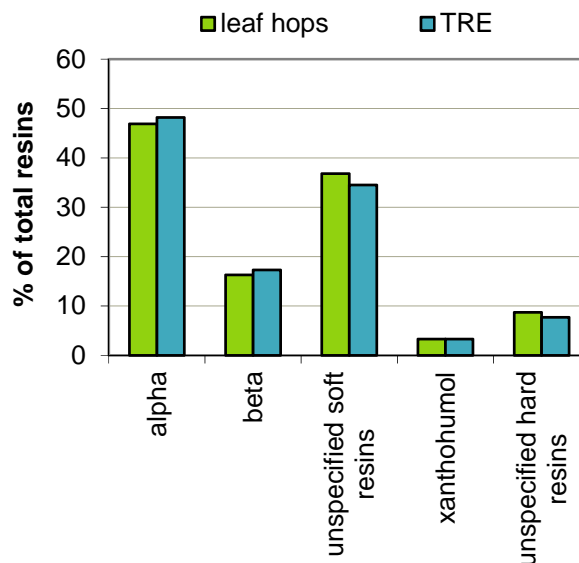


Total Resin Extract

❖ Overview

- **Total Resin Extract (TRE)** is produced from aroma or bitter hop varieties through extraction with pure alcohol derived from fermentation. **TRE** contains all of the hop bitter acids (hard and soft resins) and hop oil components of the original leaf hops.
- **TRE** is added to the kettle and can be used to partially or entirely replace leaf hops, hop pellets or CO₂ extract.
- **TRE** offers a concentrated and practical alternative to leaf hops or hop pellets with an identical bitter. Moreover, **TRE** has a long shelf life.

Composition of hop resin in leaf hops and TRE



❖ Specifications

- Description: dark green extract, highly viscous at room temperature
- Alpha acids*: 20 – 55 %
- Beta acids*: 15 – 30 %
- Iso-alpha acids: 0.5 – 2.0 %
- Hop oil*: approx. 3 – 12 %
- Residual ethanol: < 0.3 %
- pH: 6.2 (± 0.5)
- Viscosity: 400 – 1000 mPas at 45 °C (113 °F)
- Density: approx. 1.0 g/ml at 20 °C (68 °F)

*dependent on variety and crop year

❖ Properties

• Appearance

Dark green in color, **TRE** is a thick syrup/paste that becomes more fluid when warmed.

• Utilization

If **TRE** is boiled for at least 50 minutes, utilization in the range of 30 – 40 % can be expected. Actual utilization will vary from brewery to brewery due to differences in equipment and process conditions.

• Flavor

The flavor and especially the bitter characteristics of the original hops are completely retained. Early additions of **TRE** during wort boiling mainly serve to impart bitterness.

• Chemical Residues

Nitrates and heavy metals are significantly lower in **TRE**. In addition, pesticide residues are largely removed by the ethanol extraction process.

• Quality

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

❖ Packaging

TRE can be packaged in cans and drums according to customer requirements:

Cans: 0.5 to 4.2 kg
Drums: 50 and 200 kg

TRE can be produced to any alpha acid concentration desired by our customers and packaged in cans (e.g. 450 g of alpha acids per can).

Alternatively, the alpha acid content of **TRE** can be standardized to any given concentration using glucose syrup (non-GMO glucose cannot be guaranteed). The container is then filled to a standard weight (e.g. 30 % alpha acids in 1 kg cans).

❖ Product Use

TRE is typically added to the wort kettle as a complete or partial replacement for leaf hops or hop pellets.

• Dosage

Kettle additions of **TRE** are based on the concentration of bitter substances (CBV), an estimated or known utilization and the desired intensity of bitterness in the beer.

• Addition

For the highest possible utilization, **TRE** should be added early in the wort boiling process. **TRE** is not very suitable for late hop additions due to its nonpolar character. However, in this situation, better results can be achieved with pre-isomerized kettle extracts such as IKE or PIKE, products that are more soluble in wort.

Pre-warming cans of **TRE** is not necessary. Suspending punctured cans in the boiling wort will ensure that all of the extract is completely flushed out into the kettle.

If **TRE** is added by means of automatic dosing units, it should be warmed to 45 °C (113 °F) and gently mixed to ensure perfect dosing.

- **Storage**

TRE should be stored in sealed containers at temperatures < 10 °C (50 °F). Opened containers should be used within a few days.

- **Best Before Date**

TRE is stable for eight years from the date it was produced / packaged if stored under the recommended conditions.

- **Safety**

TRE is a natural substance 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 **TRE** 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**

Iso-alpha, alpha and beta acids can be measured with the current standards using the following methods :

- HPLC according to Analytica-EBC 7.8
- ASBC Hops-16

The lead conductance value can be measured using the following methods:

- Analytica-EBC 7.6
- ASBC Hops-8 (II)

TRE is normally dosed according to its Conductometric Bitter Value (CBV) as this value better represents its bitterness potential.

Note: CBV = LCV (EBC 7.6) + 50 % of iso-alpha acids (EBC 7.8)

- **Concentration of Hop Oil**

The hop oil concentration can be measured using the following methods:

- Analytica-EBC 7.10
- ASBC Hops-13

❖ 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.