

# **33rd International Congress of the European Brewery Convention 2011**

**(EBC)**

**Glasgow, Scotland, United Kingdom  
22-26 May 2011**

ISBN: 978-1-61839-320-3

**Printed from e-media with permission by:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571



**Some format issues inherent in the e-media version may also appear in this print version.**

Copyright© (2011) by the European Brewery Convention  
All rights reserved.

Printed by Curran Associates, Inc. (2012)

For permission requests, please contact the European Brewery Convention  
at the address below.

European Brewery Convention  
c/o The Brewers of Europe  
Rue Caroly 23-25  
B-1050 Brussels, Belgium

Phone: 32 2 551 1810

Fax: 32 2 660 9402

[info@europeanbreweryconvention.org](mailto:info@europeanbreweryconvention.org)

**Additional copies of this publication are available from:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: 845-758-0400  
Fax: 845-758-2634  
Email: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

# TABLE OF CONTENTS

## OPENING & KEY-NOTE SESSIONS:

<b>Challenges to the UK Brewing and Hospitality Sector: Getting on the Front Foot</b> .....	1
<i>Brigid Simmonds</i>	
<b>Changing the UK's Drinking Culture</b> .....	2
<i>Paul Hegarty</i>	
<b>Scottish Brewing Archive Association - Promoting the History of Brewing in Scotland</b> .....	22
<i>Harvey Milne</i>	
<b>Does Beer Serve Europe? The Brewers of Europe Response in a Challenging Policy Environment</b> .....	33
<i>Pierre-Olivier Bergeron</i>	
<b>Trends in Hop Research: Review of the EBC Hop Symposium 2010</b> .....	34
<i>Martin Biendl</i>	
<b>Should You Mix Your Drinks? The Globalisation of the Brewing and Distilling Industry Enters the Next Stage</b> .....	43
<i>Ina Verstl</i>	
<b>Alcohol Health Benefits and Risks 2011. Where Are We Now?</b> .....	44
<i>Oliver F. W. James</i>	

## RAW MATERIALS 1 (BARLEY & MALT):

<b>Methods, Applications and Chances for BULK SORTING OF CEREALS</b> .....	45
<i>Konrad Muller-Auffermann</i>	
<b>A New Screening Method Detects Fusarium on Barley - Using Multispectral Imaging</b> .....	61
<i>Britt Moller</i>	
<b>Analysis of the Barley Grain Protease Spectrum</b> .....	79
<i>Angela Bell, Peter C. Morris, James H. Bryce</i>	
<b>Proteomic Analysis of Drought Stress in Barley</b> .....	92
<i>Charlotte Wendelboe-Nelson, Peter C. Morris</i>	
<b>Malting – The Interface in between Agriculture and Brewing &amp; Distilling Industry</b> .....	93
<i>Michael Nierle</i>	
<b>New Insight on Steeping Step</b> .....	111
<i>Patrick Boivin</i>	
<b>Analysis of the Barley Malting Process for Increased Malt Quality and Gushing Prevention</b> .....	112
<i>Karin Gorzolka, Manfred Lissel, Stefan Loch-Ahring, Karsten Niehaus</i>	

## RAW MATERIALS 2 (HOPS):

<b>Investigations About Occurrence and Characterisation of Different Strains of Hop Wilt (<i>Verticillium Ssp.</i>) to Develop a Control Strategy Against This Pathogen</b> .....	127
<i>S. Seefelder, K. Drofenigg, E. Seigner, E. Niedermeier, G. Berg, B. Javornik, S. Radisek</i>	
<b>Occurrence of Polyfunctional Thiols and Their Precursors in Hop</b> .....	136
<i>Jacques Gros, Sabrina Nizet, Sonia Collin</i>	
<b>Influences to the Transfer Rate of Hop Aroma Compounds During Dry-hopping of Lager Beers</b> .....	148
<i>Martin Krottenthaler, Stefan Hanke, Sebastian Kappler, Thomas Becker</i>	
<b>Hopping of Low Alcohol Beers</b> .....	149
<i>Adrian Forster, Andreas Gahr</i>	
<b>Evaluation of Different Hop Products and Boiling Parameters to Reduce Sunstruck Flavor in Nonalcoholic Fermented Beverages</b> .....	165
<i>Alicia Munoz Insa, Thomas Becker, Martina Gastl</i>	
<b>Incremental Hop Dosage Regime to Improve the Oxidative Beer Stability</b> .....	166
<i>Philip Wietstock, Thomas Kunz, Wiebke Hense, Jakob Frenzel, Frank-Jurgen Methner</i>	

