

Bag opened and then ... ?

Tips for storing hop pellets

The bags in which hops are delivered to breweries are both practical and easy to handle. Simply open them, weigh out the amount of hops required according to the recipe and add. However, the whole hops in a bag are frequently not all used all at once and some remain over. What will happen to bitter and aroma substances once the bag has been opened? And does the temperature at which the open bag is stored have a significant effect?

Craft beer is usually produced from hop cones (generally pressed cones in vacupacks) or hop pellets. Composition of both products is almost identical and they reflect the original form of hops cultivated on farms. All properties typical for a variety are thus fully contained in both products.

Dried hop cones are the starting material for hop pellets. Following comprehensive incoming inspection, several lots of hop cones of the same hop variety are ground into larger batches and subsequently carefully pelletised. By combining several hop lots, it is possible to effectively balance out batch-related fluctuations as well regional fluctuations of a harvest year. This applies both to bitter and aroma substances.

At the beginning of processing of both products, dried cones are always cleaned. The products are then packed in oxygen-sealed multi-film layered bags with inert gas blanketing to prevent breakdown processes and flavour changes over the course of time.

Cones remain stable for at least three years and pellets for at least five years in this state without any problems when they are not opened and stored at temperatures below 5°C.

When used in breweries, it may happen that the whole contents of a bag are not added all at once while remaining residual quantities are needed some weeks later. To cater for this case, storage tests have been carried out that are described in this article using “stored pellets in opened bags”. The focus was on the behaviour of bitter and aroma substances.

Trial Method

Pellets of two conventional aroma and bitter varieties were stored at temperatures of 10°C (CS – Cold Stored) and 20°C (WS – Warm Stored) in open bags for a period of six weeks and analysed at regular intervals. Bitter substances were analysed weekly and aroma substances fortnightly. All analyses were based on the official and generally applied methods of Analytica-EBC:

- EBC 7.5 for determination of amount of bitter substances (conductometric value; colloquially “alpha-acid”);
- EBC 7.10 for determination of total oil content;
- EBC 7.12 for determination of individual aroma substances.

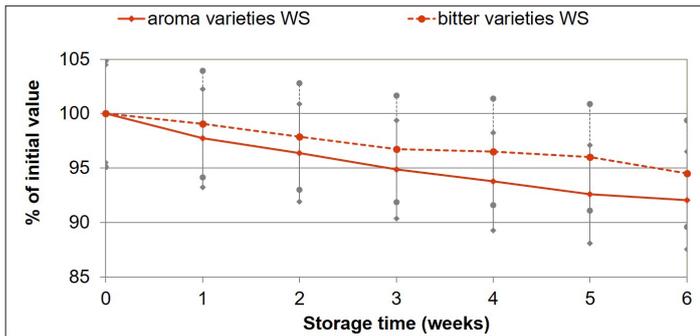


Fig. 1: Amount of bitter substances during warm storage (WS); mean value of aroma and bitter varieties

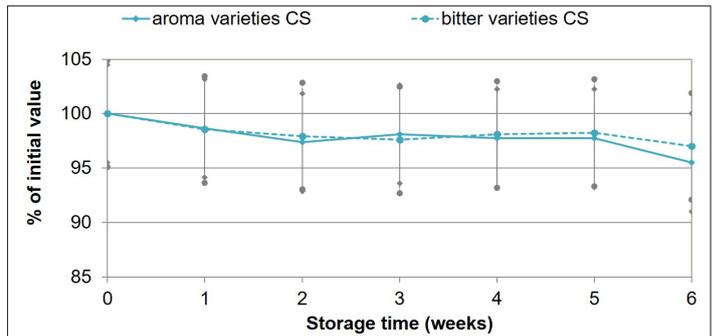


Fig. 2: Amount of bitter substances during cold storage (CS); mean value of aroma and bitter varieties

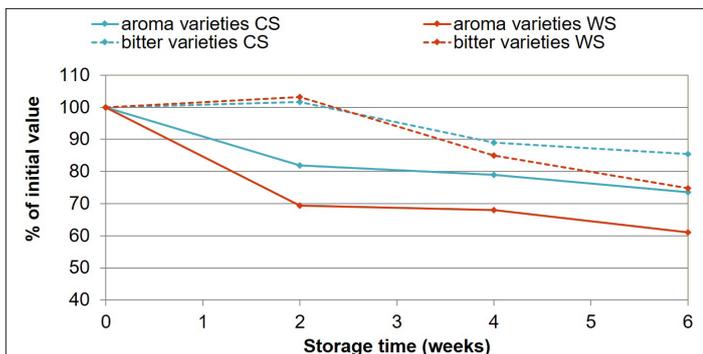


Fig. 3: Behaviour of total oil contents; mean value of aroma and bitter varieties

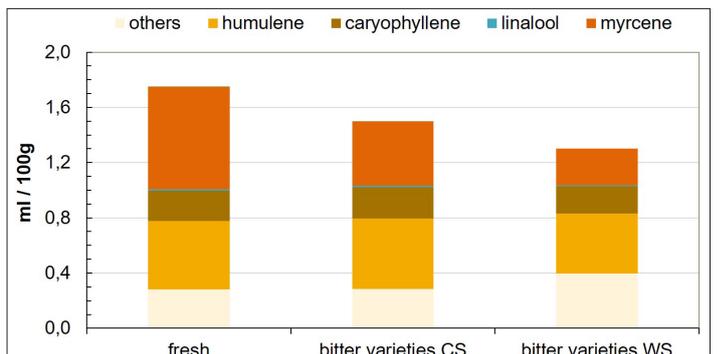


Fig. 4: Specific aroma substances of bitter varieties

Results are described below. Due to analytical accuracy, even smaller “steps” between individual points of measurement are also shown in some instances. The behaviour of selected components is suitable for comparing starting and final values.

