



# BarthHaas®

# LUPOMAX®

## CHARACTERISTICS

LUPOMAX® enriched hop pellets are a natural hop product, concentrated in the resins and essential oils that give hops their distinctive character. They provide intense hop flavors and aromas combined with a decrease in vegetal and grassy attributes. LUPOMAX® pellets are produced via the mechanical enrichment of lupulin under highly controlled conditions and low temperatures to protect the sensitive hop components. They can be introduced into the brewing process anywhere Type 90 (T90) hop pellets are employed, but best practice is addition late in the kettle boil, to the whirlpool, or preferably as a dry-hop addition during fermentation or maturation. LUPOMAX® pellets are hand selected for quality each crop year, gently processed, and designed for maximum consistency.

Supported by a long history of safe use in brewing, and in accordance with US FDA Regulations 21 CFR 170.30(c) and 170.3(f), LUPOMAX® hop pellets are generally recognized as safe (GRAS).

## PRODUCT SPECIFICATIONS

<b>Description</b>	Cylindrical pellets of approximately 6 mm (0.24 inch) diameter
<b>Consistency</b>	A formed solid that will generally disintegrate into a powder during use
<b>Color</b>	Ranges from dark green to olive green (variety dependent)
<b>α-acids</b>	Standardized to meet a predetermined and narrow specification range (variety dependent)
<b>β-acids</b>	Variety dependent
<b>Hop Oils</b>	Variety dependent
<b>Moisture</b>	7 - 12 % (Variety dependent)

## QUALITY AND FOOD SAFETY

John I. Haas, Inc., maintains quality management systems registered to the ISO 9001 standard, as well as food safety management programs based on internationally recognized (HACCP) principles. Please refer to our web site ([www.johnihaas.com](http://www.johnihaas.com)) for more information on our systems and programs.



## PRODUCT USE

LUPOMAX® pellets are designed to provide consistent hop aroma and flavor that will vary depending on the point of addition within the brewing process. They will also contribute to beer bitterness when added to the kettle or whirlpool, where the amount of bitterness introduced will be dependent on factors such as temperature, time, wort gravity, and other brewing parameters. Due to the removal of hop vegetative matter during processing, LUPOMAX® pellets will impart less green/grassy character than traditional T90 pellets or whole cone hops. This should be taken into consideration during recipe development. Brewing efficiency and yield should increase with less beer loss when using LUPOMAX® enriched pellets in place of traditional hop pellets or cones.

## PACKAGING

LUPOMAX® pellets are packed in laminated foils with an aluminum layer as a barrier against diffusion of oxygen. They are sealed under inert gas 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. Standard pack size is 5 kg.

## STORAGE AND BEST-BY RECOMMENDATION

LUPOMAX® 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
<b>Cones (3 months storage)</b>	5 %
<b>Pellets (1 year storage)</b>	3-6 %
<b>HSI (1 year storage)</b>	Up to 13 % (increasing)

**Table 1:  $\alpha$ -Acid losses in % relative during different storage conditions<sup>1,2</sup> (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.<sup>3</sup> These changes are variety dependent.<sup>4</sup> 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.<sup>2-7</sup>:

- 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** <sup>6</sup>

## ANALYTICAL METHODS

The determination of  $\alpha$ -acids in LUPOMAX<sup>®</sup> hop pellets can be measured by standard ASBC or EBC methods employing HPLC, spectrophotometric, or conductometric techniques:

- HPLC, using the current ICE standard, according to ASBC Hops-14 or EBC 7.7 ( $\alpha$ - and  $\beta$ -acids)
- Spectrophotometric according to ASBC Hops-6 ( $\alpha$ - and  $\beta$ -acids)
- Conductometric according to EBC 7.5 ( $\alpha$ -acids as lead conductometric value (LCV))
- Hop oil concentration in LUPOMAX<sup>®</sup> hop pellets can be measured by:
  - ASBC Hops-13 and Hops-17
  - EBC 7.10 and 7.12

## 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).

## TECHNICAL SUPPORT

We will be pleased to offer help and advice on the use of LUPOMAX<sup>®</sup> enriched hop pellets in brewing.

E-Mail: [Brewingsolutions@barthhaas.de](mailto:Brewingsolutions@barthhaas.de)



## REFERENCES

- (1) Biendl, M.; Engelhard, B.; Forster, A.; Gahr, A.; Lutz, A.; Mitter, W.; Schmidt, R.; Schönberger, C. 3.2 Ätherisches Hopfenöl, 49-51. In *Hopfen: vom Anbau bis zum Bier*; Hans Carl GmbH: Nürnberg, 2012.
- (2) Forster, A. The Quality Chain from Hops to Hop Products; Convention, E. B., Ed.; Proceedings of the 29th EBC Congress; Fachverlag Hans Carl, 2003; Vol. 29.
- (3) Rutnik, K.; Ocvirk, M.; Košir, I. Changes in Hop (*Humulus Lupulus* L.) Oil Content and Composition during Long-Term Storage under Different Conditions. *Foods* 2022, 11, 3089. **2022**.
- (4) Canbaş, A.; Erten, H.; Özşahin, F. The Effects of Storage Temperature on the Chemical Composition of Hop Pellets. *Process Biochemistry* **2001**, 36 (11), 1053-1058.
- (5) Val Peacock. Storage Shipping and Handling of Hop Pellets; Chicago, 2010.
- (6) Forster, A. What Happens to Hop Pellets during Unexpected Warm Phases? *Brauwelt International* **2002**, No. 1, 43-46.
- (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.