

ASBC Annual Meeting

June 4–7 ■ Fort Myers, Florida

See what SCIENCE can brew for you

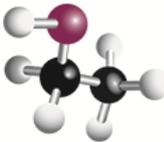
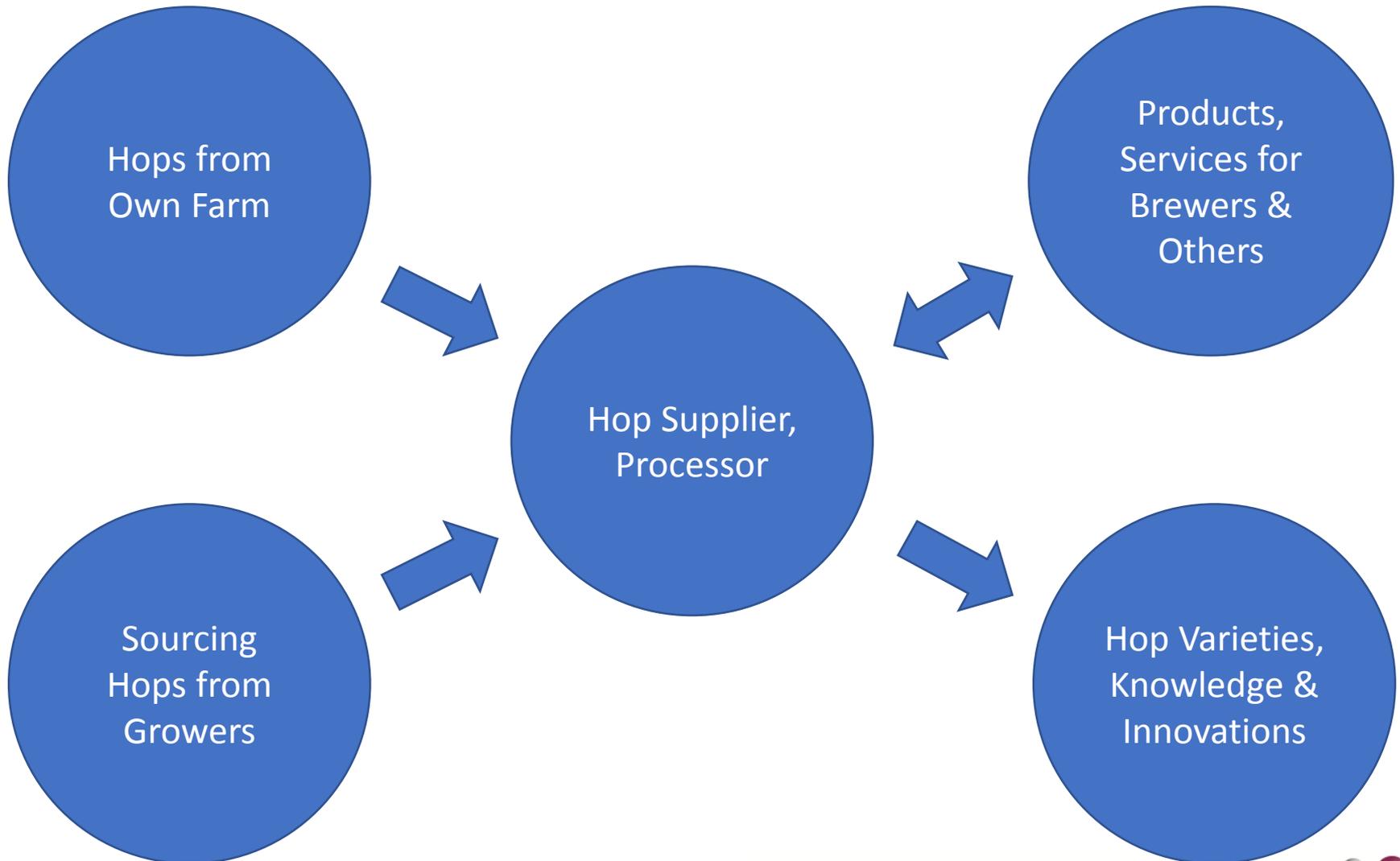
Hops II – Interfacing with the Hop Industry

Role of Hop Suppliers

Tim Kostelecky – John I. Haas, Inc.

June 6, 2017

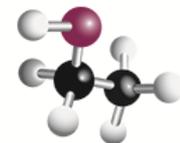
Overview of Hops Supplier Structure



Hop Supplier – Grower Relationship

Hop Quality and Supply Assurance begins at the Farm....