<b>Influence of Hop Pre-Treatment Before Dosage on the Utilisation Rate of Isohumulones and Resulting Beer Quality</b> .....	178
<i>Sebastian Kappler, Martin Krottenthaler, Thomas Becker</i>	

### **BEER PROCESSING & QUALITY:**

<b>Microbiological Stability of Beer in Plastic Packaging</b> .....	179
<i>Ruslan Hofmann, Ulf Stahl</i>	
<b>Flash Pasteurization as an Significant Influence on the Long-Term Stability of Beer?</b> .....	194
<i>Jean Titze, Vladimir Ilberg, Harun Parlar</i>	
<b>Fault Diagnosis of Bottling Plants – Analysis with a Model Based Algorithm</b> .....	202
<i>Stefan Flad, Andri Schrade, Peter Struss, Tobias Voigt</i>	
<b>Development of an Interlaboratory Test for Microbiological Analyses</b> .....	210
<i>Carsten Zufall, Carolina Wehrmann, Jeannette Romero, Alix Reyes</i>	
<b>Influence of (Novel) Brewing Raw Materials on Beer Membrane Filtration</b> .....	219
<i>Joris de Groot</i>	
<b>Efficient Beer Recuperation from Surplus Yeast</b> .....	220
<i>Gerald Zanker</i>	
<b>Hop-based Antifoam Emulsions</b> .....	234
<i>Camille Herve, Yannick Ford, Keith Westwood, Tim Foster, Bettina Wolf</i>	

### **YEAST & MICROBIOLOGY:**

<b>Effects of Fermentable Sugar Composition on Defective Fermentation</b> .....	235
<i>Yuichiro Mese, Kenichi Enomoto, Hiroyuki Yoshimoto</i>	
<b>Determining the Optimal Maturation Time in Secondary Fermentations Via Certain Fermentation by-Products and Sensory</b> .....	246
<i>Urs Wellhoener, Annette Fritsch, David Grinnell</i>	
<b>Step-wise Adaptive Evolution of a Brewer's Yeast Strain for Both OSMO- and Ethanol Tolerance</b> .....	247
<i>Brian R. Gibson, John Londesborough</i>	
<b>Resistance to hop iso-<math>\alpha</math>-Acids in Yeast Involves Active Transport and Vacuolar Sequestration</b> .....	248
<i>Lucie Haze Iwood</i>	
<b>If Only Brewing Yeast Could Speak.....</b> .....	259
<i>Katherine A. Smart</i>	
<b>Real Time Monitoring of Glucose and Fructose Metabolism in Yeast by DNP-NMR</b> .....	260
<i>Jens O. Duus, Sebastian Meier, Magnus Karlsson, Pernille R. Jensen, Natalia Solodovnikova, Jurgen Wendland, Mathilde H Lerche</i>	

### **SENSORY SCIENCE & TECHNOLOGY:**

<b>The Contribution of Aldehydes to The Staling Taste and Odour of Pale Lager Beer</b> .....	261
<i>Jessika De Clippeleer, Filip Van Opstaele, Guido Aerts</i>	
<b>The Effect of UVC Irradiation on Beer Hopped with Reduced Hops iso-<math>\alpha</math>-Acids: A Consumer Study</b> .....	262
<i>Antoine Mfa Mezui</i>	
<b>Building Sensory Information into Analytical Product Control</b> .....	270
<i>Paul Hughes</i>	
<b>Are Cheeses and Beers Tantalizing Partners? Consumers Speak Out</b> .....	271
<i>Gianluca Donadini, Maria Daria Fumi</i>	
<b>TAS2R Taste Receptor Activation and Oral Mucosa Binding Determine the Perception of the Beer'S Bitterness</b> .....	272
<i>M. Dresel, D. Intelmann, C. Batram, C. Kuhn, G. Hasleu, W. Meyerhof, T. Hofmann</i>	
<b>Hop Aroma in Beer: A Comparison of Brewers' Expectation Versus Sensory Profiling</b> .....	285
<i>Thomas H. Shellhammer</i>	

### **ENVIRONMENTAL:**

<b>Energy and Water Efficiency Benchmarking in the Beer Industry</b> .....	290
<i>Fons Pennartz</i>	

