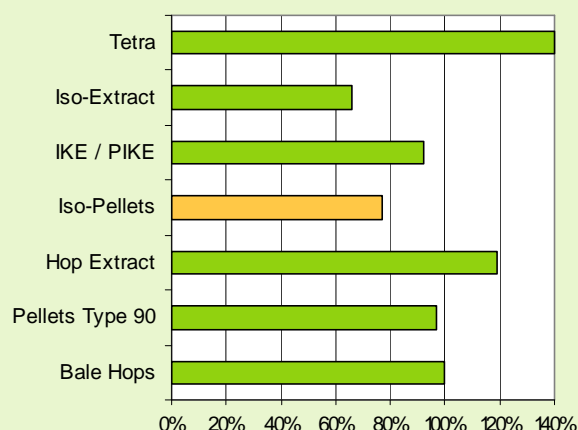


Isomerized Pellets (Iso-Pellets Type 90 & Type 45)

❖ Overview

- **Iso-Pellets** offer major improvements in utilization due to the pre-isomerization of α -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 α -acids have been converted into iso- α -acids 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 (depending on variety)
- **Color:** Typically a dull green (depending on variety)
- **Iso-alpha-acids:** Typically 2 – 20 % (depending on variety); minimum of 90 % of the total α -acid content of the finished Iso-Pellet is converted to iso- α -acid.
- **Beta-acids:** Typically 1 – 15 % (depending on variety)
- **Hop oils:** Typically 1 – 6 % of product (depending on variety)
- **Moisture:** Typically 7 – 9 %

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❖ Properties

□ Appearance

Dull-green pellets, approximately 6 mm x 10 – 15 mm in size (diameter x length); **Iso-Pellets** will be 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 45 – 55 % based on HPLC in product and in final beer.

□ 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. *

□ Quality

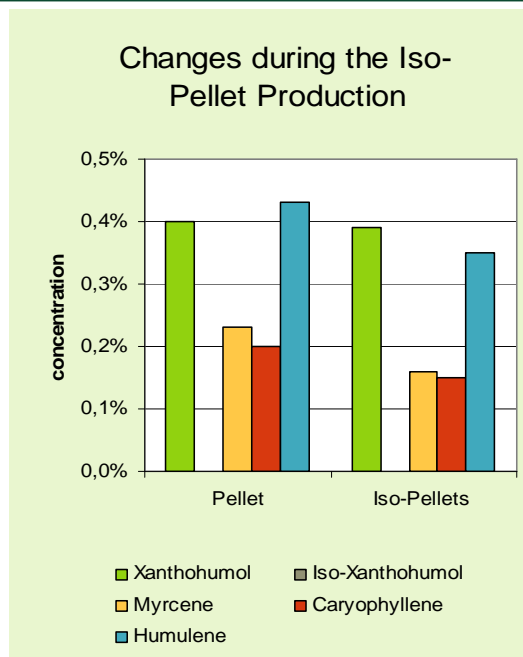
All Hopsteiner® products are produced in plants accredited to internationally accepted quality standards.

❖ Packaging

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

Pack sizes range from 2 kg (4.5 lbs) to 150 kg (330 lbs).

* "A Guide to the Use of Pre-Isomerized Hop Pellets, Including Aroma Varieties" by David Taylor, P.M. Humphrey, B. Yorston, R.J.H. Wilson, T.R. Roberts and M. Biendl
Technical Quarterly, Volume 37, Number 2, 2000, pages 225 – 231



❖ Product Use

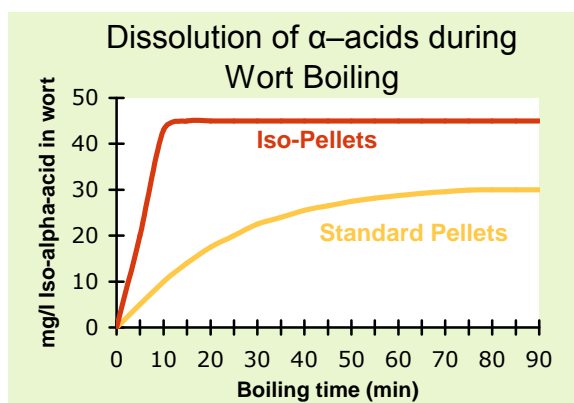
Iso-Pellets are used in similar ways to standard pellets, contributing bitterness and hop character to beer.

□ Dosage

Calculation is based on the iso- α -acid concentration in the **Iso-Pellets** and the assumption that the utilization of the iso- α -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

Iso-Pellets should be cool stored at < 5°C (41°F). Opened foils/cartons should be used quickly to avoid deterioration of bitter acids and essential oils.

□ Best Before Date

Iso-Pellets are stable 3 years from date of production under the recommended storage conditions.

□ Safety

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

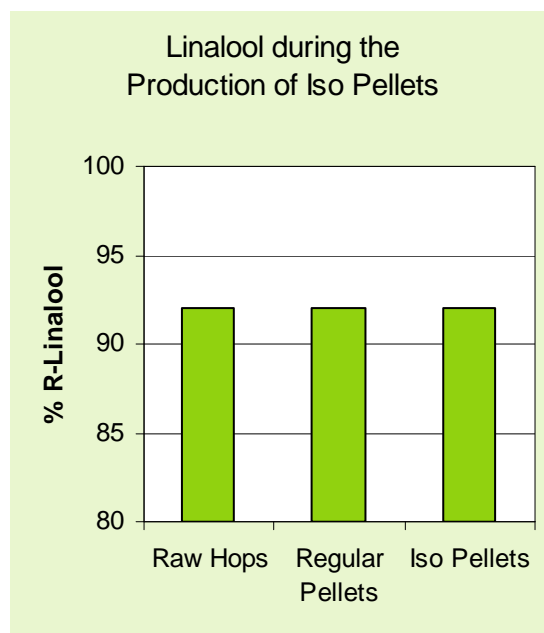
□ Concentrations of iso-α-acids, β-acids and residual α-acids

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.

□ Concentrations of Hop oils

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



❑ **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.