Behaviour of bitter substances

Figs. 1 and 2 show the percentage loss of bitter substances from the bitter and aroma varieties, averaged over storage time. The starting value at the beginning of the test (=100%) is used as a basis in each instance.

In all batches, a trend towards slow breakdown of the amount of total bitter substances can be noted. Loss is lower in the case of cold storage (Fig. 2). It takes six weeks before an analytically significant breakdown can be noted, this applies only for pellets stored at 20°C (Fig. 1). Values of cold stored pellets were always within the analysis tolerance. The maximum measured decrease of seven per cent, compared to the starting value, was observed for pellets from aroma varieties after warm storage for six weeks (Fig. 1). In one pellet, for example, having a starting value of 4.0%, about 3.7% of bitter substances remained.

Behaviour of total oil content

Fig. 3 shows the averaged percentage loss of hop oil for both bitter and aroma varieties in the course of storage time. The starting value at the beginning of the test (=100%) is used as a basis in each instance.

It was observed that total oil content of aroma varieties had dropped by 20 to 30 per cent after two weeks. It had decreased to 75 to 60% of the original quantity of hop oil after six weeks. The largest loss therefore occurs at the very beginning of the storage test, in particular at elevated temperatures. Bitter varieties also lose part of their hop oils over the whole storage time; when bags were open, about 15 per cent in the course of cold and about 25 per cent in the course of warm storage for six weeks. In this instance, the first two weeks of open storage have no measurable effect.

In all three figures, bitter varieties seem to be slightly more stable when stored (dashed line versus solid line), compared to aroma varieties. It should, however, be borne in mind that bitter varieties generally contain (sometimes considerably) higher amounts of bitter and aroma substances. In the case of bitter varieties, the loss of identical amounts of hop oils, for example, clearly has a smaller effect in percentage terms, compared to the starting value. Expressed in numbers for hop oils: aroma varieties lost 0.20 ml of the original value of 0.75 ml during cold and 0.40 ml during warm storage in the course of six weeks. In the case of bitter varieties, losses are almost identical at both temperatures, though the starting value of 1.75 ml significantly puts the percentage decrease into perspective. (Note: all ml referred to are based on 100 g of pellets weighed-in; the unit “ml per 100 g” is in line with the official unit of hop oils in hops or product).

Behaviour of volatile aroma substances

In order to provide an explanation for the losses of hop oils described above, an analysis of individual aroma substances was performed.

Fig. 4 shows hop oil composition of bitter varieties at the beginning and at the end of the six-week storage period in open bags. The high loss of myrcene is striking, whereas individual components such as linalool and caryophyllene largely remain unchanged in the product. During warm storage, all other aroma substances increased. This can be explained by formation of epoxides and other transformation products. Losses of total oils shown in Fig. 3 can thus be largely attributed to the volatile myrcene and also in part to humulene.

Summary

Specific substance groups of hops and hop products are always subject to natural losses over an extended storage period. Oxygen, temperature and time are the main factors here. For closed bags packed with inert gas blanketing, degradation of hop pellets can be prevented for many years or largely suppressed. Products react very much faster in the case of open and warm storage. The cooler hop products are stored in open bags, the lower will be the breakdown of bitter and aroma substances during the initial weeks. Bitter substances are generally less susceptible to open storage, compared to aroma substances, though mainly volatile components of aroma substances are lost and account for the majority of losses of bitter substances. Depending on hop dosage time (brewhouse or dry hopping), significant differences may arise in pellets stored open after six weeks in some instances have an influence on beer quality or the envisaged hop flavour.

In this respect, freezing of hop products is a frequent question: this might certainly be possible when cones and pellets are involved in order to better preserve valuable hop components. Nevertheless, it is worth trying to always re-seal open bags either by welding or bag ties or use smaller batches to avoid residual quantities over longer periods of time.

Final remark:

This guideline is a translation of the article „Beutel geöffnet und dann?“ taken from the journal “LEIDENSCHAFT Craft 01 / 2018” of Verlag W. Sachon. The originally published article can be found if you follow this link:

http://fzarchiv.sachon.de/Zeitschriftenarchiv/Getraenke-Fachzeitschriften/Getraenkefachgrosshandel/2018/03_18/LC_01-18_26-27_Beutel_geoeffnet_und_dann.pdf#all_thumb

Compared to the original article the best before dates were adjusted.