

A tasting of specially hopped beers

HOP INFLUENCE MORE PRECISELY DEFINED | Are beers with accentuated hop aromas a taste for everyone or are they simply specialty beers for connoisseurs? In the last few years, breweries have begun to focus more on the production of beers which have distinct aromas, especially those produced through the process of dry hopping. The recent development of the Hopsteiner FlavorWheel provides a tool which can be used in tastings to more precisely define the hop influence on a beer's aroma (BRAUWELT International no. 2, 2014, pp. 116-118).

THE INITIAL EXPERIENCES of using the FlavorWheel were gained at various tastings over the course of last year. One such event in which the flavor wheel was used was in front of a large audience during the trade fair drinktec 2013 in Munich. The visitors were offered a tasting of dry hopped beers. After the event, the participants were given their personal results as well as the overall evaluation of the tasting.

Introduction to the beers' hop addition

The base beer (Pale Ale), which was used as a medium for the dry hopping was produced exclusively using hop additions with Hallertauer Tradition (P90). 70 percent

of the subsequent dry hopping, the whirlpool hop addition only mildly affected the overall aroma of the beer.

The beer had an original gravity of 14 °P and an alcohol content of 6.0 % abv. Finally, the base beer as described above was split up into four tanks and was dry hopped each exclusively using different varieties or hop products. Table 1 shows the important characteristics of the hops used, as well as the hop additions of the four Pale Ales, which are described in-depth.

The hop varieties Mandarina Bavaria, Bravo, and Smaragd were used for the dry hopping additions with a total addition of 300 g/hl pellets type 90 (see Pale Ales No. 1 - 3). In Pale Ale No. 4, 2.4 g/hl Bravo hop oil was used. In all cases, the beers were

of the hops were added at the beginning of the boil and the remaining 30 percent were added as a whirlpool addition. Due to

DESCRIPTION OF THE HOP VARIETIES USED FOR DRY HOPPING

Pale Ale	Hop variety	Acreage 2013	Aroma description of raw hops	Product	Quantity
No. 1 (DE MB)	Mandarina Bavaria	35 ha	Notes of mandarin and lemon	Pellets type 90 (P90)	300 g/hl
No. 2 (US BR - P90)	US Bravo	250 ha	spicy, citrusy, a bit fruity	Pellets type 90 (P90)	300 g/hl
No. 3 (DE SD)	Smaragd	40 ha	fruity, herbal	Pellets type 90 (P90)	300 g/hl
No. 4 (US BR - Oil)	US Bravo	250 ha	spicy, citrusy, a bit fruity	Hop oil, Type Dry	2.4 g/hl (undiluted)

Table 1

ANALYSIS RESULTS

Pale Ale	IBU EBC9.8	Iso- α -acids mg/l *	α -acids mg/l *	Linalool μ g/l **
No. 1 (DE MB)	27.6	22.1	6.2	221
No. 2 (US BR - P90)	36.6	18.4	16.7	148
No. 3 (DE SD)	34.3	21.6	8.4	109
No. 4 (US BR - Oil)	22.9	19.3	2.9	133

* Method HHV 29 (internal method, HPLC) ** Method HHV 05 (internal method, GC)

Table 2



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dry hopped in the lager tank with a contact time of ten days.

In addition the acreage of the individual varieties is listed in table 1 and reflects their availability. In contrast to Bravo, Mandarina Bavaria and Smaragd were planted on a smaller acreage, which during a bad harvest year could result in limited availability.

Beer analysis

The analytical results regarding the bitter constituents and the hop aromas are described in table 2.

While comparing the four Pale Ales, it can be seen that the bitter constituents (alpha acids) as well as the bittering units vary quite considerably. The Pale Ale (No. 4) with the hop oil addition has no increase in alpha acids. Its bittering units and concentration of alpha acids are also considerably lower than those prepared with pellets.

The concentration of linalool can be used as an indicator of the solubility of a number of hop aroma components in beer. The almost identical concentration of linalool in Pale Ales No. 2 and No. 4 also serves as an indicator that other important aroma components behaved in a similar manner and therefore resulted in an analogous aroma profile (see below).

Tasting results

The tasting results were collected from a panel of 750 tasters from across the globe, who visited the Hopsteiner tasting stand erected especially for this experiment at the drinktec trade show.

At the beginning of the tasting, the participants were informed that the Pale Ales were made using the same base beer. In order to avoid influencing the tasters, the type of hops and products used for the dry hopping was kept secret. The newly developed Hopsteiner FlavorWheel was used as a tasting guide, a more exact description of which can be found in BRAUWELT International no. 2, 2014, pp. 116-118.