<b>High Temperature Zeolith Storage for the Brewery</b> .....	298
<i>Ovidiu-Alin Diaconu, Winfried Ruß</i>	
<b>Early Protein Flocculation to Decrease Boiling Need of Wort</b> .....	299
<i>Gert De Rouck, Guido Aerts</i>	
<b>Application of Cost/Time Saving Solution (Rotary Jet Head) - Suitability and Influence on Product Quality</b> .....	300
<i>Aleksander Poreda, Marek Zdaniewicz, Jaros-aw Hoc, Piotr Antkiewicz, Tadeusz Tuszynski</i>	
<b>Dry Husk Combustion: A New Method for the Just-In-Time Production of Energy for Brewing Processes</b> .....	301
<i>Michael Dillenburger, Marcus Hertel</i>	
<b>1<sup>st</sup> Global Switch From an Industrial Kieselguhr Filter System to a Sustainable Kieselguhr Free Precoat Filtration</b> .....	302
<i>Nikolaj Schmid</i>	
<b>Eco,nomics is True Sustainability – “Going Green” and Nursing Your Bottom Line can go Hand in Hand...</b> .....	321
<i>Johnnie Rask Jensen</i>	

### **BREWING & BIOTECHNOLOGY:**

<b>The Influence of Unmalted Barley on the Oxidative Stability of Wort and Beer</b> .....	322
<i>Christian Muller</i>	
<b>Barley Specifications for Brewing Technology based on Unmalted Barley</b> .....	333
<i>Hans Peter Heldt-Hansen, Niels Elvig, Sven Schonenberg, Stefan Kreis</i>	
<b>Enzymes: Valuable Technology for Improving Brewing Sustainability</b> .....	346
<i>Ron Duszanskyj, Kjeld Olesen, Jeroen Van Roon</i>	
<b>Whole Grain Conditioning Alternative Method to Increase Brewhouse Performance</b> .....	347
<i>Jens Voigt, Hans-Jorg Menger, Max Sandherr Buhler</i>	
<b>Stick, Twist or Burn? Potential Uses for Brewers’ Grains: A Review</b> .....	360
<i>Scott Davies, Dave Cook</i>	
<b>Association of Differentially Expressed Genes During Micromalting to QTL for Malt Quality in Spring Barley</b> .....	375
<i>Markus Herz, Kerstin Krumnacker, Sabine Mikolajewski, Gunther Schweizer</i>	
<b>Structural Characterization and Ligand Binding Analysis of Barley Limit Dextrinase</b> .....	384
<i>Anette Henriksen, Malene B. Vester-Christensen, Maher Abou Hachem, Birte Svensson</i>	

### **RISK FACTORS & BEER SAFETY:**

<b>Impacts of Premature Yeast Flocculation Factor(s) on Fermentation and Metabolite Profiles</b> .....	385
<i>Apostolos G. Panteloglou, Katherine A. Smart, David J. Cook</i>	
<b>Premature Yeast Flocculation (PYF) - Risk Assessment based on a Routine Laboratory Analysis of Barley Malt</b> .....	400
<i>Michael Voetz, Heiko Woes</i>	
<b>Formation of Styrene by Top Fermenting Wheat Beer Yeast</b> .....	401
<i>Frank Jurgen Methner, Katrin Schwarz</i>	
<b>Emergent Mycotoxins: Behaviour from Field to Final Beer</b> .....	413
<i>Regis Fournier, Patrick Boivin</i>	
<b>Mycotoxins: Know Your Limits</b> .....	414
<i>Ian Ormrod</i>	

### **ANALYSIS (BREWING RAW MATERIALS, PROCESS, PRODUCT, SAFETY):**

<b>Bisphenol A - Risks and Analysis of Debatable Plastics Used in Beer Can Coatings</b> .....	428
<i>Leif-A. Garbe</i>	
<b>Bisphenol A in European beers - Are We at Risk?</b> .....	429
<i>Juliette Love, Ian R. Slaiding, Gillian M. Fisher, James R. Wickens</i>	
<b>A Real Time PCR as a New Rapid Control for Malting Barley and Malt Quality</b> .....	430
<i>Regis Fournier, Patrick Boivin</i>	
<b>Building Sensory Information into Analytical Product Control</b> .....	431
<i>Paul Hughes</i>	

