment, which includes their package analyzer for true TPO and CO₂ measurement as well as their wireless, in-line and portable DO meters. The MecSens units can be used in conjunction with the Headmaster dissolved oxygen and CO₂ calibrator which will also be displayed. Also on the booth will be the Advanced Instrument’s CO₂ purity analyzer; Rotech’s keg racker monitoring system and Pfeuffer Sortimat and Tannometer.

310 ProLeiT AG, Einsteinstr. 8, 91074 Herzogenaurach, Germany, Telephone: +49 9132 777 100, Fax: +49 9132 777 150, Website: www.proleit.com. ProLeiT provides process control engineering and MES solutions for the process industry. Based on well-founded, industrial process know-how for breweries the complete range of the automation and information engineering from the field level through to the enterprise management level is covered. The preparation of design and functional specifications, the development of user software, including the commissioning, training, service and support belongs to our delivery spectrum for turn-key automation solutions. The technical basis is the in-house developed technology-oriented Plant iT process control system. Plant iT is marketed under the trade name brewmaxx for use in breweries.

408 PureMalt Products, Victoria Bridge, Haddington, East Lothian, United Kingdom, EH41 4BD; Telephone: +44 162082 4696, Fax: +44 1620828 667, Website: www.puremalt.com. PureMalt Products Limited is the world leader in new specialty malt ingredients for the brewing industry. PureMalt Products Limited produces refined malt extracts of pale malt, crystal malt and roasted malt suitable for late addition to beer. The ZAB range offers solutions for blending of non-alcoholic and low-alcohol beers and malt beverages. A new product is aimed at increasing the drinkability of reduced-alcohol or reduced-calorie beers and beverages.

213 Pursuit Dynamics, Inc., 101 Merritt 7, Norwalk, CT 06851; Telephone: +1.203.286.0608, Fax: +1.203.286.0601, Website: www.pdx.biz. The PDX® wort heater represents the latest in energy-saving technology being introduced to the brewing market. Key PDX® wort heater benefits include: quality profiles maintained—quality profiles such as SMM, DMS, hop isomerization and flavor are easily maintained; up to 50% reduction in energy use—energy savings during the wort heat up and boiling cycle; reduced cleaning times—no hot spots or no burn on, resulting in significantly reduced cleaning times; accelerated cycle times—no hot spots or burn on, thus no insulating layer of wort build up resulting in a more efficient thermal transfer.

712 Radiant Industrial Solutions, Inc., 10801 Kempwood Dr., Ste. 1, Houston, TX 77043; Telephone: +1.713.972.0196, Fax: +1.832.248.4229, www.radiantuv.com. Radiant Industrial is the premier food and beverage disinfection provider specializing in air, surface, and water applications. Radiant provides contamination control through disinfection products specific to the F&B environment. Radiant products are designed to provide safety process controls and contamination removal that are measured, controlled, and reported. Products range from standard to custom equipment. Disinfection levels range from 1 to 9 log reduction. Radiant provides ultraviolet water systems meeting current and forthcoming regulations, as well as ultraviolet air treatment for product safety, consumer confidence, and documented contamination control. Surface disinfection provided by Radiant is specific to each application ranging from standard bottle caps to product surface disinfection. Radiant offers equipment for harsh environments including extreme temperatures from sub-zero to high heat; high volatility, to standard F&B wash down environments. From application design to process/product service, Radiant is your partner in the beverage industry for disinfection solutions.

310 Rochester Midland Corp., 333 Hollenbeck St., Rochester, NY 14621; Telephone: +1.585.336.2200, Website: www.rochestermidland.com. Rochester Midland Corporation provides a HAACP-based food safety program that offers sanitation solutions to food and beverage manufacturers across all aspects of brewing from fermenters to fillers. Our BrandGuard Program® is made up of 7 steps which are all critical components of a consultative and effective food safety program. Built into each step are the environmental, social and financial legs of sustainability. With our 120+ years of experience, we have formed long-term partnerships with our customers to provide them with the integrated solutions that will protect their business financially.