Aroma impression – intensity and quality

The FlavorWheel helps in the description of aromas resulting from dry hopping. It consists of eight categories: citrusy, fruity, floral, herbal,

AROMA CHARACTERISTICS

Aroma characteristics	No. 1 DEMB	No. 2 US BR - P90	No. 3 DESD	No. 4 US BR - Oil
Aroma characteristic 1	hoppy	hoppy	hoppy	hoppy
Aroma characteristic 2	mandarin	lemon	sugarlike	lemon
Aroma characteristic 3	sugarlike	sugarlike	berry	sugarlike

Table 3

spicy, resinous, sugar-like, and miscellaneous. These categories contain a multitude of aroma characteristics, such as mandarin or grapefruit (citrus), honeydew or passion fruit (fruity) and white wine or glacier mint (miscellaneous).

When performing a sensorial evaluation of the beers, the aroma impression can be rated on an intensity scale of 0-5. In figure 1, the tasting results are depicted in a spider chart.

The tasters had a strong consensus about the aroma profile of the beer made with Bravo pellets and Bravo oil and described it as citrusy, herbal, slightly floral, and fruity. The beer with Bravo oil was rated as slightly more intense in some categories. In contrast, in the assessment of the type Mandarina Bavaria and Smaragd a more intense fruit and sugar-like aroma was noted, whereas the herbal note had a weak presence.

Looking at the three most common aroma characteristics of beer in the individual categories (table 3) it is obvious that these could really be categorized as “hops spice”. This brings us to the conclusion that dry hopped beers are dominated by the typical hop aroma and have undertones of unique aromas specific to the individual varieties. With regards to the four Pale Ales, notes of citrus, mandarin, lemon and

sugar-like aromas were noticeable. In the Pale Ale made with Smaragd a fruity, berry characteristic was forthcoming.

When classifying the aroma quality, the panelists were able to give a rating between 1 and 5. Comparing the flavor quality as shown in figure 2, the beers with Bravo pellets and Smaragd follow an almost normally distributed curve with a tendency towards a positive evaluation. A significant portion of the results for the beer which was dry hopped with Mandarina Bavaria is situated in the positive to very positive area. The best rating with regards to aroma quality was the beer made with Bravo oil, of which 63 percent of the tasters gave a rating of four or five.

Evaluation of bitterness

Another criterion used to evaluate the beer at the tasting was the sensory classification of the bitterness of the beers.