<b>Development of NIR Fingerprints to Evaluate Malt Batches According to Lautering Performance</b> .....	432
<i>Christopher Holtz, Daniel Krause, Martina Gastl, Mohamed Hussein, Thomas Becker</i>	
<b>2D-Solid Phase Extraction - Flexible, Fast and Cost Effective Sample Preparation for Precise Analysis of Low Level Beer or Wort Constituents</b> .....	433
<i>Nils Rettberg, Konrad Neumann, Leif-A. Garbe</i>	
<b>Polycyclic Aromatic Hydrocarbons (PAHs) in Malting Barley</b> .....	434
<i>Ian R. Slaiding, E. Denise Baxter</i>	
<b>At-line Hops Takeover and Dosage Control During Beer Production</b> .....	435
<i>Broz Adam, Savel Jan, Kosin Petr</i>	
<b>Gas-diffusion Microextraction in Beer Analysis</b> .....	436
<i>Luis M. Goncalves, Ines M. Valente, Jose A. Rodrigues, Aquiles A. Barros</i>	
<b>Combined Particle Analysis – A New Analytical Approach to Predict Gushing</b> .....	437
<i>Manuel Christian, Jean Titze, Fritz Jacob, Vladimir Ilberg</i>	
<b>Nonvolatile N-Nitrosamines in European Beer of Pilsner Type</b> .....	438
<i>J. Culik, T. Horak, P. Cejka, M. Jurkova, J. Dvorak, V. Kellner</i>	
<b>A New Rapid method for Measuring Beer Flavour Stability Using FTIR</b> .....	439
<i>Nanae Nashimoto, Zenzo Okazaki, Takayoshi Kanaya, Hidetoshi Sato</i>	
<b>Influence of Hops and Barley Varieties on Thiol Levels and the Oxidative Stability of Wort</b> .....	440
<i>Signe Hoff, Jacob Damgaard, Birthe M. Jespersen, Marianne N. Lund, Mogens L. Andersen</i>	
<b>Gluten in Beers: Improvement of Prolamins Extraction in Immunochemical Analysis</b> .....	441
<i>Stefano Buiatti, Paolo Passaghe, Giuseppe Perretti, Marta Fontana</i>	
<b>Use of the MicroBeer Platform for Screening, Characterization and Development of Yeast Strains for Beer</b> .....	442
<i>Catrienus de Jong, Lucie A. Hazelwood, Annereinou Dijkstra, Liesbeth Pepin</i>	
<b>Gushing Suppression of Barley by Mixing Gushing Negative Malt</b> .....	443
<i>Yuta Katayama, Takeo Ishihara, Masayuki Shimase, Masahide Sato, Tatsuro Shigyo</i>	
<b>Detection of Thiols in Beer and Their Correlation with Oxidative Stability</b> .....	444
<i>Marianne N. Lund, Victor Abrahamsson, Nikoline Juul Nielsen, Mogens L. Andersen</i>	
<b>Determination of Volatile Compounds in Different Hop Varieties by Application of Quantitative Headspace Trap GC-/MS Analysis - in Comparison with Conventional Hop Oil Analysis</b> .....	445
<i>A. Aberl, M. Coelhan, F. Trinkl</i>	
<b>Aroma Active Epoxydecenals in Beer: Formation, Characteristics and Contribution to Beer (off) Flavour</b> .....	446
<i>Konrad Neumann, Nils Rettberg, Leif-Alexander Garbe</i>	
<b>Optimised Chapon Method to Ascertain the Reduction Potential of Fermentable and Unfermentable Sugars in Beverages and the Brewing Process</b> .....	447
<i>Victoria Schiwek, Thomas Kunz, Torsten Seewald, Eon-Jeong Lee, Frank-Jurgen Methner</i>	
<b>New Method for Dextrin Characterization in Beer</b> .....	448
<i>Richard Cmelik, Vratislav Psota, Lenka Sachambula</i>	
<b>Prevalence of Anaerobic Bacteria in UK Breweries</b> .....	455
<i>A. E. Hill, A. D. Paradh</i>	
<b>A Novel Method for the Detection of Gram-Negative Spoilage Organisms in Breweries</b> .....	456
<i>A. D. Paradh, A. E. Hill, W. J. Mitchell</i>	
<b>Towards A Better Understanding of the Origin of Staling Aldehydes in Pale Lager Beer</b> .....	457
<i>Jessika De Clippeleer, Filip Van Opstaele, Gert De Rouck, Luc De Cooman</i>	
<b>New Measurement Methods for an Inline Process Control of the Mashing Process</b> .....	458
<i>Johannes Tippmann, Jens Voigt, Karl Sommer</i>	

