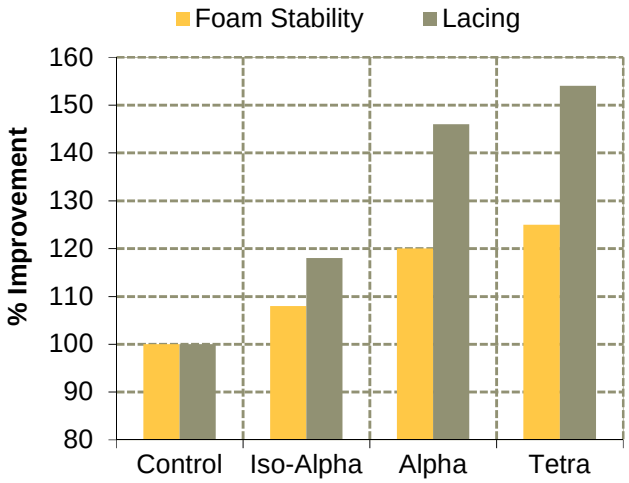
Tetra Iso-Extract (Tetra)

❖ Overview

- **Tetra** is a pure, aqueous solution of the potassium salts of tetrahydro-iso-alpha acids produced entirely from CO_2 hop extract.
- **Tetra** will greatly enhance beer foam when used as a post fermentation replacement for a proportion of the regular bittering.
- The exclusive use of **Tetra** (or also a combination of **Tetra** with other reduced products) instead of regular alpha and iso-alpha acids prevents light struck flavors in beer.

Effect of 3 mg/l pure Hop Acids on Foam and Lacing – Product Comparison



❖ Specification

- Description: An amber colored, aqueous solution of tetrahydro-iso-alpha acid as potassium salts
- Concentration: 9.0 ± 0.5 % (w/w) of tetrahydro-iso-alpha acids by HPLC or 10.0 ± 0.5 % (w/w) by UV spectrophotometric analysis
- Iso-alpha acids: below detection limit
- Alpha acids: below detection limit
- pH: 9.5 (± 1.0)
- Viscosity: 2 – 6 mPas at 20°C (68°F)
- Density: 1.017 (± 0.005) g / ml at 20°C (68°F)

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❖ Properties

- **Appearance**

  A homogeneous, amber, clear aqueous solution; free flowing at recommended storage and use temperatures. Miscible with demineralized water and alcohol.

- **Utilization**

  Based on HPLC analyses, utilization of **Tetra** in final beer can be between 60 – 80 % depending on the time and efficiency of dosing.
  Actual utilization will vary from brewery to brewery depending on plant and process conditions.

- **Light Stability**

  Tetra will only provide protection from light struck flavor in the complete absence of regular iso-alpha acids. **Tetra** can be used in conjunction with any Hopsteiner® light stable product to achieve light stability.

- **Foam enhancement**

  Tetra enhances both foam retention and cling. Noticeable foam improvement can be achieved with 3 mg/l of tetrahydro-iso-alpha acid in beer already.

- **Flavor**

  Tetra should provide 1.0 to 1.3 times the perceived bitterness as compared to the same bitterness from traditional hopping. The actual intensity depends primarily on the BU level and type of beer. Therefore, the target level for beer BU must be determined in preliminary tests to achieve the correct degree of sensory bitterness.

- **Quality**

  All Hopsteiner® products are produced in plants accredited to internationally accepted quality standards.

❖ Packaging

Tetra is normally supplied in 20 kg (45 lbs) pails.

❖ Product Use

Tetra is typically added after fermentation and before final filtration.

- **Dosage**

  Dosage is based on the product concentration, an estimated or known utilization and the desired bitter intensity in the beer. Remember that **Tetra** will give about 1.0 to 1.3 times the perceived bitterness of iso-alpha acids derived from traditional hop sources. Trials at the brewery will determine the correct dosage of **Tetra**.

- **Addition**

  We recommend dosing **Tetra** undiluted to the center of the beer stream during at least 70 % of the beer transfer, preferably before final filtration and after any gravity adjustment. **Tetra** can be injected at ambient temperature. An accurate, high pressure, dosing pump is required ensuring vigorous injection into the beer stream.
  If dilution is necessary, always add **Tetra** to demineralized water to achieve a dilution and adjust pH to 10 – 11 using KOH.
  In case containers are used for several days, it is recommended to flush the headspace with nitrogen (CO_2 is not suitable).

- **Cleaning Recommendation**

  Tetra should not be left in dosing lines at low temperatures. Lines and dosing pump should be flushed with warm, slightly alkaline, demineralized water or ethanol to clean.

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- **For Light Stable Beer**

  For maximum protection against light struck flavor, it is essential that no other sources of non-reduced iso-alpha acids be inadvertently introduced into the wort or beer. Therefore, be sure to:
  - Use exclusively light stable hop products through the entire process.
  - Avoid contamination from equipment surfaces that have been in contact with regular iso-alpha acids.
  - Never pitch wort with yeast that has been in contact with regular alpha and iso-alpha acids.

- **Storage**

  Tetra should be stored in sealed containers at 5° – 15°C (41° – 59°F). Avoid exposure to sunlight. Opened containers should be used up within a few days.

- **Best Before Date**

  Tetra is stable 2 years from date of production under the recommended storage conditions.

- **Safety**

  Tetra is a slightly alkaline, intensely bitter substance but may be safely handled using routine precautions to avoid contact with skin and, particularly, eyes. Any material coming into contact with the skin should be washed off with soap and water. If **Tetra** gets into the eyes, irrigate with excess water until clear and seek medical attention.

  For full safety information please see the relevant Hopsteiner® safety data sheet.

❖ Analytical Methods

- **Concentration of Bitter Substances**

  Tetrahydro-iso-alpha acids acids can be measured by any of the following methods:
  - HPLC method according to Analytica-EBC 7.9 using the current ICS standards
  - UV Spectrophotometry

  Details of recommended methods are available on request.

- **Concentrations of reduced iso-alpha acids in beer**

  The concentration of reduced iso-alpha acids in beer is determined by HPLC according to Analytica-EBC 9.47.
  The analytical result of the corresponding BU value might need to be adjusted as the used factor for this analyses will result in lower values if reduced hop products were used exclusively or in higher amounts.

- **Foam Stability and Cling Test**

  Foam stability can be measured according to any of the following methods listed in MEBAK, ASBC or Analytica-EBC, for example:
  - NIBEM-T Meter
  - NIBEM Cling
  - Steinfurth Foam Stability Tester
  - Ross & Clark
  - Pour Test

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❖ Technical Support

We will be pleased to offer help and advice on the full range of Hopsteiner® products:

- o Copies of all relevant analytical procedures
- o Safety Data Sheets (SDS)
- o Assistance with pilot or full brewery trials
- o Specialist analytical services

❖ Patent

Tetra is produced under the conditions of US patent No. 7344746 B1, US 9051536 B2 and equivalents.

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