



How can hops in their natural unchanged form be of aid to you when developing and designing new beer types?

Join us in the quest for the answers you have always been looking for regarding the use of hops in beer recipes



? How does a beer that has been brewed exclusively with finest aroma hops actually taste like?

? How does a beer that has been brewed with fractionated CO₂ Extract from high quality bitter hops actually taste like ?

? How do the „sensorial bitter feeling" and the analysed EBC Bitter-units relate to each other?

? How can I take advantage of the reducing characteristics of the hops related polyphenols for my beer ?

Beer 1 : „Pure Hops Love“

Target: to produce a full bodied beer using adjuncts, which is rich in low molecular polyphenols, offers a sensorically pronounced though very soft bitterness and pleases the nose with an elegant aroma.

Ingredients:

- 100 % choicest Aroma hops Hallertau Hersbrucker
- **100 % Pellets Type 90**
- 3 additions into the wort kettle
- 65 % pale Malt – 15 % bright caramel Malt
- 10 % maize – 10 % rice
- 70 min. boiling time
- Bottom fermenting yeast

Beer 1 : „Pure Hops Love“

Hopping

Hop variety:	Hallertau Hersbrucker
Product Type:	Pellets type 90
Alpha content:	3%
Boiling time:	70 min
Hopping rate:	13,5 gr alpha / hl
Additions:	3 at 0', 40', 65'
Bitter units:	25 IBU
isomerisation:	19% IBU / Hop rate
Isohumulones:	18,3 mg/l
humulones :	2,7 mg/l
% iso-cohumulones:	27,3 %

Beer analysis

Extract:	11,4% W/W
pH:	4,44
Alcohol:	4,8 vol %
Color EBC:	9,7 EBC
Foam:	242 Nibem

Special Analysis

(some selected compounds)

Total Polyphenols:	248,0 mg/l
Low Molecular:	100,8 mg/l
K-Glucosyde:	2,6 mg/l
Catechine:	9,4 mg/l
Proanthocyanidine:	1,4 mg/l
Iso-xanthohumol:	0,7 mg/l

Beer aroma and flavour compounds

Linalool:	34 µ g/l
Hexanic acid:	2219 µ g/l
2-Phenylethylacetate:	284 µ g/l
Furaneol:	285 µ g/l
Maltol:	865 µ g/l

Average hopping costs for achieving this superb taste

0,023 € / l

Beer 2 : "Sankt Johann"

Target: to produce a light tasting beer using adjuncts and hops with lowest cohumulone contents in order to achieve a pronounced though very smooth bitterness. The beer character receives its final touch by a late addition of the extract's oil fraction and by reducing the whirlpool temperature.

Ingredients:

- 100 % high quality Bitter hops Hallertauer Taurus
- **100 % Fractionated CO₂ Extract**
- Alpha acid rich fraction dosed at the beginning of boiling, the oil rich fraction at the end
- 65 % pale Malt – 15 % bright Caramel Malt
- 10 % maize – 10 % rice
- 70 min. boiling time, whirlpool temperature 80°C
- Bottom fermenting yeast

Beer 2 : "Sankt Johann"

Hopping

Hop variety: Hallertau Taurus
Product : Fractionated CO₂ Extract
Alpha : α - rich fract. 57 %, 4,5 ml oil/100g
oil- rich fract. 33 %, 35 ml oil/100g
Boiling time: 70 min
Hopping rate: 9,0 gr alpha / hl
Additions: α - rich at 0', oil- rich fract. 70'
Bitter units: 23 IBU
isomerisation: 27% IBU / Hop rate
Isohumulones: 22,6 mg/l
humulones : 2,7 mg/l
% iso-cohumulones: 24,4 %

Beer analysis

Extract: 11,7% W/W
pH: 4,35
Alcohol: 4,9 vol %
Color EBC: 9,3 EBC
Foam: 252 Nibem

Special Analysis

(some selected compounds)

Total Polyphenols: 141,0 mg/l
Low Molecular: 61,8 mg/l
K-Glucosyde: 0,0 mg/l
Catechine: 3,3 mg/l
Proanthocyanidine: 0,9 mg/l
Iso-Xanthohumol: <0,1 mg/l

Beer aroma and flavour compounds

Linalool: 54 μ g/l
Hexanic acid: 1820 μ g/l
2-Phenylethylacetate: 219 μ g/l
Furaneol: 215 μ g/l
Maltol: 712 μ g/l

Average hopping costs for achieving this superb taste

0,005 € / l

Beer 3 : "Hallertau Nights"

Target: to produce a dark beer full of character with a pronounced hops flavour, where the color has been fine-tuned to a fine bordeaux note with the use of sugar colour.