## **BARELY BREEDING & AGRONOMY:**

<b>T-2 and HT-2 Toxins in Spring Barley Assessment of Agronomic and Climatic Factors in France</b> .....	459
<i>Alain Froment, Thierry Varrailon</i>	
<b>Influence of Crop Health and Fungal Contamination of Spring Barley on Mycotoxin Content and Malting Quality</b> .....	460
<i>Michael Heß, Martina Gastl, Stephan Weigand, Gunter Henkelmann, Michael Rychlik</i>	

## **BEER QUALITY (FOAM & HAZE):**

<b>Applications of Molecular Simulation to the Understanding of the Surface Chemistry of Alcoholic Beverages</b> .....	461
<i>Stephen R. Euston, Paul S. Hughes</i>	
<b>Influence of Metallic Ion Complexes and pH-Value on the Haze Formation and Oxidative Beer Stability</b> .....	462
<i>Thomas Kunz, Patricia Diniz, Stefanie Karrasch, Frank-Jurgen Methner</i>	
<b>Proteome Mapping Using LC-MS/MS for Description of Foam Stability in Malt Beer and 100% Unmalted Barley Beer</b> .....	463
<i>Lone Baekgaard, Stefan Kreisz, Niels Elvig, Christian Isak Jorgensen, Carsten Sonksen, Hans Peter Heldt-Hansen</i>	
<b>Influence of Pale Caramel Malt Additions on Foam Stability and Flavour</b> .....	464
<i>Jens Voigt, Andreas Richter</i>	
<b>Influence of Fluorescence of Dark Beers on Haze Measurement</b> .....	465
<i>R. Benes, H. Klein</i>	
<b>Effect of Container Wall Properties on Beer Foam</b> .....	466
<i>Pavel Novak, Martin Baszczynski, Tomas Branyik, Marek Ruzicka, Maria Zednikova, Jiri Drahos</i>	
<b>Breakpoints of Foam Stability</b> .....	467
<i>P. Kosin, J. Savel, A. Broz</i>	
<b>Clarifying the Haze Issue</b> .....	468
<i>Karin Pawlowsky, Belen Perez</i>	

## **BEER QUALITY (IN-PACKAGING & DISPENSE):**

<b>Physico-Chemistry and Thermodynamic Involved by Primary Gushing: A Review</b> .....	469
<i>Guy Derdelinckx, Sylvie M. Deckers, Mohammadreza Khalesi, Zahra Shokribousjein, Kurt Gebruers, Yannick Lorgouilloux, Geert Baggerman, Hubert Verachtert, Jan A. Delcour, Chris Michiels, Johan Martens</i>	

## **BEER QUALITY (SENSORY & FLAVOUR):**

<b>Acceptance of Off-Flavours in Beer by Common Consumers</b> .....	470
<i>Stefan Hanke, Moritz Krahl</i>	
<b>Impact of Amino Acid Optimization on Aroma-active Metabolites</b> .....	471
<i>Susanne Procopio</i>	
<b>Influence of Hop Volatiles on Perception of Hop Aroma</b> .....	472
<i>Stefan Hanke, Thomas Becker</i>	
<b>Impact of the use of Inline Pre-isomerized Hop Products on Analytical and Sensory Markers for Beer Ageing</b> .....	473
<i>Andreas Stephan, Annika Lagemann, Georg Stettner</i>	
<b>Detailed Multivariate Modeling of Staling Process in Commercial Pale Lager Beers</b> .....	474
<i>Barbara Jaskula-Goiris, Brecht De Causmaecker, Gert De Rouck, Luc De Cooman, Guido Aerts</i>	
<b>Degasification Behaviour of Relevant Wheat Beer Aroma Compounds</b> .....	475
<i>Hubertus Schneiderbanger, Yan Li, Mathias Hutzler, Konrad Muller- Auffermann, Dario Cotterchio, Fritz Jacob</i>	
<b>The Influence of Wood Aging on Beer Flavour and Monophenol Concentrations</b> .....	476
<i>Femke L. Sterckx, Filip Delvaux, Freddy R. Delvaux</i>	
<b>Brewhouse Process Design in Order to Reduce Beer Ageing - TBI and Furfural Analysis in Wort and Beer</b> .....	477
<i>Marek Zdaniewicz, Aleksander Poreda, Piotr Antkiewicz, Ma-gorzata Makarewicz</i>	