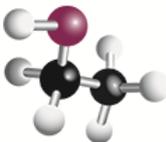
- Through procurement, hop suppliers maintain constant contact and develop relationships with the grower base.
- With brewer input, communicate to growers on hop requirements and collect information on growers' capabilities.
- Hop Suppliers visit farm sites during the growing season and note agronomic conditions and work in concert with growers to address quality issues.
- Some Suppliers maintain Grower Portals through which we provide feedback to the Grower community on hop quality related issues.



Ensuring Quality & Adding Value

From the Field to the Brewery!

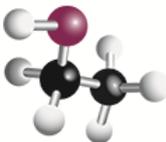
- Harvest Take-in and Warehousing: Harvest is a time to verify that our quality standards have been met, and where hops formally enter our quality system.
- Manufacturing: State of the art manufacturing facilities and processes ensure the quality, trace-ability and preservation of our products. Quality Assurance/Control programs provide feedback at all steps of the process.
- Sales Administration and Logistics: It is not good enough just to make great products, top suppliers ensure quality in the documentation, sales administrative and logistical services.
- Innovations: Driven to innovate – always looking to develop and improve products and processes.



Customer Driven Innovation

Technical Resources:

- Hop Breeding Programs and Experimental Farms
- Hop Product Innovation and Development
- Extensive Hops Laboratory Capabilities Including Hops Sensory Analysis
- Research Breweries
- Hops & Beer Analytical Capabilities and Sensory Descriptive Panels

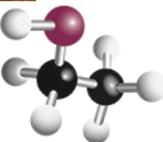


Customer Collaboration

Hop Suppliers successfully collaborate with brewers worldwide, big and small, to help each reach their goals, whether it be with traditional hopping and new varieties, or in the use of more advanced hop products.

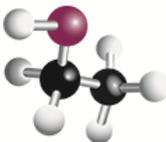
With recent emphasis on hops in brewing formulations and beer brands, it is even more important to establish both commercial and technical relationships with brewers to help with the challenges now faced in the beer market.

The commitment to these challenges is evidenced by the investments made in hops innovations efforts and in the construction of new facilities including research breweries.

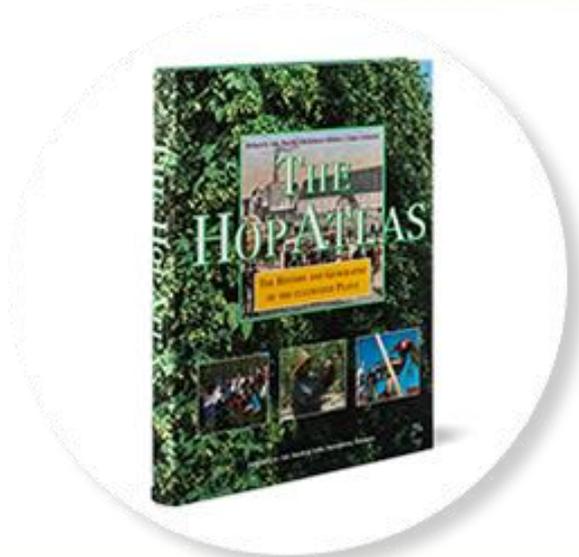
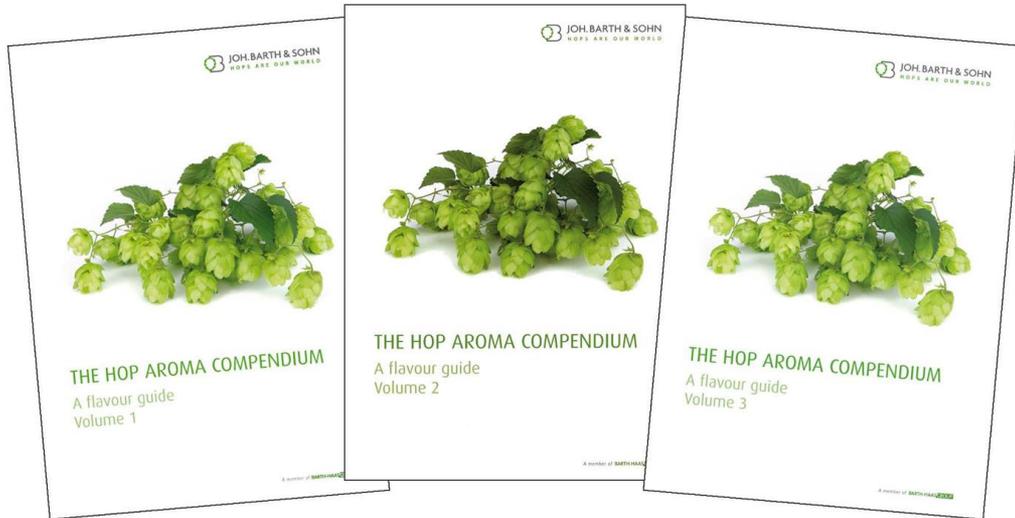
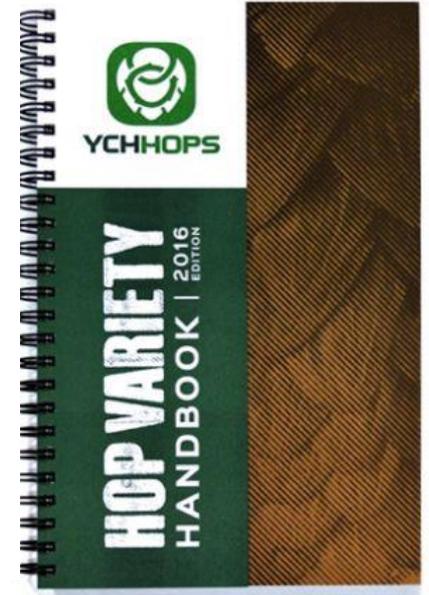
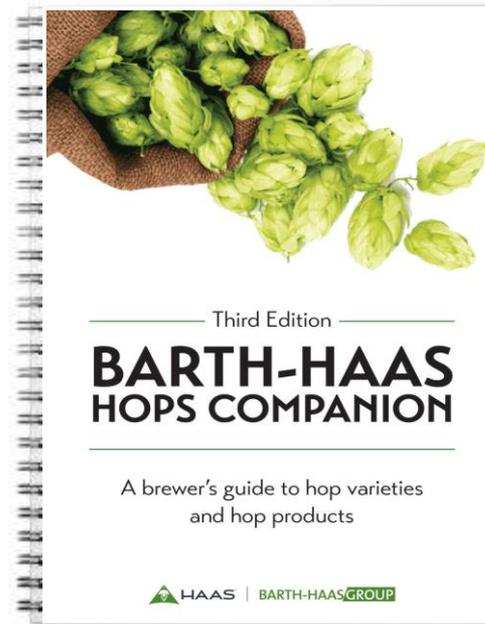


