

## Tetrahop Gold®

Tetrahop Gold® is an aqueous alkaline solution of the potassium salts of tetrahydro-iso- $\alpha$ -acids. It is produced from CO<sub>2</sub> hops extract using a patented all aqueous process. Tetrahop Gold® enhances beer foam when used as a post-fermentation replacement for a part of the normal bittering. In the absence of normal  $\alpha$ -acids and iso- $\alpha$ -acids, Tetrahop Gold® will give complete protection from the formation of light-struck flavour. Furthermore, it will act as an antimicrobial agent when added to beer. Tetrahop Gold® is classified as a modified hop extract that may be safely used in beer in accordance with the US FDA regulation 21 CFR 172.560 (b) (6).

### Product Specifications:

Description:	A yellow to amber colored, aqueous solution of the potassium salts of tetrahydro-iso- $\alpha$ -acids.
Concentration:	Standard concentration is 9.0% $\pm$ 0.5 of tetrahydro-iso- $\alpha$ -acids by HPLC
pH:	8.5 - 11.0
Density:	1.017 g/mL (approximately) at 20 °C (68 °F)
Viscosity:	2 - 10 mPas at 20°C
Solubility:	Soluble in pH-adjusted de-mineralised water, and in alcohol
Iso- $\alpha$ -acids:	< 0.1%

### 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](http://www.barthhaas.com)) for more information on our systems and programs.

### Product Use:

Tetrahop Gold® is normally used after fermentation and before final filtration. Utilisation of Tetrahop Gold® in final beer can be expected between 55 - 80% depending on the time and efficiency of dosing (kettle dosing is not advisable). The point of addition should be close to a region of turbulent flow, e.g. on the suction side of a centrifugal pump. The dosing pump should be adjusted to deliver Tetrahop Gold® over approximately 70% of the total transfer time. It is advisable to make the addition prior to the final filtration step. Local high concentrations of tetrahydro-iso- $\alpha$ -acids should be avoided and the addition point should be well separated from that of any other additives. Tetrahop Gold® may be added at ambient temperature without prior dilution directly to beer. If dilution is necessary, the use of demineralised water and a pH adjustment to 10 - 11 with KOH is necessary. Do not use sodium bases to adjust the pH of the dilution water - caustic soda or sodium hydroxide form poorly soluble salts with most hop acids.

The amount of Tetrahop Gold® is calculated based on the product concentration and the assumed utilisation. Conducting trials at the brewery will determine the correct dosage of Tetrahop Gold® with regard to sensory bitterness and foam enhancement. Depending on the type of beer, Tetrahop Gold® may give 1.0-1.7 times the perceived bitterness of normal iso- $\alpha$ -acids. Tetrahop Gold® should not be left in dosing lines at low temperatures. We recommend cleaning lines and dosing pumps with warm slightly alkaline demineralised water or ethanol after use.

### Usage Calculations:

The following calculations are based on the assumption of tetrahydro-iso- $\alpha$ -acids (THIAA) being 1.7 times as bitter as iso- $\alpha$ -acids (IAA). Utilisation of THIAA is expected to be up to 70 - 75% when Tetrahop Gold® is used as recommended.

Desired Sensory Bitterness Units = BU

$$\text{THIAA required in beer (mg/L)} = \frac{\text{BU}}{1.7}$$

$$\text{Dosage THIAA in mg/L (70\% utilisation assumed)} = \frac{\text{BU}}{1.7} \times \frac{100}{70}$$

$$\text{Dosage in grams THIAA per hL of beer} = \frac{\text{BU}}{1.7} \times \frac{100}{70} \times \frac{100}{1000}$$

Dosage amount of Tetrahop Gold® (9% THIAA) in g/hL :

$$\frac{\text{BU}}{1.7} \times \frac{100}{70} \times \frac{100}{1000} \times \frac{100}{9} \text{ g/hL} = \text{BU} \times 0.93 \text{ g/hL}$$

Dosage amount of Tetrahop Gold® (9% THIAA) in mL/hL :

$$\frac{\text{BU}}{1.7} \times \frac{100}{70} \times \frac{100}{1000} \times \frac{100}{9} \times \frac{1}{1.015} \text{ mL/hL} = \frac{\text{BU} \times 0.93 \text{ g/hL}}{1.015 \text{ g/mL}} = \text{BU} \times 0.92 \text{ mL/hL}$$

(e. g. for 5 desired sensory bitterness units  $5/1.7 \times 100/70 \times 100/1000 \times 100/9 =$

**4.7 g/hL (4.6 mL/hL) of Tetrahop Gold® are necessary)**

### Foam Enhancement:

Calculate required Tetrahop Gold® as shown above (for foam and cling enhancement we generally recommend Tetrahop Gold® not be added to the final beer at a concentration greater than 5 ppm THIAA). Reduce kettle bittering by an equivalent BU to compensate for the bitterness contribution of Tetrahop Gold®.

### Light Stability:

Tetrahop Gold® will only provide protection from light-struck flavour if a complete absence of normal iso- $\alpha$ -acids is achieved, therefore no other sources of non-reduced iso- $\alpha$ -acids should exist in the wort or beer streams. Thus for light-stable beers packaged in clear or green glass bottles, all the hop bitterness must be derived from reduced hop acids such as Tetrahop Gold®, Redihop® or Hexahop® products. Iso- $\alpha$ -acids (from equipment or yeast) must not be present in the beer. If beta extracts are used as kettle additives, ensure that the concentration of  $\alpha$ -acids and iso- $\alpha$ -acids are below 0.2%

**Packaging:**

Normally supplied in high-density polythene containers of 20 kg.

**Storage and Best-by Recommendation:**

Store Tetrahop Gold® in full, closed containers at 15 - 25 °C (59 - 77 °F). Prolonged storage at high temperature will cause deterioration. Tetrahop Gold® performs best if used within 24 months from the time of production if stored as recommended. Opened containers should be used within a few days.

**Safety:**

Safety Data Sheet (SDS) is available on our website [www.barthhaas.com](http://www.barthhaas.com).

**Analytical Methods:**

The concentration of tetrahydro-iso- $\alpha$ -acids is measured by UV Spectrophotometry (with modified factors) or by the EBC Method 7.9 (HPLC). Details of recommended methods are available on request.

**Technical Support:**

We will be pleased to offer help and advice on the use of Tetrahop Gold® in brewing.