Ingredients:

- 100 % choicest Aroma hops Hallertauer Hersbrucker
- **100 % Pellets Type 45**
- 3 hops additions in the wort kettle
- 100 % dark roasted Malt
- Fine-tuning with sugar colour
- 70 min. boiling time
- Bottom fermenting Yeast

Beer 3 : "Hallertau Nights"

Hopping

Hop variety: Hallertau Hersbrucker
Product : Pellets Type 45
Alpha : 6 %
Boiling time: 70 min
Hopping rate: 15,0 gr alpha / hl
Additions: 3 at 0', 40', 70'
Bitter units: 27 IBU
isomerisation: 19 % IBU / Hop rate
Isohumulones: 23,6 mg/l
humulones : 3,3 mg/l
% iso-cohumulones: 25,3 %

Beer analysis

Extract: 11,8% W/W
pH: 4,41
Alcohol: 5,0 vol %
Color EBC: 38,0 EBC
Foam: 271 Nibem

Special Analysis

(some selected compounds)

Total Polyphenols: 254,0 mg/l
Low Molecular: 99,0 mg/l
K-Glucosyde: 1,3 mg/l
Catechine: 5,3 mg/l
Proanthocyanidine: 1,4 mg/l
Iso-Xanthohumol: 0,5 mg/l

Beer aroma and flavour compounds

Linalool: 36 µ g/l
Hexanic acid: 2211 µ g/l
2-Phenylethylacetate: 231 µ g/l
Furaneol: 666 µ g/l
Maltol: 1946 µ g/l

Average hopping costs for achieving this superb taste

0,027 € / l

Average beer tasting results during the 8 days of the drinktec Interbrau 2001 in Munich

- Over 150 times we had the opportunity of collecting your opinions
- The comparison of the two blond beers remarkably resulted in no clear preference between tasters for one special type
- The description of the sensoric feeling was remarkably uniform
- Beer N°1 was described as full bodied, light, soft, hoppy character, elegant hoppy note, "active flavour", high drinkability, IBU was guessed to be between 15 and 21
- Beer N°2 was described as crispy, soft but intense, full bodied, clean aroma, very soft disappearing after taste, smooth, IBU was guessed to be between 19 and 26
- Beer N°3 was described as very tasty, flavour rich, finest aroma, "the beer for having at home", IBU was guessed to be between 15 and 20
- Beer N°2 was felt in the bitter intensity higher than N°1
- Beer N°3 was described as the less bitter of all three
- 3 Participants didn't like the beers at all

IBU = Bitterness ?

- **The IBU analysis is unspecific and does measure other compounds which do not necessarily relate to bitterness**
- **IBU is a good analysis for process-control in the brewery but does not give any information about:**
 - **Sensoric Bitterness Intensity**
 - **Sensoric Bitterness Quality**
 - **Quality of the remaining after-taste**
 - **Hop flavour of the beer**
- **When analytically comparing two different beers in their bitter level, the chromatographic measurement of iso-humulones should be used.**
- **Other beer compounds influence, mask, increase or decrease bitterness perception**

“Aroma” hops = Perfumed beer ?

- **Apparently some brewers fear the use of aroma hops in the believe that it will lead to a perfumed beer**
- **Marketing says that the Market “rejects” perfumed beer**
- **All the hop varieties do contain bitterness and oil compounds. Some “bitter” varieties even in higher quantities than “aroma” varieties**
- **The aromatic compounds are at the same time flavour-relevant**
- **The leaf fraction of the hops flower has other compounds like glycosides and polyphenols that do also have aromatic and flavour imparting characteristics**
- **Even dosing up to 15 gr. Alpha/hl of “aroma hops” the bitter intensity and quality was soft, mild and pleasant**
- **Our tests showed you, that it is possible to brew beers with only “aroma hops” and achieve a clean, elegant slightly hoppy and herbal character**

“Bitter” hops = Herb aggressive bitterness ?

- The high alpha-acid containing varieties are very different in their alpha-acid, oil and ester compositions
- The consumer relates other beer problems, like yeast flavour, oxidation, ageing, light-struck with bitterness
- Even an analytically low bittered beer can be harsh, aggressive, unpleasant or too long aftertasting in its bitterness impression
- The selection of hop varieties with low co-humulone contents shows to impart better flavour quality to the beers.
- The isomeres of the iso-cohumulone are far more unstable over the time than those of the n- and ad humulone. Low cohumulone contents are essential for a better taste stability
- Our tests showed you, that it is possible to brew beers with only “bitter hops” with around 23 mg/l isohumulones though having a soft, fine after clinging bitterness, smooth in perception with an intense and noble hop character.
- **The consumer expects/wants less unpleasant bitter tasting beers rather than less bitter tasting beers**

Conclusions I

- **We could see a lot surprised faces when we showed the analytical measured IBU`s**
- **We could feel throughout the tasters, that there were big differences in the ranges of detection of certain aromas, flavour compounds and bitterness**
- **Beer N°2 with 23 IBU was felt more intense in bitterness than beer N°1 with 25 IBU**
- **Beer N°3 with 27 IBU was felt to be the “less bitter” of all three**
- **No one could tell that beers N°1 and N°2 were brewed with 20% adjuncts**
- **Through the selection of the raw materials you can brew beers which are intense and characteristic in taste, though very smooth and with a high drinkability**
- **By changing the hops dosage using natural products and different varieties you can make out of the same basic recipe two totally different characterized beers**

Conclusions II

- **Further studies need to be done on the influence of the natural hops compounds in beer**
- **Breweries should get deeply involved with the influence of hops in their product**
- **There is not a patent recipe for everyone and for every beer, but there are clear indications of positive influences of certain philosophies with regard to hopping**
- **Hops is important for the flavour, personality and for the drinkability of your beer**

Should you require more information then please don` t hesitate to get in touch with us at contact@hvg-germany.de

These trials were planned and developed by Dr. Adrian Forster, Dr. Martin Ketterer, Andreas Gahr, Kurt Niederwieser and Carlos Ruiz