

A matter of taste

Determination of dimethyl sulfide in wort with Headspace Gas Chromatography

Hops, malt and water – only these three ingredients should be used in the beer brewing process according to the German purity law (“Reinheitsgebot”). But even with only three basic ingredients the brewing process is a complex procedure, which, in a completely natural way, can also lead to the formation of compounds that influence the taste of the beer in an unfavorable way. Dimethyl sulfide (DMS) is one of those compounds which has a bad influence on the taste. This sulfur containing organic compound is formed e.g. in the cooking process of corn.

During the malting process small amounts of S-methyl methionine and dimethyl sulfoxide are produced which form dimethyl sulfide when the wort is cooked. The wort is essential for the brewing process and influences the alcohol content as well as the nutritional value of the beer. A critical threshold for the DMS concentration in wort is as low as 35 µg/L. This will already have an impact on the taste of the end-product beer.

Instrumentation

Analysis was performed using a Shimadzu GC-2010 with flame photometric detector FPD-2010 and headspace sampler AOC-5000. Data acquisition as well as data processing was done using the Shimadzu GCsolution software.

Quantitative analysis of DMS in wort using standard addition method

The DMS was quantitatively determined in the wort and differentiated from its precursor compounds S-Methyl methionine and dimethyl sulfoxide which should be completely transformed to DMS during the cooking process. Analysis was performed using a gas chromatographic method with flame photometric detection in combination with a headspace autosampler. The headspace of the wort sample was used for the quantitative determination, making a complicated sample preparation procedure obsolete.

To account for a possible matrix effect, calibration of the method was performed via standard addition. This means that the sample is divided into different aliquots and the compound which should be quantitated (in this case DMS) is added in different concentrations (Figure 1). Dosage of the standards and samples should always be done via syringes, as a part of the DMS could move into the gas phase of a pipette which is normally used in laboratories and thus be lost for the quantitative determination, delivering wrong results.

The chromatogram in Figure 1 shows the DMS peak in an wort sample using the standard addition method with 50, 100, 150 and 200 µg/L and the calibration curve obtained. Correlation factor of the calibration curve, R^2 , was 0.9991 showing an excellent performance of the method.

The sample analyzed here showed a value of 26.9 µg/L DMS, well below the threshold value which could influence the taste in the final product.

Summary

Headspace gas chromatography using the flame photometric detection is a suitable method for the quantitative determination of DMS in wort. For a correct quantification a standard addition method has to be used, ruling out matrix effects. Dosage of the samples and standards needs to be done via syringes to prevent loss of DMS in the sample preparation process.

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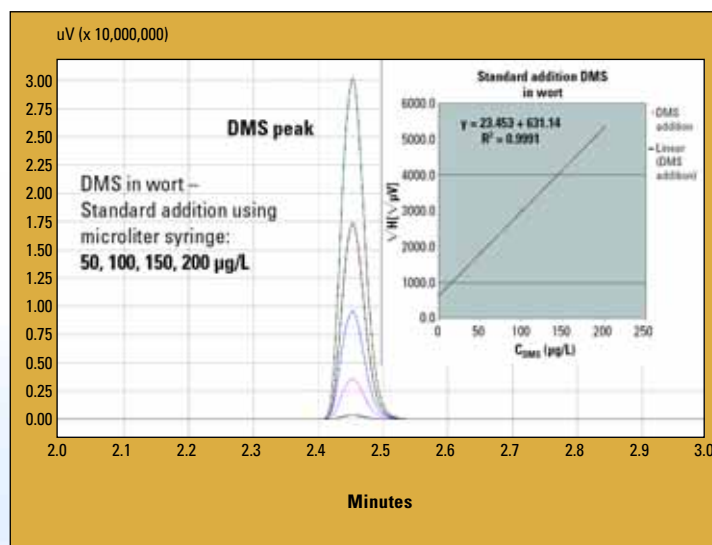


Figure 1: Standard addition of DMS in wort

