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Bitterness Units in beer: retrospective trends and current concept of commerce

The Bitterness Units (BU) of a large collective of 2,076 beer samples analyzed between 1983 and 2005 is systematically investigated in this study. No change in BU could be detected during the examination period. Pilsner beer that is characterized by its predominant taste of hops, showed a constant BU of approximately 30, which appears to be the generally accepted concept of commerce of German Pilsner beer. Beer labelled as Pilsner with no distinct bitter taste (e.g. with BU lower than 20) must be reported to the official food control as deceptive to the consumer.

Descriptors: Bitterness units, concept of commerce, Pilsner-style beers

1 Introduction

The organoleptic characteristics of beer are mainly determined by the bitter-tasting *iso*- α -acids, which are formed in the brewing process from the α -acids occurring in hops [1,2]. Especially in Pilsner or Lager beer, the taste of hops predominates, while the malt aroma prevails in beer with a lower content of hops (for example Export-type beer). To determine the amount of bitter hops substances in beer, a photometric method to measure the so-called Bitterness Units (BU) is often used [3]. Until now the only systematic investigation regarding the amount of bitter substances in Pilsner beer was conducted by Mehnert et al. [4] in 2005. Pilsner beers typically have Bitterness Units of about 30 BU and premium products, like Czech Pilsner beer, may have up to 40 BU.

In the last years, an increasing number of so-called Pilsner beers was found on the market that did not show the typical characteristics either in organoleptical or chemical evaluation. The labeling and advertising of such products was judged as misleading to consumers, which is a direct offence against European food law (article 16 of regulation (EC) No 178/2002) or more specific national regulations (e.g. §11 of the German "Lebensmittel- und Futtermittelgesetzbuch").

However, in cases of complaints about Pilsner beer by official food control, due to the absence of a distinct bitter taste in sensory analyses and Bitterness Units for a beer that contains less than 20 BU, breweries often responded by stating that the market definition of a Pilsner has changed in recent years. To verify or disprove this argument, for the first time a large collective of 2,076 beer samples, analyzed between 1983 and 2005, was statistically evaluated.

2 Material and methods

The sampling was conducted by local authorities, either directly from the breweries or from retail trade. As a rule, samples were analyzed within 14 days of submission. Samples outside of the expiration date were excluded from the evaluation. The determination of the Bitterness Units was done according to the Analytica-EBC method 9.8 without modification [3]. In short, the bitter substances were extracted from acidified beer with *iso*-octane.

After centrifugation, the absorbance of the *iso*-octane layer was measured at 275 nm, against a reference of pure *iso*-octane. Then, the Bitterness Units (BU) were calculated by multiplication of the absorbance with a factor of 50.

All data were evaluated using standard statistical packages for Windows. Statistical significance was assumed at below the 0.05 level of probability. Groups of two cases were compared using t-tests. One-way analysis of variance (ANOVA) was used to test whether three or more cases have the same mean. Pearson's test was used to evaluate the significance of linear relations.

3 Results and discussion

The evaluation showed that over the duration of the study there was no detectable increase or decrease in Bitterness Units. Significant differences between the BU during the years were found neither in the total collective of all beer samples nor in Pilsner and Export sub-collectives (ANOVA $p > 0.05$).

Figure 1 shows the BU of Export, Pilsner and Wheat beer. Pilsner beer for example had a BU of 29.5 ± 6.2 between the years 1983–1993 and a BU of 29.9 ± 6.0 between the years 1998–2004 (table 1). It is interesting to note, that for single breweries, whose Pilsner beer was tested routinely on a yearly basis, noticeable changes could be detected (table 1). There appears to be a convergence of the values to BU 30, which means that breweries with low BU in the 1980's increased the addition of hops in the meantime, while breweries with an extremely high addition of hops decreased it.

Most of the breweries in our study confirm the findings of Průcha [5], that a specific Czech Pilsner beer has shown constant values of bitterness since the 1950's, as have beer samples from Germany. The generally accepted concept of commerce for German Pilsner beer has, in fact, not changed over recent years. An authentic Pilsner beer shows BU of about 30 (fig. 2).

Pilsner beer with BU lower than 20 must be reported as being misleadingly labelled with special regard to the results of sensory analyses.

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Tables and figures see Appendix

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Appendix

Table 1 Average Bitterness Units of Pilsner beer of two examination periods for all examined beer and selected breweries

	1983–1993	1998–2004	P (t-test)
Pilsner beer total	29.5	29.9	0.74
Pilsner brewery 1	26.8	28.2	0.11
Pilsner brewery 2	34.0	30.6	0.03
Pilsner brewery 3	34.7	30.0	0.10
Pilsner brewery 4	28.1	29.7	0.20