## **BEER, SOCIETY, HEALTH & NUTRITION:**

<b>Know Your Customers!</b> .....	478
<i>Martin Lechler</i>	
<b>Gluten-free Barley Malt Beers</b> .....	479
<i>Anita Van Landschoot, Sylvie Vandoorne, Dana Vanderputten</i>	
<b>Influence of Process Parameters on Vitamin Content in Beer</b> .....	480
<i>Anne Pietercelie, David Allardin, Laurence Van Nedervele</i>	

## **BREWING & MALTING CO-PRODUCTS:**

<b>Brewer's Grain Lignin: A Potential Value-added Product for Food and Non-food Applications</b> .....	481
<i>Piritta Niemi, Johanna Buchert, Annika Wilhelmson, Maria Saarela, Anna-Marja Aura, Kaisa Poutanen</i>	
<b>Isolation and Characterization of New Functional Ingredients from by-Products of the Malting and Brewing Industry and their Application in Cereal Products</b> .....	482
<i>A. C. Loetterle, S. Wunderlich, E. Zannini, M. Zarnkow, T. Becker, F. Jacob, E. K. Arendt</i>	

## **BREWING & MALTING MICROBIOLOGY:**

<b>Adhesion of Beer-spoiling Microorganisms to Solid Surfaces</b> .....	483
<i>Tomas Branyik, Milan Bittner, Jan Volsicka, Lucie Siristova, Dagmar Matoulkova</i>	
<b>Production of Factors Inducing Gushing and Premature Yeast Flocculation (PYF) by Different Fusarium Fungi in Malting</b> .....	484
<i>Arja Laitila, Tuija Sarlin, Markus Linder, Annika Wilhelmson</i>	

## **END OF BEER PROCESSING, INCLUDING AUXILIARY & PROCESS AIDS:**

<b>Influence of Silica Sol on Beer Quality Parameters</b> .....	485
<i>Elisabeth Steiner, Martina Gastl, Thomas Becker</i>	
<b>The „Tank-O-Scope“ – A New Approach to Visual Inspection of Inner Tank Surfaces</b> .....	486
<i>Roland Pahl, Georg Wenk, Ruslan Hofmann</i>	
<b>Continuous Beer Stabilization – For Improved Process Economics and Environmental Protection</b> .....	487
<i>Jurgen Ziehl, Martin Zeiler, Ralf Ascher, Pall GmbH</i>	
<b>The Formation and Movement of Solids in a Commercial Maturation Vessel</b> .....	488
<i>Jane Kershaw</i>	

## **ENVIRONMENTAL ISSUES & SUSTAINABILITY:**

<b>Water Management in Food and Beverage Industry by Hybrid Automation using the Example of Breweries</b> .....	489
<i>V. Blomenhofer, T. Becher, H.-J. Menger</i>	
<b>Sustainability: Buzzword or Ethos?</b> .....	490
<i>R. Laurence Nelson</i>	
<b>Delignification of Brewery Spent Grains for Bioethanol Production</b> .....	491
<i>Timo Broeker, Marco Steffens, Dennis Blohse, Jan Schneider</i>	
<b>Bioethanol from Brewer's Spent Grains: A Novel Approach</b> .....	492
<i>Jason P.A. Bennett, Graeme M. Walker, David H. Bremner</i>	
<b>Treatment of Brewery Process Water Recovery of Resources</b> .....	493
<i>Willie Driessen, David Leinster</i>	

## **FLAVOUR CHEMISTRY:**

<b>Correlation Between the Formation of the Aroma Compounds 4-Vinyl Guaiacol, 4-Vinyl Phenol and 4-Vinyl Benzene by Top Fermenting Wheat Beer Yeast</b> .....	494
<i>Katrin Schwarz, Rene Stubner, Frank-Jurgen Methner</i>	
<b>How Sotolon and Abhexon Can Impart Madeira off-Flavours to Aged Beers?</b> .....	495
<i>Caroline Scholtes, Collin Sonia</i>	