Knowledge, Creativity & Development

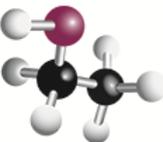
- Top-tier hop suppliers have in-depth hop knowledge and skilled technical personnel located around the globe.
- Typically with vertically integrated product development company providing hop breeding, traditional and advanced hop products.
- Employ both hops and brewing experts to assist customers with defining their brewing needs. With internal resources and industry network we are able to rapidly take a project from concept to completion.
- Provide effective support for your hop and brewing research requirements.



Sharing Knowledge



2017 ASBC Meeting



Timely Technical Information

MARCH 2017

HOP SCIENCE

KNOWLEDGE FOR YOUR SUCCESS

by Dr. Christina Schoenberger, christina.schoenberger@johbarth.de

BARTH-HAAS GROUP
FOR YOUR SUCCESS

CO₂ EXTRACT FOR BETTER FLAVOUR STABILITY!

This German research group is looking into beneficial components in hops to improve flavour stability. In their latest publication, they summarize their trials using CO₂ extract in context with reducing the iron content in beer. In comparison to dosing the extract at the beginning of boil they tried different versions of dividing the hop dosing throughout the boil. With this they were able to reduce the iron content by about 30%, resulting in improved flavour stability not only based on analytical values but also on sensory evaluation.¹

ABOUT THE STABILITY OF BITTER COMPONENTS IN HOPS DURING STORAGE...

These German researchers are specialists in identifying and quantifying bitter components in hops. In this project, heat maps were developed for all bitter components during the storage of several years. The data presented gives profound insight into the molecular bitter compound variability of certain hops. Quantitative analyses of hops stored with and without the influence of oxygen revealed that the decline of distinct hop constituents cannot be explained by an increase in transformation products formed during beer aging, thus implying unknown degradation mechanisms in hops. In a controlled, cool and oxygen free environment, the relevant bitter components proved to be stable for a period of 2 years.²

THE TRUE BITTERNESS OF HUMULINONES

A couple of recent studies revealed that the increased bitterness in dry hopped beers is greatly influenced by the formation of humulinones (oxidized hop α -acids).