705 Siebel Institute/World Brewing Academy, 1777 N. Clybourn Ave., Chicago, IL 60614-5519; Telephone: 1.847.284.2337, Fax: +1.312.255.1312, Website: www.siebelinstitute.com. The Siebel Institute of Technology and World Brewing Academy (a partnership between Doemens Academy and Siebel Institute) are proud to offer more brewing-related courses than any other school, including our web-based Concise Course in Brewing and our new 20-week English-language Master Brewer Program. Our campus-based and web-based programs cover the full range of brewing-related subjects, offering world-class training that ranges from the fundamentals of brewing to advanced-level programs designed and presented by the most talented instructors in brewing education. We also offer consulting, yeast management and production, lab services and laboratory media for your QC/QA applications.

200 Siemens Industry, Inc., 11601 Lilburn Park Rd., St. Louis, MO 63146; Telephone: +1.423.747.5850, Fax: +1.678.297.8120, Website: www.siemens.com. Siemens supplies automation solutions and brewing know-how to help craft breweries increase capacity, improve productivity and increase the repeatability/quality of their beer. With a full line of instrumentation, motors and drives and the Braumat Compact control system, we cover your brewhouse, cellars, utilities, grain handling, and CIP operations. Siemens also provides a complete line of water and wastewater treatment solutions and services for the brewing industry. Processes and technologies include membrane filtration, pretreatment, water reuse processes, and biological wastewater treatment to assist
you in meeting compliance issues, minimize waste, and reduce BOD levels.

101 Skalar, Inc., 5012 Bristol Industrial Pkwy., Bedford, GA 30518; Telephone: 1.800.782.4994, Fax: +1.770.416.6718, Website: www.skalar.com. Skalar is a Dutch instrument manufacturer established in 1965. The Skalar analyzers meet the highest quality standards and have proven to be the most reliable and economical choice in today’s modern routine laboratory. Skalar has developed many applications specifically designed for the brewing and malting industries over the years allowing not only quicker turn-around time for results, but also with great precision. Such analytes include, but are not limited to: IBU, total SO₂, alpha amylase, beta-glucan, free amino nitrogen, diastatic power. Their automated total SO₂ method is an approved ASBC/EBC method on their unit and can be coupled with any listed above.

400 SPX Flow Technology, Waukesha Cherry-Burrell and APV brands, 611 Sugar Creek Rd., Delavan, WI 53115; Telephone: +1.800.252.5200 or +1.262.728.1900, Fax: +1.800.252.5012 or +1.262.728.4904, Website: www.gowcb.com and www.apv.com. Waukesha Cherry-Burrell brand manufactures sanitary equipment for brewery processes. WCB’s new features in brewery mix proof technology include: minimal CIP loss; superior mechanical strength; chemically inert, press-on PTFE seats; free-draining, horizontally mounted valves; reliability and various control top options with networking technology. APV has been a leading supplier to the brewing industry for over 80 years and has developed a network for working closely with customers all over the world. Our international pool of brewing experts and their expertise within design and project management makes APV a specialist in the design and execution of customized beer processing lines.

502 S.S. Steiner, Inc., 655 Madison Ave., New York, NY 10021; Telephone: +1.212.838.8900, Fax: +1.212.593.4238, Website: www.steiner.com. S.S. Steiner is a full-service worldwide grower, processor, and dealer of hops and hop products. Additional information regarding the purchase of whole leaf, pellets (90 and 45), CO₂ extract, and other modified hop products in a variety of package sizes is available on our website at www.hopsteiner.com.

308 Steinfurth Inc., 5148 Kennedy Rd., Ste. 600, Forest Park, GA 30297-2051; Telephone: +1.678.500.7035, Fax: +1.678.500.7036, Website: www.steinfurth.com. Steinfurth, leading specialist for quality control instruments, will be presenting its automatic foam stability tester and the SF-PastControl System (pasteurization logger). The newest Steinfurth products, the compact package analyzer for combined CO₂, torque fill level & density measurement and Automatic Multiple Sampler AS380C is rounding up the family of instruments for quality control on beverages and beverage packages. Steinfurth’s range of products for the beverages industry includes CO₂ measuring systems; devices for calibrating pressure and temperature; torque tester; logger for pressure, temperature and pasteurization; packaging testing devices, measuring for foam stability and turbidity in beer; laboratory carbonization systems and sampling devices.