## **HOPS (HOPE BREEDING, AGRONOMY & PROCESSING):**

<b>Acylphloroglucinol Glucoside from Hops: Isolation, Identification and Haze-Activity</b> .....	496
<i>Alexandra Chesnokova, Thomas Kunz, Vladislav Lutsky, Frank-Jurgen Methner</i>	
<b>Recovering Hop Cultivation in Galicia (NW Spain)</b> .....	497
<i>J. L. Olmedo, D. Vazquez</i>	



<b>The Influence of Hop Bitter Acid Components on the Phenomenon of Gushing: A Study of Advanced Hop Products Under Forced Testing Conditions</b> .....	498
<i>Brian P. Buffin, Philip C. Campbell</i>	
<b>Application of a Heat and Condensate Recovery System in the Hop Kilning Process</b> .....	499
<i>Ruslan Hofmann, Sebastian Weber, Siegfried Vogl-Wolf, Roland Folz</i>	
<b>Authentication of Hop Varieties Based on Characteristic Contents of Selected Secondary Metabolites</b> .....	500
<i>Lukas Jelinek, Monika Doleckova, Marcel Karabin, Pavel Dostalek</i>	

### **MALTING (MALT PRODUCTION & QUALITY):**

<b>Cereals: Characterisation of the Microstructural Changes in the Grain During the Malting-Process by using Confocal Laser Scanning Microscopy</b> .....	501
<i>Martin Zarnkow, Andrea Faltermaier, Martina Gastl, Elke K. Arendt, Thomas Becker</i>	
<b>Bioactive Compounds in the Malting Process</b> .....	502
<i>Moritz Krahl, Julia Steiner, Thomas Becker</i>	
<b>Lactic Acid Bacteria In Oat Malting</b> .....	503
<i>Kordialik-Bogacka Edyta, Diowksz Anna, Pawlowska Paulina, Ambroziak Wojciech</i>	
<b>In-deep Profiling of the Industrial Malting Process</b> .....	504
<i>Karin Gorzolka, Manfred Lissel, Stefan Loch-Ahring, Karsten Niehaus</i>	
<b>Screening of Xylanase Producing Bacteria During Malting</b> .....	505
<i>Sofie Malfliet, Annelies Juste, Bart Lievens, Kris Willems, Luc De Cooman, Guido Aerts</i>	

### **MANAGEMENT, TRAINING, MAINTENANCE & FINANCIALS:**

<b>Constructing an Improvement Initiative via a “Visualized” System</b> .....	506
<i>Hideaki Matsuo, Norihito Matsuoka, Yoshinori Ito, Nobutoshi Imaizumi</i>	
<b>Technical Education – A Key Foundation for WCM and Operational Excellence</b> .....	507
<i>Simon Jackson</i>	

### **MICROBIAL PHYSIOLOGY & GENETICS:**

<b>Influence of Raw Materials and Extraction Methods on the Antibacterial Potential of Hops</b> .....	508
<i>Benjamin Schurr, Jurgen Behr, Christian Vogt, Michael Dresel, Thomas Hofmann, Rudi F. Vogel</i>	
<b>Influence of Manganese Starvation on Beerspoilage Ability of Lactobacillus Brevis</b> .....	509
<i>Patrick Preissler, Jurgen Behr, Rudi F. Vogel</i>	
<b>Relevance of Biodiversity of Pectinatus and Megasphaera Isolates for the State of the Art Detection Methods of Beer Contaminants</b> .....	510
<i>Jurgen Behr, Mathias Hutzler, Fritz Jacob, Rudi F. Vogel</i>	
<b>Yeast Strain Identification by a Combination of Partial IGS2-rDNA-PCR and Rep-PCR Fingerprinting</b> .....	511
<i>Robert Riedl, Marlene Pulgar Rosa, Alexandra Brack, Fritz Jacob, Mathias Hutzler</i>	

