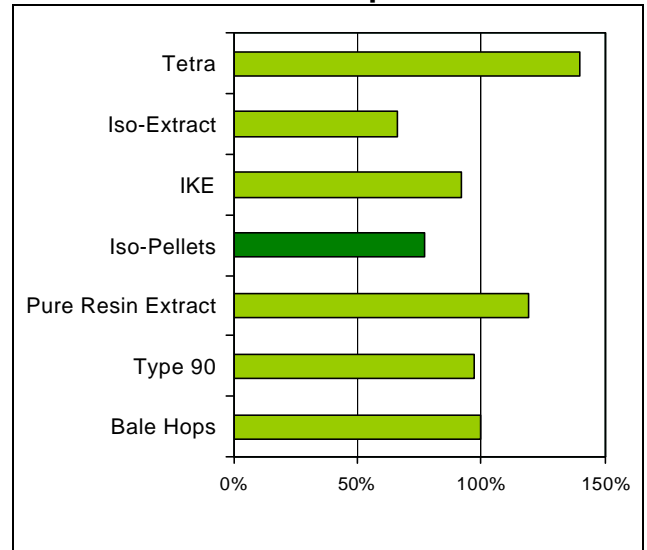


Isomerized Pellets (Iso-Pellets)

❖ Overview

- **Iso-Pellets** offer major improvements in utilization due to the pre-isomerization of a-acids during processing
- **Iso-Pellets** demonstrate excellent storage characteristics
- **Iso-Pellets** can replace existing conventional, alpha and aroma hop products without any changes in beer quality
- **Iso-Pellets** provide opportunities for considerable savings in hop costs

Relative cost of Bitterness using Different Hop Products



❖ Specification

- **Description:** Cylindrical pellets in which most of the a-acid has been converted into iso-a-acid by the addition of a small quantity of food grade MgO during pelleting followed by a period of warm storage after packing.
- **Consistency:** A solid which normally breaks up into powder (variety dependent)
- **Color:** Typically a dull green (depending on variety)
- **Iso-alpha-acid:** Typically 2-20% (dependent upon hop variety); minimum of 95% of the total a-acid content of the finished Iso-Pellet is converted to iso-a-acid.
- **Beta-acid:** Typically 1-15% (dependent upon hop variety)
- **Hop oils:** Typically 1-6% of product (dependent upon hop variety)
- **Moisture:** Typically 7-9%

❖ Properties

□ Appearance:

Dull-green pellets, approximately 6mm x 10-15mm in size (diameter x length); **Iso-pellets** will normally be darker and slightly harder than standard pellets but bulk pellets should break apart easily upon opening the pack.

□ Utilization:

Utilization of **Iso-pellets**, including late addition aroma pellets, is typically in the range from 50-60% by HPLC analysis.

□ Flavor:

Brewing trials, backed up by extensive practical experience, demonstrate that beers of identical flavor can be produced when **Iso-Pellets** are used as a direct replacement for standard bitter and aroma pellets. As with Type 90 Pellets, late addition of **Iso-Pellets** can achieve a strong hop character.

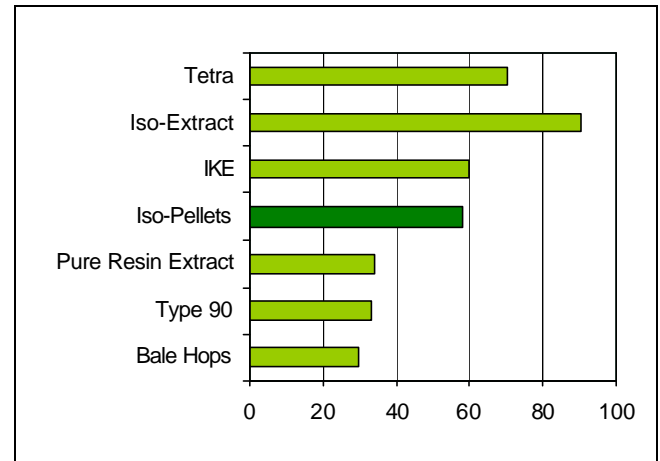
□ Stability:

Stored at ambient or cool temperatures in unopened packs, iso-a-acid losses should be less than 5% even after 2 years. Care should be taken to avoid damage to the vacuum packs, as any contact with oxygen could result in a rapid degradation of iso-a acid to non-bitter products. For maximum preservation of aroma characteristics (essential oils), **Iso-pellets** should be cold stored.

