A beer, but a fresh one, please

DEFINITION OF FRESHNESS | When asking beer drinkers all the world over what they associate with a freshly dispensed glass of lager, 99 percent will answer: "freshness". True, there is hardly anything better than a glass of fresh beer when sitting on a hot summer's day in a shaded beer garden. But what does it actually mean: "fresh beer"? How is freshness defined, when is a beer not all that fresh anymore and which factors influence such staling?

BEER IS A NATURAL product. It changes in the course of its shelf life. The end of shelf life does not imply that beer would be undrinkable after that date. In filtered beers, haze can form that has hardly any influence on flavour. Beer also "ages". Its flavour changes. Depending on beer type, these changes are perceived in various ways. Whereas beers with higher alcohol contents are indeed perceived as more pleasant by consumers, paler beers in particular, those with an alcohol content around 5 AbV, rapidly diminish in acceptance by consumers with increasing age.

Changes in flavour are, e.g., especially reflected in hop aroma. The hop aroma fragments over time, and its aroma profile also changes, in some instances profoundly. Unpleasant, sometimes sweetish-musty aroma impressions in terms of flavour and smell are formed in beer. Cardboard flavour is a very typical staling off-flavour that is clearly perceptible in many beers. A metallic flavour is also often found. Beers having such off-flavours certainly do not encourage further drinking. One of the main culprits is related to one substance group: staling carbonyls.

However, formation of new flavour components is not the only drawback, aromas that are, as such, desirable in beer, are lost, such as some esters formed by yeast, and in particular those responsible for a fruity flavour impression in some beers. So the interested brewer faces the question: how should he brew his beers and also possibly influence the time period until these negative impressions come to bear.

Well, let's first of all have a look at the general influencing factors.

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Main influencing factors

Staling carbonyls

Staling carbonyls, responsible for the unpleasant flavour impression, are formed from various other substance groups, in particular from fatty acids, higher alcohols and amino acids. In the course of shelf life, they are converted into staling carbonyls. If an interested brewer wishes to brew a beer that keeps its fresh character for the longest time possible, he should avoid having too many of these precursors in his beer. But how? First of all, the source of these substances in beer has to be identified. Yeast can be identified as the source for all these three substance groups. Depending on its physiological state, yeast produces greater or lesser amounts of these substances. In other words, yeast needs to have excellent vitality and viability to produce beers that remain fresh. This boils down to excellent yeast management, ensuring that yeast is not stressed and, in particular, not stored for excessive periods. Fermentation control also is of major importance. In particular in bottom-fermented beers, when pitching temperatures are too high, an excessive amount of higher alcohols are formed which, in turn, promote formation of staling carbonyls. Wort aeration also plays a role in flavour stability: when wort is aerated just slightly before pitching and when the right yeast strain is selected, yeast will form quite a lot of sulphur dioxide that, in turn, improves the reduction behaviour of beers and acts as an antioxidant, conducive to freshness.

Oxygen

Oxygen is another factor influencing freshness. One the one hand, oxygen is an extremely potent staling contributor and, on the other hand, introduces further undesirable aromas into beer due to oxidation of components. Care should be taken that the least possible amount of oxygen is picked up. The risk of oxygen uptake is higher, in particular during filtration and filling. It is recommended to use e.g. degassed water or suitable filling equipment for filling to avoid oxygen uptake.

Temperature

Temperature, naturally, also plays a part in producing stable fresh beers. Not just during each and every fermentation but also during storage and transport of filled beers. The higher the temperature is, the faster chemical reactions will proceed.

It's therefore obvious that beers age faster at high temperatures. An uninterrupted cooling chain, from brewery to consumer, would be optimal for beer but – unfortunately, this is usually difficult to achieve and involves high costs.

Time

It goes without saying that time is the essential factor. A beer coming from the filling line is optimally fresh and then degradation processes set in. In order to maintain flavour

stability over the shelf life, it would be easiest to indicate a short shelf life on the label. This would be relatively easy for a pub brewery but very difficult for a brewery selling e.g. bottled beer. This is attributable to the trading companies that mostly prefer a long shelf life for reasons of logistics. But: beer isn't tinned food. Brewers should give a lot of consideration to whether it really makes sense and whether it may be possible to indicate a shelf life of, for example, 8 or 12 months.

Movement

Another factor that is usually neglected is movement. The more a beer is moved, the faster it will age. The reason is quite obvious. So that some of the substances in beer responsible for staling can react, they have to get into contact with each other. This will happen much faster, the more a beer is moved. Consequently, long transport routes and frequent rearrangement of beers are clearly detrimental to freshness.

Incidence of light

Being exposed to daylight is also harmful to beer. After a short time, an intense light-struck flavour will develop, making the beer almost undrinkable. Freshness is then a thing of the past. The container in particular is of the utmost importance. Whereas draught and canned beers are completely resistant to the effects of light as the containers are impermeable to light, bottled beers face a completely different situation. The bottle colour is also important. Brown bottles are best able to keep UV light at bay and are thus the most suitable bottle containers. In green bottles, the amount of detrimental UV light rises; it passes through the bottle wall and damages the beer. Clear white bottles fare worst; beer is damaged very quickly.

Freshness-promoting measures

A high amount of antioxidants such as e.g. sulphur dioxide is beneficial for freshness. These substances bond to oxygen that may be present so that the latter is no longer in a position to oxidise other components in beer.

The pH value of beer is a somewhat controversial point. Though, on the one hand, there is no doubt that a low beer pH will assist formation of staling carbonyls, though on the other hand, a low pH enhances, in particular, esters in beer and contributes to the fact that the freshness of fresh beers is perceived more clearly. The full truth is neither here nor there: pH should be low such that beer esters can unfold their full potential but it should be high enough such that few staling carbonyls are formed. It is, thus, not possible to give a general "right" pH value as this also always depends on a particular beer.

Stabilisation using silica gels, silica sols and/or PVPP will contribute to an extension of shelf life. In the course of beer ageing, more and more proteins in beer will form bonds with polyphenols that are also present in beer. Over time, these agglomerates will grow until they become visible as haze. Beer filtered until clear thus develops haze. Silica gels and sols bond beer proteins whereas PVPP bonds polyphenols. When using one of the substances mentioned during filtration, fewer agglomerates will form later as concentrations of one reaction partner have dropped. It is also possible to reduce both substance groups but the effect will be the same.

It should be borne in mind that this method will improve only colloidal stability but not flavour stability.

In summary, the interested brewer should undertake everything possible to, on the one hand, keep components causing staling as low as possible and, on the other hand, to maintain the largest possible amounts of components that keep beer fresh for a longer time.

Brewers should also give attention to other more marginal parameters such as incidence of light and movement.

A brewer's philosophy should thus be committed to freshness. If commercially viable, uninterrupted cooling chains should be installed. Retention samples should also be tasted regularly so that the brewer is aware of the point in time at which staling of his own beers becomes perceivable from a sensory viewpoint. Ultimately, the brewer should take measures to either maintain "freshness" of his beer for longer periods or shorten the shelf life.

It's the consumer who pays the brewer's invoices. Accordingly, the brewer owes it to his customers to always supply a beer that complies with the highest quality standards. And one of the main quality parameters of beer should be freshness and flavour stability. ■