### **NEW PROCESS DEVELOPMENT:**

<b>Steinecker EquiTherm &amp; ShakesBeer EcoPlus - A Very Efficient Recovery System - More Than 30% Primary Energy Savings</b> .....	512
<i>Peter Gattermeyer</i>	
<b>Industrial Trials of Simultaneous Beer Filtration and Stabilisation with a Regenerable Filter Aid (Peox)</b> .....	513
<i>M. Libouton, D. Daoust, M. Sclavons, J. J. Biebuyck, L. Van Nedervelde</i>	
<b>Optical Monitoring of Wort Saccharification and Fermentation in Real Time</b> .....	514
<i>E. S. Estracanhalli, C. Kurachi, I. Polikarpov, V. S. Bagnato</i>	
<b>Beer for the Coming Era - Beers with New Taste, Flavor, and Functional Properties</b> .....	515
<i>Ida J. Leskosek-Cukalovic, Sasa Despotovic, Mile Veljovic, Radovan Djordjevic, Milomir Niksic, Viktor Nedovic, Sofija Djordjevic, Vele Tesevic</i>	
<b>The Potential of Cassava Flour as a Brewing Adjunct</b> .....	516
<i>B. Mandanna, J. H. Bryce</i>	

## **NOVEL RAW MATERIAL FOR BEER PRODUCTION:**

<b>Oats Proteins and Their Changes During Malting and Brewing in Comparison to Barley Proteins</b> .....	517
<i>Christina Klose, Elke K Arendt</i>	
<b>Comparison of the Quality Parameters of Hop Hard Resins</b> .....	518
<i>Cynthia Almaguer, Martina Gastl, Thomas Becker</i>	
<b>The Influence of Glumes in the Malting of Einkorn and Emmer</b> .....	519
<i>Ombretta Marconi, Heidi Meyer, Giuseppe Perretti, Gianfranco Regnicoli, Paolo Fantozzi</i>	
<b>Behavior of Malted Cereals and Pseudo-cereals for Production of Gluten-free Beer</b> .....	520
<i>Paolo Fantozzi, Gary Freeman, Ombretta Marconi, Chris Booer, Stefano Buiatti, Giuseppe Perretti, Bruno De Meo</i>	

## **WORT PRODUCTION:**

<b>A New Method for the Controlled Insertion of Flavours Contained in Aromahop into Wort or Beer</b> .....	521
<i>Marcus Hertel, Michael Dillenburger</i>	
<b>High Gelatinization Temperatures of Barley Starch - What Maltsters and Brewers Can Do</b> .....	522
<i>Florian Schuell</i>	
<b>Impact of Mashing-off Temperature on Trub Quantity and Clarification in High Gravity Worts</b> .....	523
<i>L. Marle, A. Dewulf, F. Harmegnies</i>	
<b>Optimization of the Steam Supply of a Medium-Sized Brewery by Application of Hybrid Simulation</b> .....	524
<i>M. Nagel, A. Delgado</i>	
<b>From an Internal to an External Cooker in an Industrial Brewery: Influence on Wort and Beer Quality</b> .....	525
<i>A. C. Vandeville, M. Libouton, D. Claude, L. Van Nederveelde</i>	

## **YEAST & FERMENTATION:**

<b>Stress, Viability and Dried Brewing Yeast</b> .....	526
<i>Chris Powell</i>	
<b>Amino Acid Profile and Fermentation Performance</b> .....	527
<i>Marc Schmitt, Patrick Boivin</i>	
<b>Development of Analysis of Yeast Physiological State Using Intracellular Metabolite Concentration</b> .....	528
<i>Hiroyuki Yoshimoto, Kyoko Horikoshi, Kenichi Enomoto, Tomohiko Ichii</i>	
<b>The Impact of yeast Physiology on the Refermentation Process of Beer</b> .....	529
<i>Tinne M. L. Dekoninck, Filip Delvaux, Freddy R. Delvaux</i>	
<b>Adaptation of an Intracellular pH Method to Flow Cytometry for Evaluation of Vitality From a Yeast Population</b> .....	530
<i>Fei Qian, Ingrid Bohak, Reiner Springer, Thomas Becker</i>	
<b>The Advantages of Using Dry Yeast for Bottle Conditioning</b> .....	531
<i>Sylvie Van Zandycke, Tobias Fischborn</i>	
<b>Optimization of Fermentation Process with ECO-FERM™</b> .....	532
<i>Rudolf Michel</i>	
<b>Further Development of EBC Fermentation Test-Tubes</b> .....	537
<i>Thomas Tyrell, Rolf Exner, Roland Folz</i>	
<b>Activation of Yeast by Pulsed Electric Energy</b> .....	538
<i>Marcus Hertel, Martin Kern, Michael Dillenburger</i>	
<b>Can Reducing Compounds from Brewers Yeast Contribute to the Beer Flavour Stability?</b> .....	539
<i>Torben Sune Berner, Nils Arneborg</i>	
<b>Author Index</b>	