Using previously established synthesis methods and preparative liquid chromatography, high-purity extracts of humulinones and hulupones were prepared for sensory testing. A trained flavour descriptive panel found humulinones to be 66% as bitter as iso- α -acids, and hulupones to be 84% as bitter as iso- α -acids. This study also found that the bitterness intensity of humulinones and hulupones are substantially higher than previous estimates of 35% and 50%, respectively. Whereas iso- α -acids were confirmed to be more bitter than oxidized α -acids and β -acids, both hulupones and humulinones were bitter enough to potentially have a significant impact in beer, especially in dry hopped beers. The threshold value of humulinones was found to be around 8 mg/L in unhopped beer.³

REFERENCES:

- Winkler, P. et al. Influence of Dosing Technology on Oxidative Stability and Sterilized Carboys in Ale Lager Beer. *Brewing Science*, November / December 2016 (Vol. 69) <http://www.elsevier.com/locate/jbs> (doi:10.1016/j.jbs.2016.11.001)
- Dose, M. The Bitter Chromatography of Hops (Humulus lupulus L.). *J. Agric. Food Chem.* 2016, 64, 1169-1179. <https://doi.org/10.1021/acs.jafc.5b04944>
- Algerini, W. Bitterness Intensity of Oxidized Hop α -Acids, Humulinones and Hulupones. <http://www.brewersassociation.org/resources/2016/06/2016-ASBC-13009-113642016>

EVENTS



Upcoming Barth-Haas Hop Academy:
Apr. 21-22, CFRB, University of Perugia, Italy.
All About Hop Flavour (lectures in Eng/Sp/Ital/Fr).
Registration at gusepoe.pierre@uni-perugia.it

Make sure to attend the 2nd International Brewers Symposium on Hops, July 26th to 28th, Corvallis, OR USA. <http://hopsflavor2017.com>

Other hoppy events:

- Apr 10.11-13th, **Craft Brewers Conference**, Washington DC, USA
- May 14.15-18th, **EBC Congress**, Ljubljana, Slovenia
- June 4th-7th, **ASBC Annual Meeting**, Fort. Myers, FL USA

HOPSTEINER | NEWSLETTER 03/2017

DRY HOPPING LOW IBU BEERS AND ITS EFFECT ON BEER BITTERNESS

TECHNICAL SUPPORT

Low IBU beers (20 ppm of isoalpa acids or less) that are heavily dry hopped, with 1 lb of hops per barrel (0,381 kg/hl) or more, can experience significant changes in hop acid composition.

Unlike high IBU beers, low IBU beers that are dry hopped lose very little isoalpa acids yet gain significant amounts of humulinones and alpha acids. Humulinones are reported to be 66% as bitter as isoalpa acids and alpha acids about 1/10th as bitter as isoalpa acids. The below table contains the HPLC analysis of a control beer dry hopped with 0.5 lbs, 1.0 lbs, and 2.0 lbs of Cascade hop pellets for three days at 16 °C. The Cascade hops assayed 0.76% humulinone and 5.6% alpha acids.

Dry hopping under these conditions caused a slight drop in isoalpa acid concentration but caused a large increase in alpha acid concentration and humulinone concentration. This change in hop acid composition increases the bitterness intensity of the beer.

By taking into account the relative bitterness of all three hop acids one can "calculate the bitterness" of these beers to better estimate what the perceived sensory bitterness will be.

Hop (lbs) per barrel	kg/hl	Iso (ppm)	α -acids (ppm)	Humulinone (ppm)	Calculated Bitterness*
0	0	15	0	0	15
0.5	0,19	12	8	9	19
1.0	0,38	11	17	18	24
2.0	0,76	10	26	28	31

*Calculated bitterness = ppm isoalpa acids + (ppm α -acids \times 0.1) + (ppm humulinone \times 0.56)

Depending on the variety used, this means dry hopping low IBU beers will make beers taste more bitter. This is the complete opposite of what happens when one dry hops a high IBU beer. To see what happens when one dry hops a high IBU beer, see February 2017 Newsletter.

To learn more please do not hesitate to contact us.

Simon & Steiner Hopfen GmbH *S & S Steiner Inc.*
Newsletter, March 2017

SAVE THE DATE!

EVENTS MARCH

MARCH, 6TH

104. Brau- und maschinentechnische Arbeitstagung

MARCH, 22ND

Bier Quer Denker

MARCH, 22ND - 24TH

RMI Analytics

MARCH, 28TH - 30TH

Brewers Forum St. Petersburg

EVENTS APRIL

APRIL, 10TH - 12TH

CBC Washington

APRIL, 17TH

Trends in Brewing

APRIL, 21ST

Beer Craft Bozen

APRIL, 27TH

Dresden Brauertag

JOIN US!



