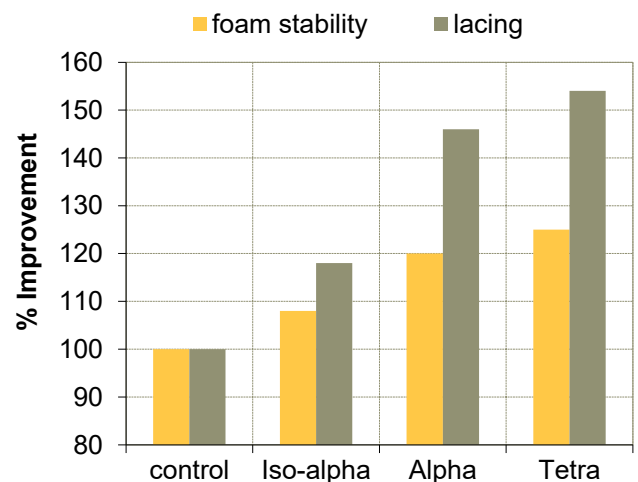


## Tetra-S

### ❖ Overview

- **Tetra-S** is a pure glycerine solution of the potassium salts of tetrahydro iso-alpha acids derived exclusively from CO<sub>2</sub> hop extract. The formulation in glycerine minimizes precipitation when exposed to cold temperatures. Even freezing during transport will not damage the product
- **Tetra-S** greatly enhances beer foam when used as a replacement for a portion of conventional bittering products.
- **Tetra-S** provides protection against lightstruck flavor when used as the sole source for bitterness or in combination with other light stable hop products.

The effects of 3 mg/l of pure Tetra on foam and lacing – a product comparison



### ❖ Specifications

- Description: amber, solution of the potassium salts of tetrahydro-iso-alpha acids in glycerine
- 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: < 3000 mPas at 20 °C (68 °F); batch dependant
- Density: 1.22 (± 0.05) g/ml at 20 °C (68 °F)

## ❖ Properties

### • Appearance

**Tetra-S** is a homogeneous, clear solution that is amber in color. It is free-flowing at the recommended storage and application temperatures. **Tetra-S** is miscible in demineralized water and alcohol.

### • Utilization

Based on HPLC analysis of the finished beer, utilization of **Tetra-S** is 60 – 80 %, depending on the product is added and efficiency of that addition point.

Actual utilization will vary from brewery to brewery due to differences in equipment and process conditions.

### • Light Stability

**Tetra-S** only provides protection against lightstruck flavor in the complete absence of alpha acids and iso-alpha acids. **Tetra-S** can be used in conjunction with any Hopsteiner® light stable product to achieve light stability in clear and green bottle packaging.

### • Foam Enhancement

**Tetra-S** enhances both foam retention and cling. An improvement in beer foam is already noticeable at 2 – 3 mg/l of tetrahydro iso-alpha acids in the finished beer.

### • Flavor

**Tetra-S** provides 1.0 to 1.3 times the sensory bitterness compared to that achieved with iso-alpha acids. The actual intensity of bitterness depends primarily on the quantity of bittering units and the type of beer. Therefore, the target number of bittering units must be determined in preliminary tests in order to achieve the correct level of sensory bitterness.

### • Quality

All Hopsteiner® products are processed in facilities which fulfill internationally recognized quality standards

## ❖ Packaging

**Tetra-S** is normally packaged in 20 kg pails. 10 kg jugs are also available.

## ❖ Product Use

**Tetra-G** is typically added post-fermentation and prior to the final step in filtration.

### • Dosage

Dosage is based on the product concentration, an estimated or known utilization and the desired intensity of bitterness in the beer. The fact that the perceived bitterness of **Tetra-S** is about 1.0 to 1.3 times the bitterness of iso-alpha acids derived from conventional hop products must be taken into consideration. The correct dosage of **Tetra-S** must be determined through trials at the brewery.

### • Application

We recommend adding **Tetra-S** at full strength (undiluted) into the center of the beer stream for at least 70 % of the total beer volume being transferred. An accurate, high pressure dosing pump is required to add the product into the beer stream at a point where vigorous mixing is assured. **Tetra-S** can be added at ambient temperatures

If dilution is necessary, always add **Tetra-S** to demineralized water first and adjust the pH to 8.5 – 9.5 using either potassium hydroxide (KOH) or potassium carbonate (K<sub>2</sub>CO<sub>3</sub>). Laboratory scale testing is recommended prior to commercial use.

If containers are used over several days, it is recommended that the headspace be flushed with nitrogen (CO<sub>2</sub> is not suitable).

- **Cleaning Recommendation**

**Tetra-S** should not be left in dosing lines at low temperatures. Lines and dosing pumps should be flushed with warm, slightly alkaline, demineralized water or ethanol for purposes of cleaning.

- **For Light Stable Beer**

For maximum protection against lightstruck flavor, it is essential that no other sources of non-reduced iso-alpha acids are inadvertently introduced into the wort or beer. Therefore, the following must be carefully implemented:

- exclusive use of light stable hop products throughout the entire process
- avoid contamination through equipment surfaces previously in contact with regular iso-alpha acids
- never pitch wort with yeast that has been in contact with regular alpha acids and iso-alpha acids

- **Storage**

**Tetra-S RHO-S 30 %** should be stored in sealed containers at 5 – 25 °C (41 – 77 °F). Opened containers should be used within a few days. For long-term storage, the ideal temperature is between 10 – 20 °C (50 – 68 °F). Freezing during transport will not damage the product.

- **Best Before Date**

**Tetra-S** is stable two years from the date it was produced / packaged if stored under the recommended conditions.

- **Safety**

**Tetra-S** is a slightly alkaline, intensely bitter product and may be safely handled using routine precautions to avoid contact with skin and, in particular, the eyes. Any product coming into contact with the skin should be washed off immediately with soap and water or an appropriate hand cleanser. If **Tetra-S** gets into the eyes, flush with copious amounts of water until clear and seek medical attention.

For full safety information, please refer to the relevant Hopsteiner® safety data sheet.

## ❖ Analytical Methods

- **Concentration of Bitter Substances**

The concentration of tetrahydro iso-alpha acids can be measured using the following methods:

- HPLC according to Analytica-EBC 7.9 with the current ICS standards
- UV spectrophotometric analysis

- **Concentrations of Reduced Iso-Alpha Acids in Beer**

The concentration of reduced iso-alpha acids in beer, like Tetrahydro-iso-alpha acids can be measured by HPLC according to Analytica-EBC 9.47.

Note:

It is possible that analysis results for the corresponding value for bitterness must be adjusted. The factor used in this analysis will result in lower values if reduced hop products were used as the exclusive source for bitterness or in higher amounts.

- **Foam Stability and Cling Test**

Foam stability can be measured using the following methods listed in MEBAK, ASBC or Analytica-EBC:

- NIBEM-T Meter
- NIBEM Cling
- Steinfurth Foam Stability Tester
- Ross & Clark
- Pour Test

## ❖ Technical Support

We are pleased to offer assistance and advice on the full range of Hopsteiner® products:

- copies of all relevant analytical procedures
- Safety Data Sheets (SDS)
- assistance with pilot or full-scale brewing trials
- special analytical services

Disclaimer: The information provided in this document is believed to be correct and valid.

However, Hopsteiner® does not guarantee that the information provided here is complete or accurate and thus assumes no liability for any consequences resulting from its application.