Lupulin Enriched Hop Pellets (Type 45 Pellets)

Characteristics

Lupulin Enriched Hop Pellets are a hop product added to the kettle to provide bitterness and a hop character that is indistinguishable from that achieved using raw hops. With Lupulin Enriched Hop Pellets, the hop bitter acids and hop oils are concentrated by the mechanical enrichment of lupulin. They provide improved homogeneity, better storage stability and reduced storage/transport costs compared to raw hops. Supported by a long history of safe use in brewing, and in accordance with US FDA regulation 21 CFR 170.30(c) and 170.3(f), hop pellets are generally recognised as safe (GRAS).

Product Specifications

Description	Cylindrical pellets of approx. 6 mm (0.24 inch) diameter, milled and compressed whole hops
Consistency	A solid which normally breaks up into a powder
Color	Typically from dark-green to olive-green (depending on variety)
α-acids	Typically 4 - 16% (depending on variety and crop year; standardisation is possible)
β-acids	Dependent upon raw hops
Hop Oils	0.4 - 3.5 mL/100 g (depending on variety and crop year; standardisation is possible)
Moisture	7 – 12 %

Quality and food Safety

BarthHaas maintains quality management systems registered to the ISO 9001 standard, as well as food safety management programs based on internationally recognised (HACCP) principles. Please refer to our web site (www.barthhaas.com) for more information on our systems and programs.

Product Use

For efficient provision of bitterness, the pellets should be added to the wort at the beginning or up to 15 minutes after the start of the boil. Utilization of α-acids into beer depends on the boiling system and conditions and is normally in the range of 30% - 35%. Added late into the boil, utilization of α-acids diminishes as the utilisation of the aroma improves giving a characteristic hop flavor in the beer. The quantity to be added is calculated using the α-acids content and the estimated utilization. For aroma, the quantity to be added should preferably be calculated using the oil content of the product. Pellets can be dosed automatically.

Packaging

Pellets are packed in laminated foils with an aluminum layer as a barrier against diffusion of oxygen. They are sealed under inert gas and/or vacuum packed. The foil material used meets all food industry packaging regulations. The residual oxygen content in the foil packs is less than 2% by volume. Pack sizes are available from 1 kg to 500 kg.

Storage and best-by Recommendation

Lupulin enriched Pellets should be stored cool at 0 – 5 °C (32 - 41 °F). Pellets are best used within 5 years after processing. Foils, once opened, should be used within a few days to avoid deterioration of bitter acids and essential oils.

Hop Deterioration during Storage and Shipping

Definition of Hop Quality

Bitter Acids

During storage, the concentration of hop bitter acids is influenced by several parameters. These parameters lead to a decrease in alpha acids which can be up to 6 % (depending on the variety) in the first year (Table 1). This means that the alpha acid concentration reported at processing decreases over time.

Hop Product	Cold Storage at 3 °C
Cones (3 months storage	5 %
Pellets (1 year storage)	3-6 %
HSI (1 year storage)	Up to 13 % (increasing)

Table 1: α-Acid losses in % relative during different storage conditions [1,2] (only indicators)

Essential Hop Oils

During storage, the concentration of hop oil is influenced by various parameters.
When hops are harvested and processed, their levels of essential oil start to decrease, and the chemical composition of the oil starts to change.[3] These changes are variety dependent.[4] Internal analyses have shown that "flavor" hops are especially prone to hop aroma losses compared to normal aroma varieties.

HSI

The Hop Storage Index (HSI) is a method to define the freshness of hops and hop products.
There is no strict definition of "good" or "bad" values; the HSI only shows trends and indications.
It is very important to mention that the starting HSI of hops and hop products varies significantly. Different hop varieties will have different HSI values due to their variety-specific phenotypic expression (mainly genetics and growing conditions). But also, within one single hop variety, the HSI varies, even right after hop picking (mainly due to different growing conditions).
This means that hop varieties will show different HSI values from batch to batch, sometimes also above 0.35.

Influence on Hop Quality

Hop products don't deteriorate, but the composition changes. The following list shows the most important influences on hop and hop product quality.[2–7]:

- Intact lupulin glands. After pelletizing, the lupulin glands are crushed, therefore they need to be properly protected (i.e. suitable foil against light and oxygen and cold storage)
- Oxygen
- Light
- Hop Variety: The hop variety has shown to be an important factor in storage stability
- Temperature
- Time: Longer storage times can result in changes in hop aroma profile. Some aroma changes will occur sooner, depending on the variety, so depending on the purpose of the hop, different lifetimes may be warranted.
- Temperature control is also important during shipping (see Table 2)

Shipping Temperature	Alpha Losses
Up to 25°C	3-6 %
Up to 30°C	5-8 %
Up to 35 °C	6-10 %
> 35°C	Up to 15 %

Table 2: Alpha-acid losses during overseas transportation in % relative [6]

Analytical Methods

The determination of α-acids comprises three types of methods, the specific measurement of α-acids by means of HPLC, spectrophotometric or conductometric methods:

- α-acids can be measured by any of the following methods:
  - EBC method 7.5 - (α-acids as lead conductometric value (LCV))
  - ASBC Spectrophotometric method (Hops-6) - (α and β-acids)
  - By HPLC, using the current ICE standard, according to the EBC 7.7 method, or the ASBC method (Hops-14) - (α and β-acids)
- Hop oil concentration can be measured by:
  - EBC 7.10
  - ASBC Hops-13

Safety

If dust is generated, it is advisable to use a dust mask. Hop pellets are a combustible material. For further information please download the relevant Safety Data Sheet (SDS) from our web site www.barthhaas.com.

Technical Support

We will be pleased to offer help and advice on the use of Hop Pellets in brewing.

E-Mail: Brewingsolutions@barthhaas.de

References

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(7) Mikyška, A.; Krofta, K. Assessment of Changes in Hop Resins and Polyphenols during Long-term Storage. *Journal of the Institute of Brewing* **2012**, *118* (3), 269–279.