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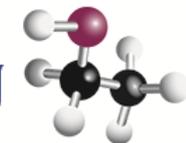
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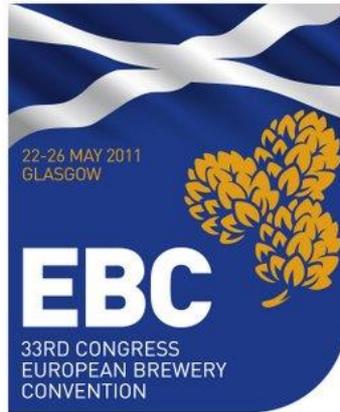
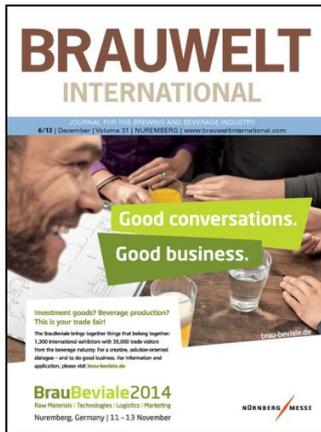
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HOPSTEINER_EUROPE/

Hopsteiner
COMMITTED TO THE BREWER

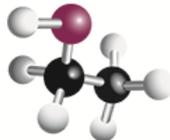
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Technical Involvement & Relationships



2017 ASBC Meeting



Providing Hops Education

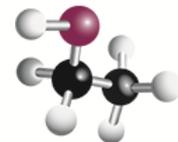


BARTH-HAAS HOPS ACADEMY

The Barth-Haas Hops Academy is a formal hops education program providing courses worldwide and is accredited as part of the "Institute of Masters of Beer" (IMB) two-year professional brewing training curriculum in Germany.

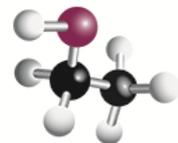


2017 ASBC Meeting



Laboratory & Sensory Services

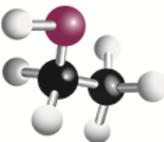
- Industry leading quality assurance facilities providing analytical services of hops for bitter and aroma compounds, as well as hops in beer and standard beer analyses.
- Research and development of advanced hop products, from laboratory scale to commercialization.
- Combining the analysis of both hops and beer, using state-of-art technologies in analytical chemistry and sensory analysis.



Products to Fit the Needs of Brewers



- Whole hops and hop pellets
- CO2 Hop Extracts
- Advanced Hop Products

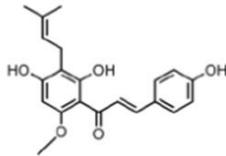


Hop Technology – Solutions & Innovations

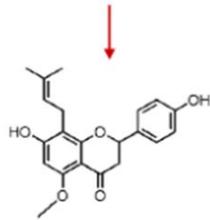
Bitter compounds in hops and beer

chemical structures

chalcones



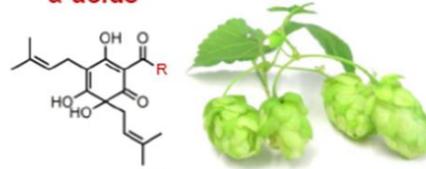
xanthohumol



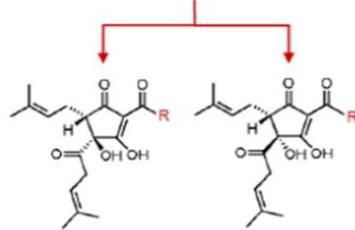
isoxanthohumol



α-acids

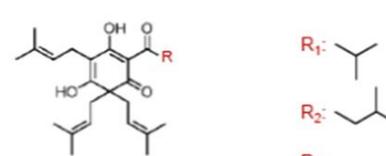


cohumulone (R_1)
humulone (R_2)
adhumulone (R_3)

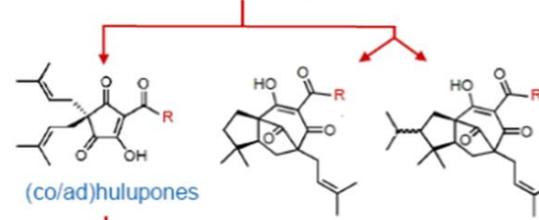


trans/cis-isohumulone (R_1)
trans/cis-isocohumulone (R_2)
trans/cis-isoadhumulone (R_3)

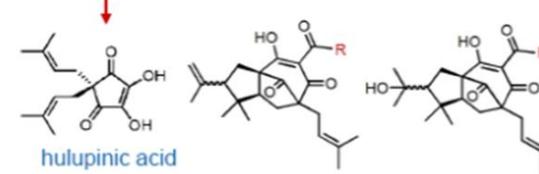
β-acids



colupulone (R_1)
lupulone (R_2)
adhulupone (R_3)