508 Symbiont, 6737 W. Washington St., Ste. 3440, West Allis, WI, 53214; Telephone: +1.414.291.8840, Fax: +1.414.291-8841, Website: www.symbiontonline.com. Symbiont, Science, Engineering and Construction is an engineer-led design-build company specializing in the beverage industry. Symbiont provides full service engineering services in house with single point accountability. Brewing services include material handling, brewing process, cold services, fermenting, conditioning, packaging, and process piping controls. Industrial services include facilities and site engineering, process design, plant utilities, process instrumentation and control, design-build project delivery, energy optimization, water/ wastewater treatment, investigation remediation, air and waste management, and environmental management.

806 Tig-Pro Inc., 21 Tee Dr., Portland, ME 04103; Telephone: +1.207.878.1190, Fax: +1.207.871.1898, Website: www.tigpro.com. TigPro has been servicing the food and beverage industries since January 2000. We offer complete lines of sanitary process equipment from some of the industry’s leading manufacturers including pumps, valves, heat exchangers, tanks, flow components, and instrumentation. Our engineering services include sanitary process and control, prototypes, equipment sizing/selection, piping system design, fabrication, installation, and system start up. Our shop fabrication services include custom modular skidded systems, manifolds, valve clusters, transfer panels, catwalks, platforms, railings, tables, and countertops. Our welders are certified to ASME section IX standards and are also certified for tank entry to repair cracks and replace components.

509 Tyco Flow Control, 10707 Clay Rd., Houston, TX 77041; Telephone: +1.713.986.4665, Fax: +1.713.986.8575, Website: tycoflowcontrol.com. Tyco Flow Control is the world’s largest manufacturer of valve products that move, control, and sample liquids, gases, powders, and other substances. We together are the world’s premier manufacturers of flow control products. With over 90 valve brands, we offer a level of expertise that is second-to-none in providing innovative solutions to the most challenging flow control applications. Tyco has an extensive track record of meeting the demands of the food and beverage industries. Combining advanced technology with outstanding engineering expertise, we have a series of valve, actuation and control products designed to solve your toughest problems.

The University of Nottingham-Brewing Science, Sutton Bonington Campus, Loughborough, United Kingdom, L312 6RD; Telephone: +44 1159 516214, Fax: +44 1159 516162; Website: www.nottingham.ac.uk. 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 programs are delivered through the latest innovations in e-learning, coupled with intensive residential-taught courses. We are engaged in a range of research programs 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 and biofuels, malting science, crop science and beer flavor technology.

VitalSensors Technologies, 3 Post Office Square, Acton, MA 01720; Telephone: +1.978.635.0450, Fax: +1.978.635.0590, Website: www.vitalsensorstech.com. VitalSensors Technologies is the world leader in real-time, infrared quality control sensors for beverage and food manufacturers. Our sensors are not affected by pressure spikes or extreme working conditions. All VitalSensors products operate in place during cleaning and sterilizing and contain no moving parts. The VS-3000 Beer and
Wine Monitor directly measures three of the most important quality control concentrations used by beer and wine producers: CO₂, alcohol, Brix/extract and calculates original gravity. The VS-3000 measures the concentration and temperature of fluids in a process stream or tank in real-time. VitalSensors also offers industry-leading single concentration sensors with our VS-1000 family.

**Wine Monitor**

**Wayne Chemical Inc.**

**VLB Berlin**

**VTT Technical Research Centre of Finland**

409

406

707

809

404 & 406

**Weyermann® Specialty Malts**

**White Lab/Frings America**

**Wyeast Laboratories Inc.**

**Ziemann Ludwigsburg GmbH**

**Ziemanns—Taking care of brewing and bottling. Everything from one source!**