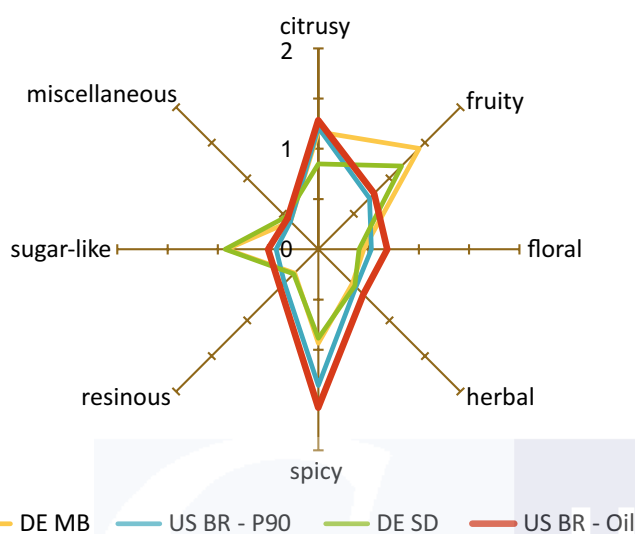


Fig. 1 Aroma impressions and intensity

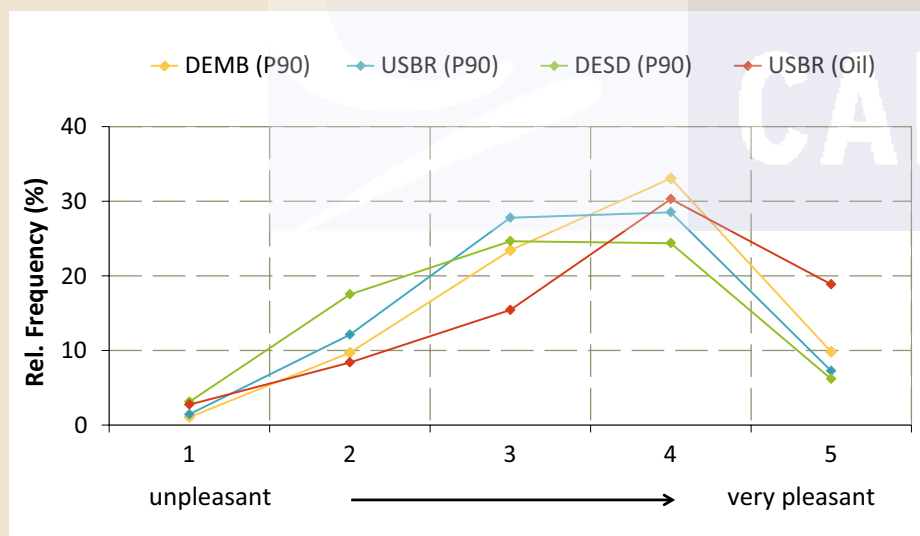


Fig. 2 Aroma quality

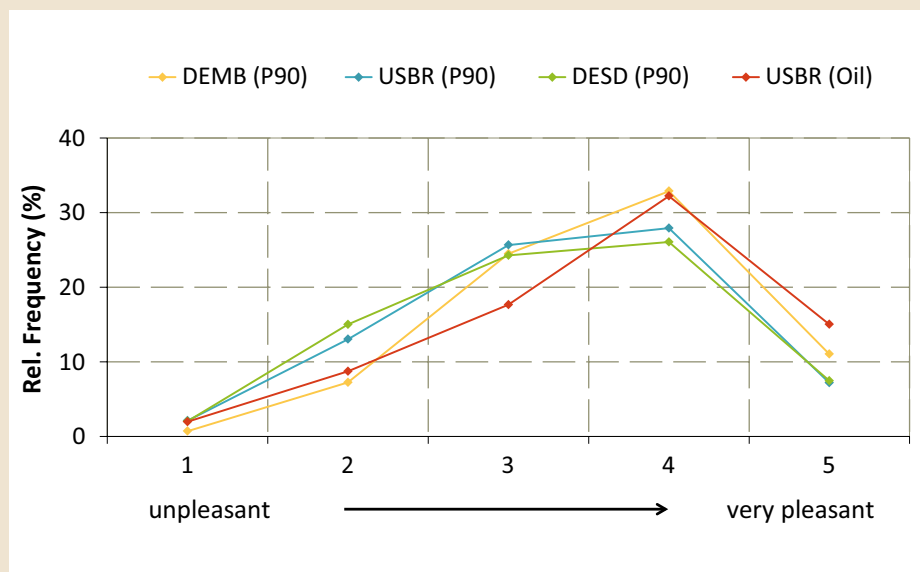


Fig. 3 Bitter quality

Both the quality and the intensity of the bitterness were evaluated. For the qualitative rating, the tasters once again assessed the beers on a scale of 1 - 5, the results of which can be seen in figure 4.

The results clearly show that overall the tasting panel found the bitterness of the beers to be positive. More than 75 percent of the tasting panel rated the Pale Ales with Bravo pellets and Smaragd between 3 and 5. The Pale Ale made with Mandarina Bavaria and Bravo hop oil was also rated between 3 and 5 by over 85 percent of the tasters. If the estimation of the bittering units were to be examined, it could be observed that around 40 percent of the testers estimated the beers' bittering units to be between 25 and 35, which corresponds to the analytically measured bitterness. The sensory evaluation of the Pale Ales' bitterness proves that the alpha acids introduced to the beers through dry hopping with pellets had only minimal effect on the bitterness of the beer.

If the quality of the bitterness is compared with the perceived bittering units, there is no correlation to be found between the bittering units and the quality of the bitterness.

Overall impression

Figure 5 clearly shows that the overall evaluation is similarly distributed to the ratings of the aroma or the bitterness. Especially in the case of the Smaragd and Bravo pellets, it appears that not all the tasters preferred the hoppy aroma. In contrast to this, the beers made with the other hop varieties and products were somewhat better received. Mandarina Bavaria was rated 4 to 5 by over 50 percent of the tasters and Bravo hop oil was given a 4 or 5 rating by over 60 percent of the testers. Along with the evaluation of the tasting sheets with the Flavor Wheel, bitterness, and the overall impression correlations between specific characteristics of the participants were also examined. An attempt was made to find a correlation between choices made in relation to gender, nationality, and trade. However, the evaluation of the results in connection with these features did not reveal any statistically significant dependencies. This gives reason to believe that men and women, professionals, and consumers of different nationalities have a wide variety of impressions with regard to beers with hoppy characteristics. Therefore, one can-

not draw any conclusions about tasters' personal traits and their preferences.