(co/ad)hulupones

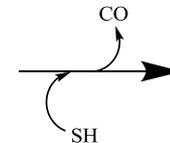
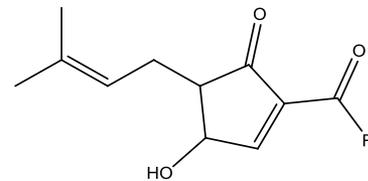
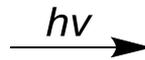
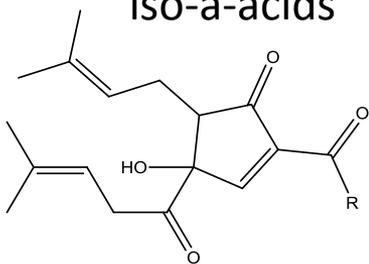


hulupinic acid

tricyclo(co/ad)lupones

Haseleu, G.; Intelmann, I.; Hofmann, T. *Food Chem.* 2009, 116, 71-81

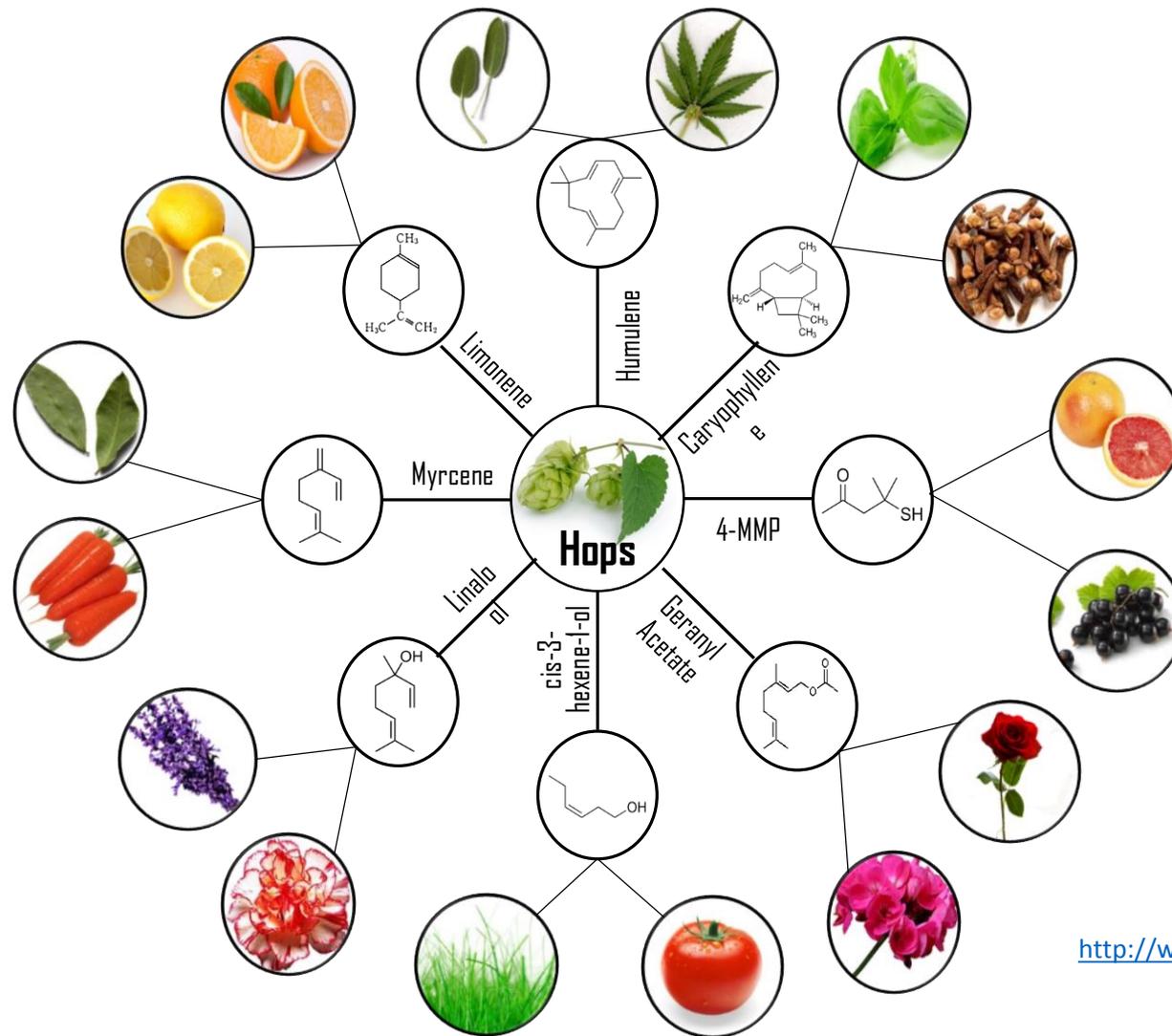
iso-a-acids



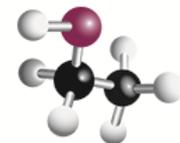
Light-struck Compound

3-methyl-2-butene-1-thiol

Hop Aroma Research



<http://www.bojensen.net/index.html>



Sophisticated Analysis Methodologies



GAS CHROMATOGRAPHY/MASS SPECTROMETRY-OLFACTOMETRY (GC/MS-O)

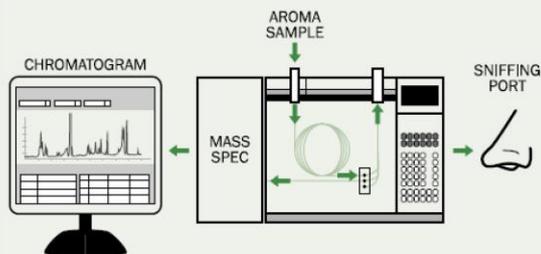
By Cheryl Ermey and Victor Algazzali | John I. Haas

A Supreme Tool for Flavor Innovation

The selectivity of human olfaction make Gas Chromatography/Mass Spectrometry-Olfactometry (GC/MS-O) a powerful tool for flavor analysis.



Linking GC/MS data to Human Smell



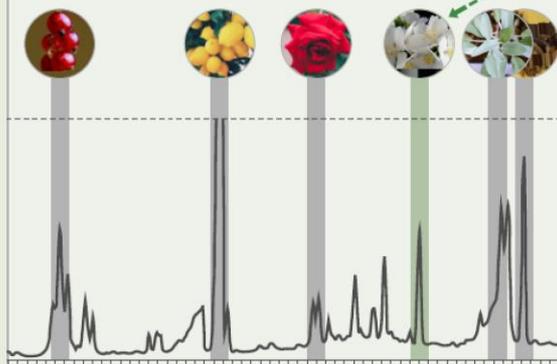
Imagine the Possibilities

- Quantify beer and hop flavor