□ Quality:

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

Typical Utilization of Hop Products



❖ Packaging

Iso-pellets are normally packed in laminated foils, within cartons, under partial vacuum with a slight back flush of an inert gas (N₂ or CO₂).

Pack sizes range from 2kg (4.5 lbs) to 150kg (330 lbs); normally 20 kgs (44 lbs) in the US.

❖ Product Use

Iso-pellets are used in similar ways to standard pellets, contributing bitterness and hop character to beer.

□ Dosage:

Calculation is based on the iso-a-acid concentration in the **Iso-Pellets** and the assumption that the utilization of the iso-a-acid is likely to be at least 50% better than that achieved with standard pellets. Actual utilization will vary from brewery to brewery depending on plant and process conditions.

□ **Addition:**

Iso-pellets can be manually weighed and added directly into the boiling wort. A contact time of about 10 minutes within the boiling wort is sufficient to achieve maximum utilization. **Iso-pellets** can be automatically dosed into the kettle but care should be taken to avoid prolonged exposure to air in any bulk handling system.

□ **Storage:**

In order to maintain the quality of the essential oils, **Iso-pellets** should be cold stored at <10°C (50°F) in sealed packs. Opened foils/cartons should be used quickly to avoid deterioration.

□ **Safety:**

No serious, health hazard in normal use. If dust is generated, it is advisable to wear a dust mask. Hop pellets are a combustible material. For full safety information please see the relevant Steiner material safety data sheet.

❖ **Analytical Methods**

□ **Concentration of iso- α -acids, β -acids and residual α -acids:**

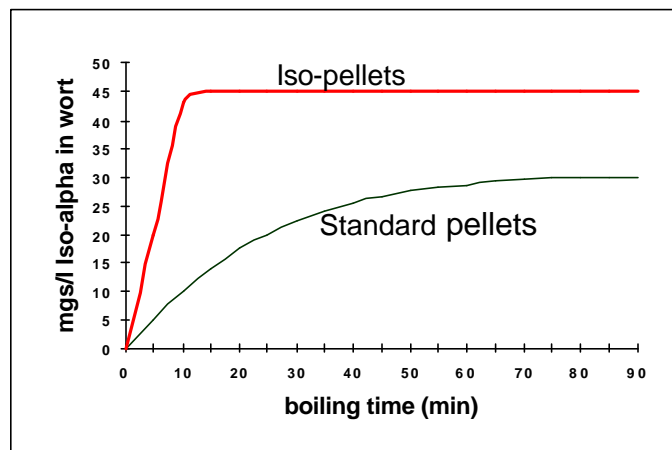
Measured by HPLC using the EBC 7.8 method together with the current ICS & ICE standards; sample preparation according to EBC 7.5 or 7.7 methods.

Alternatively, ASBC Hops-15 may be used in conjunction with the additional step of calibration for α - & β -acids using the current ICE standards.

□ **Concentration of Hop oils:**

Hop oil concentration can be measured by either the IOB 6.3 or ASBC hops-13 method.

Dissolution of α -acids during Wort Boiling



□ **Bitterness in the Final Beer:**

Experience has shown that fewer non-bitter degradation products are produced in **Iso-pellets** during storage and wort boiling than in less stable, non-isomerised products. An Iso-pellet beer of a particular BU could therefore have a higher perceived bitterness than that of a similar beer of identical BU value made with standard pellets. Adjustments to the Optical Density multiplication factor (55-57 instead of 50) may need to be made if specifications are to remain unaltered. However any alternative factor needs to be established by the individual breweries concerned. Alternatively HPLC analysis can be used.

❖ **Technical Support**

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

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



❖ Patent

Iso-pellets are produced under the conditions described in Steiner's US Patent No. 4,946,691 and equivalents.

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