FOAM & FOAM ENHANCEMENT

Superior foam stand and exceptional lacing are hallmarks of a fine beer and an important quality mark for consumers . In order to enhance the beer foam, we should first take a look on the beer foam basic physics. The perfect foam consists of uniformly small stable bubbles giving a very creamy impression. Foam is a dispersion in which released carbon dioxide is evenly distributed in the liquid beer phase enriched with foam positive substances. In addition to the surface tension of the beer, nucleation sites as such as microscratches in the side of the glass (or solids substances in the beer) are very important for foam generation. Furthermore the size of the nucleation sites is directly proportional to the size of bubbles that are generated. There are two important factors that determine the foam and its retention: 1) the amount of foam positive substances and 2) physics of foam[1,2].

<u>The key events involved in foam formation and retention are:</u>

- bubble formation
- drainage (of liquid from foam into beer)
- bubble coalescence (merging of two bubbles through the rupture of the film between them)
- disproportionation (the passage of gas from a small bubble to an adjacent larger one).

<u>Foam positive substances can be hydrophobic, film stabilising or may increase the viscosity. Foam positive substances are:</u>

- Malt-derived proteins with specific molecular weights that form a strong, flexible and cohesive film in order to reduce gas permeability and to inhibit coalescence and disproportionation.
- Metal cations (derived from malt or water) forming foam stabilising complexes with iso-alpha-acids
- natural stabilisers (polysaccharides derived from malt increasing viscosity and inhibiting drainage; iso-alpha acids)

Foam negative substances include fatty acids (lipids), basic amino acids (both deriving from malt) and a high content of ethanol.

Therefore, establishing and ensuring a suitable beer head can be a real complex issue. The concentration of foam positive or negative substances can be influenced by the choice of the raw materials and by process technology.

What is the role of hops in Foam ?

A role of the hop acids is to stabilise the foam complexes. Each of the different iso-alpha acids acts in a slightly different manner to produce varying degrees of foam depending on the different surface activities. The hydrogenation step in the production of tetrahydro-iso-alpha acids and hexahydro-iso-alpha acids is the crucial part to further increase the foam enhancing ability of the iso-alpha acids.

Table 1: Sensory and foam enhancing proporties of our products

	Prod. Conc. %	Bitter Unit Factors	Foam enhancement
Isohop	30	1.0	normal
Tetrahop Gold®	9	1.0-1.7	very good
Hexahop Gold®	10	1.3	very good
Redihop	30	0.7	normal

Tetrahop Gold®:

Suitable for maximum foam enhancement along with a higher bitterness impact. As addition rate we recommend 3-5ppm THIAA (pure tetrahydro-iso-alpha acids), this will enhance foam stand and cling. The bitterness profile from that of iso-alpha acids might change since the sensory bitter characteristics are different. The bitterness impact of the addition might be more than 3-5 IBU, depending on the beer characteristics.

ppm = mg/l = dosage ppm THIAA x Bitter Unit factor = Resulting Bitter Units

ppm = mg/l = 3ppm for foam enhancement x 1.7 = 5 BU

$$\text{kg of Product} = \frac{\text{(ppm of THIAA) x (hl of finished beer)}}{\text{(product conc.) x (utilization) x (10 000)}} = \frac{\text{(3) x (400 hl of finished beer)}}{\text{(9\%) x (75\%) x 10 000}} = 1.8\text{kg}$$

Hexahop Gold®:

Suitable for maximum foam enhancement especially in low BU beers but also effective in bittered ales and dark lager beers. As a suggested addition rate, we recommend 3 to 5ppm HHIAA (pure hexahydro-iso-alpha acids) for improved foam stand and cling. The bitterness profile is not significantly influenced by the use of Hexahop Gold®, though the bitter intensity might be slightly more than 3-5 IBU (reflecting the dosing rate), depending on the beer characteristics.

ppm = mg/l = dosage ppm HHIAA x Bitter Unit factor = Resulting Bitter Units

ppm = mg/l = 3ppm for foam enhancement x 1.3 = 4 BU

$$\text{kg of Product} = \frac{\text{(ppm of HHIAA) x (hl of finished beer)}}{\text{(product conc.) x (utilization) x (10 000)}} = \frac{\text{(3) x (400 hl of finished beer)}}{\text{(10\%) x (75\%) x 10 000}} = 1.6\text{kg}$$

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ISOHOP:

Since Isohop contains exclusively iso-alpha acids (IAA), the foam effects will be parallel to those beers brewed with traditional hop products.

ppm = mg/l = dosage ppm IAA x Bitter Unit factor = Resulting Bitter Units

ppm = mg/l = 3ppm for foam enhancement x 1.0 = 3 BU

$$\text{kg of Product} = \frac{(\text{ppm of IAA}) \times (\text{hl of finished beer})}{(\text{product conc.}) \times (\text{utilization}) \times (10\,000)} = \frac{(3) \times (400 \text{ hl of finished beer})}{(30\%) \times (75\%) \times 10\,000} = 0.53\text{kg}$$

For more information about these products, please refer to the relevant technical specification and product use document on our website.

[1] D. E. Evans, M. C. Sheehan: Don't be fobbed off: the substance of Beer foam – a Review, J. Am. Soc. Brew. Chem. 60(20): 47-57, 2002
[2] C. W. Bamforth: The relative significance of physics and chemistry for beer foam excellence: theory and practice, J. Inst. Brew. 110 (4), 259-266, 2004

e-mail: info@BarthHaasGroup.com www.BarthHaasGroup.com