- Identify new flavor HBC hop varieties
- Measure dry hopping and flavor efficiency
- Create innovative flavor products

Investigating the Complexity of Hop Aroma



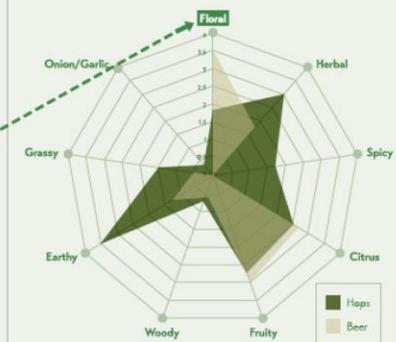
The GC/MS-O separates a single sample into its individual compounds so they can be simultaneously identified and smelled.



LINALOOL

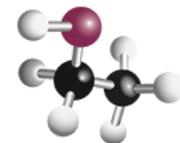


Loral™ Hop Profile



Smelling the Future

The GC/MS-O provides our industry with a relationship between the chemical and sensory data collected. This capability will help us to create the path for new and exciting innovations in brewing and hop breeding. It can also be a valuable tool for quality control and new product development.



Practical Applications from Technology

Bergamot
Liquorice
Blackberry
Aniseed
Citrus fruits

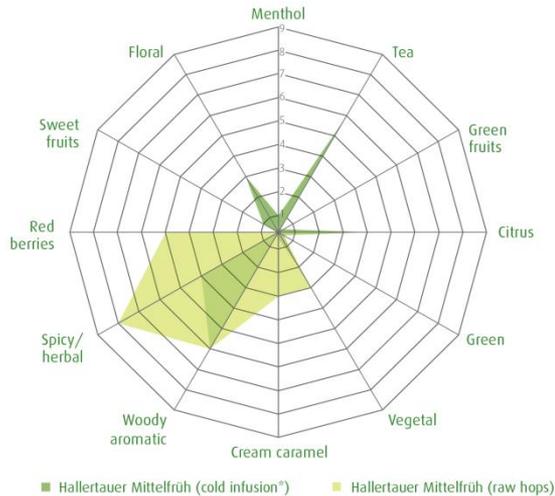


Hallertauer
Mittelfrüh
Germany



Hallertauer Mittelfrüh is the original regional variety of Hallertau and, with its delicate aroma and average bitter content, is still very popular today.