Conclusion

This tasting clearly demonstrates the increasing trend to create new and hoppy beers using dry hopping which are received with great interest. In this regard, brewers have a huge range of traditional hop varieties as well as new hop products (some of which do not conform to the "Reinheitsgebot") at their disposal.

The tasting results show that the sensory evaluation of the different Pale Ales is characterized by subjective opinions. Pale Ales and IPAs (Indian Pale Ales), which are still niche products in Germany, offer us the opportunity to experience new and diverse hop aromas. The Hopsteiner FlavorWheel now gives the taster an aid to describe these previously unknown flavors in beer.

Of particular interest was the comparison between the beers made with Bravo hop oil and hop pellets. While both beers had an identical aroma description, they had a different overall impression. This demonstrates that the overall impression of the beer is not only dependent on the choice of variety but also the type of hop product used (pellets, hop oil) when dry hopping. Our tasting showed that the usage of hop oil Type Bravo in dry hopping provided the best results in regards to bitterness, aroma as well as the overall impression of the beer.

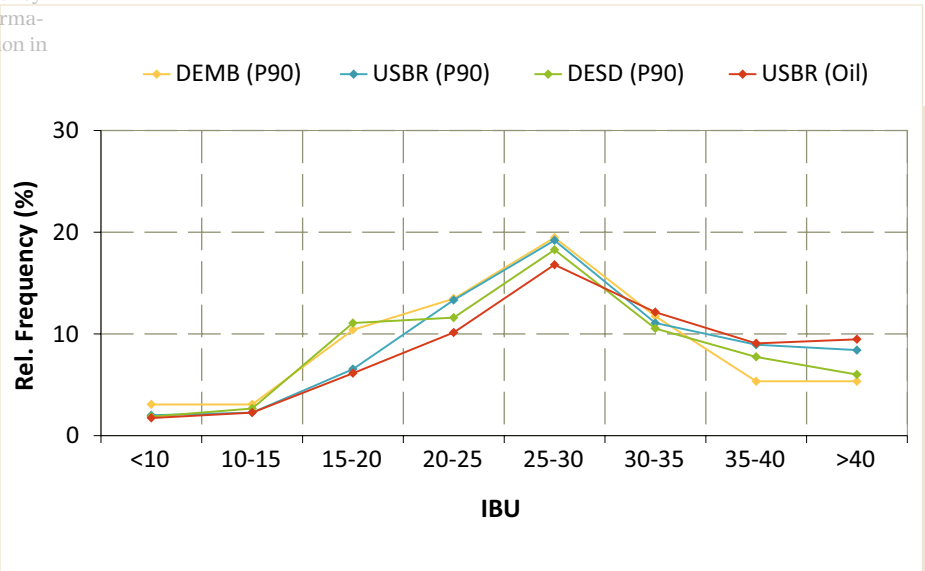


Fig. 4 Estimated bitter units

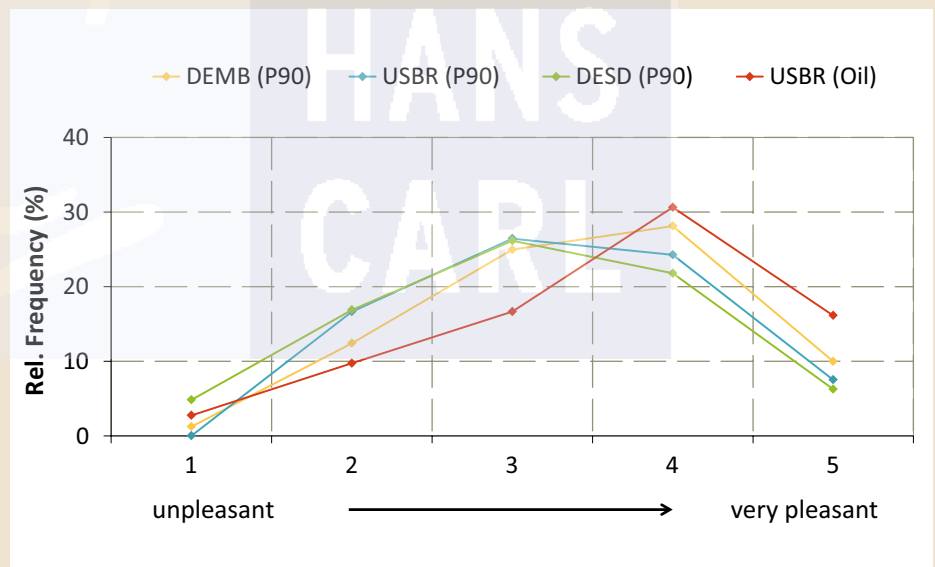


Fig. 5 Overall impression