This hop variety almost disappeared due to its high susceptibility to wilt. Thanks to a resurgence in demand and newly available virus-free plants, however, the cultivar is currently making a comeback. The flavour profile of the Hallertauer Mittelfrüh in its raw state is characterised by spicy, woody aromas, such as liquorice and hay, with slight notes of blackberries. In the cold infusion, floral, tea-like components enhance the overall impression.



Strawberry
Citrus
Blackberry
Toffee
Lychee

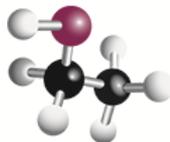
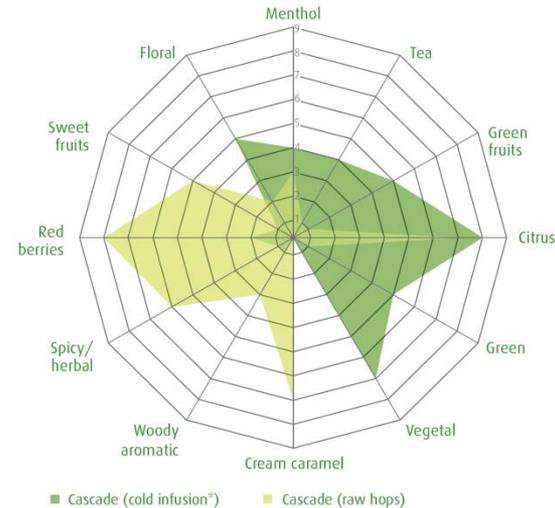


Cascade
Washington/
Oregon



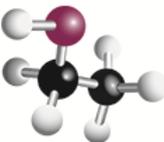
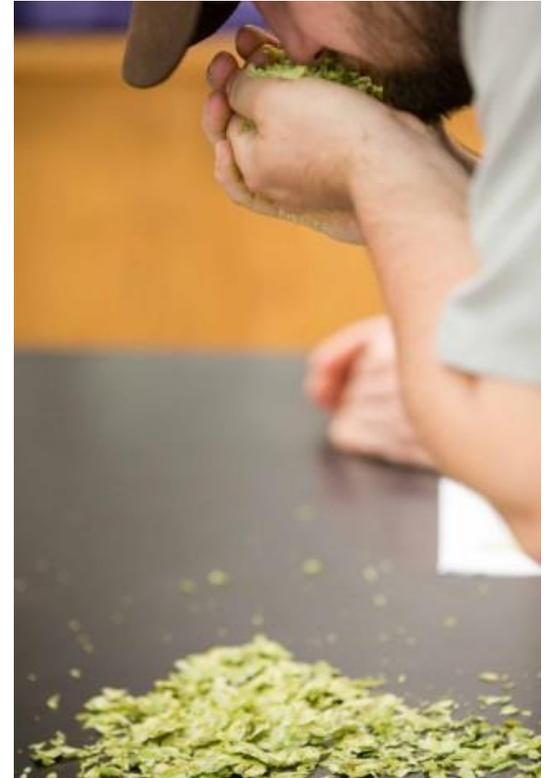
The Cascade mountains, with their volcanic origins, give the cultivar of the same name its medium-strong, very distinct, fragrant floral aroma.

The main features of this variety are its long, dark-green cones and its low alpha content. In the cold infusion, citrus aromas come strongly to the fore, whereas cream-caramel and fruity notes of blackberries and mango predominate in the raw hops. Due to its optimal cultivation characteristics and good resistance to downy mildew, Cascade is a high-yielding hop.



The Art of Hops Evaluation

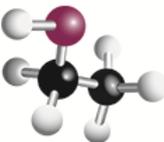
Hop Quality Evaluation and Selection



Hop Quality Evaluation & Selection

Objectives for Hop Selection:

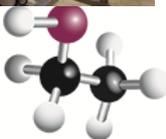
- Evaluating hop lots to fulfill purchase agreement
- Determining sample varietal true-to-type
- Evaluating consistency
- Inspecting for damage and disease
- Ensuring hops have been processed properly
- Developing relationship with your suppliers



Not Just Suppliers – We're Also Brewers

Haas Innovations Research Brewery in Yakima

- State-of-the-art 2-barrel research brewery combines flexibility and reproducibility. Offers complete brewing capabilities and is designed for maximum flexibility and commercial scale-ability.
- Able to accommodate all hop products, traditional and advanced.
- The brewery contributes significantly to the evaluation of experimental hop varieties and the development of new hops and hop products.



Integral to Providing Value to the Industry

