QCL BREWING SCIENCE

CDR BEERLab®

CDR BeerLab

Determination of Total SO2

This study demonstrates the exceptional accuracy and repeatability of the CDR BeerLab® method for the determination of total sulfur dioxide (SO2) in beer samples. It provides brewers with an improved version of this analysis in the brewery.

Abstract

Sulfites are widely used as additives in beverages to prevent spoilage by oxidation and bacterial growth during production and storage. In particular, SO2 is considered as the most important factor in preserving the shelf life of beer, because it inhibits beer oxidation.

As the accurate determination of total SO2 in beer is essential to ensuring regulatory compliance, several methods have been developed. Based on a European Brewery Convention (EBC) method optimization, the BeerLab method is easier and faster than traditional procedures. The BeerLab estimates the quantity of total SO2 in beer quickly and easily, allowing the brewers to improve quality control in all phases of beer production.

Introduction

SO2 is recognized as the most important factor in delaying stale flavours and lengthening the shelf life of beer. SO2 and sulfites in various forms show an antioxidant activity or rather they are compounds that can act by decreasing molecular oxygen levels, scavenging chain-initiating and chain-propagating free radicals, chelating metals or decomposing peroxides. (Halliwell, Gutteridge, & Aruoma, 1987).

In this way, they have a significant role as inhibitors of oxidative damage to achieve the stability of beer quality. SO2 is employed by breweries as potassium metabisulfite ($K_2S_2O_5$), commonly abbreviated E224. When it is dissolved in water or beer, E224 releases free sulfite ions, which are responsible for the antioxidative properties of the mixture.

Many different methods are used to determine the sulfite content, including various versions of the classical Monier-Williams method, the gas chromatographic methods using the technique of headspace GC and the colorimetric procedures such as the p-rosaniline. The colorimetric method using rosaniline hydrochloride was adopted by the American Society of Brewing Chemists (ASBC) and proved to be acceptable until the last few years when the carcinogenicity of the p-rosaniline became an issue.

Another colorimetric method for total SO2 in beer is recommended by the European Brewery Convention (EBC). Sulfur dioxide is distilled from acidified 25 mL samples into a buffered DTNB solution, with a nitrogen carrier gas and the absorbance measured at 415 nm. (Li & Zhao, 2006). The BeerLab uses the EBC reference method, but makes it simpler, quicker and suitable for all brewers.

The Aim of the BeerLab

The BeerLab is a beer analysis system designed to perform quality controls during all the brewing phases. CDR developed a new method to quantify total SO2 in commercial beer samples. This method is much faster than traditional procedures to determine sulfites.

Application for Brewers

The BeerLab analyser is based on photometric technology, and is equipped with LED emitters in the reading cells and 37°C thermostated incubation cells. The method uses a reagent in a pre-filled cuvette. 200 uL of degassed beer is added to it and the reaction is blanked. After the addition of 50 uL of the R2 reagent and 180 seconds of incubation, the reaction is measured at a wavelength of 430nm. All reagents are supplied ready to use so operators do not have to handle toxic or carcinogenic compounds. There is no need for a dedicated laboratory or cleaning of containers or traditional glassware.

The BeerLab Method

The BeerLab method estimates the quantity of the analyte (total SO2) in several samples of beer. Method linearity was tested in deionized water and it was calibrated with standard solutions of $K_2S_2O_5$ (MW = 222.33 g/mol), in a concentration range from 2 mg/L to 25 mg/L. All samples were measured as triplicates. The calibration curve is shown in Figure 1. Correlation data are obtained by the linear equation, exactly K = 33.9 and Q=- 0.5 with an R2 of 0,999.

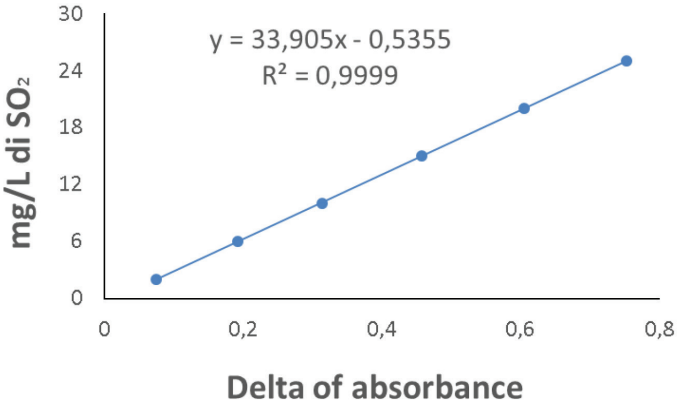

Figure 1 Total SO2 correlation graph

7 different commercial beer samples were analyzed for colour, IBU and alcohol by volume, after degassing for few minutes (Table 1).

	Colour (EBC)	ABV%	IBU
Beer 1	8	4.50	7.3
Beer 2	158	7.50	13.0
Beer 3	79	5.60	20.0
Beer 4	25	6.10	38.0
Beer 5	8	12.0	28.0
Beer 6	7	4.90	15.2
Beer 7	14	5.40	18.3

Table 1 Chemical features of the analyzed beers

A volume of 50 uL of potassium metabisulfite was added to each sample of beer and the Δ Absorbance was measured at 430 nm. The analyte concentration was calculated both according to the linear correlation and according to the additions. Then, following each addition, recovery was calculated, and in this way an estimate of the amount of the analyte present within the beer samples was measured.

Result and Discussions

The results from the BeerLab tests are summarized in Table 2. First, a fixed amount of metabisulfite, for all the commercial beers was added in order to remove the possible reaction of it. Then the recovery was calculated after a second addition of metabisulfite.

Table 2 shows a good recovery for all the beers that were analyzed. It is interesting to note that the repeatability of the BeerLab method is validated by the analysis of one beer sample carried out 10 times and the method showed an excellent standard deviation (Table 3).

	Conc. (mg/L)	Measured Conc. (mg/L)	Recovery (%)
Beer 1	18.5	17.8	96.2
Beer 2	24.2	23.6	97.5
Beer 3	27.7	27.6	99.6
Beer 4	12.7	11.7	92.1
Beer 5	12.8	13.4	104.7
Beer 6	20.6	19.5	94.7
Beer 7	27.7	26.3	94.9

Table 2 Recovery results for the BeerLab Total SO2 method

	Total SO2 Result (mg/L)
Repetition 1	6.4
Repetition 2	6.7
Repetition 3	6.3
Repetition 4	6.4
Repetition 5	6.4
Repetition 6	6.4
Repetition 7	6.3
Repetition 8	6.5
Repetition 9	6.3
Repetition 10	6.4
Average	6.4
Standard Dev.	0.12

Table 3 Repeatability test of BeerLab Total SO2 analysis

The results obtained demonstrate that BeerLab method is able to quantify total SO2 in real beer samples providing a reliable assessment of total sulfur dioxide in beer.

Conclusions

The BeerLab is a versatile system specifically developed by CDR to respond to the needs of master brewers and breweries of any size. The BeerLab analysis system allows brewers to perform tests with one single instrument, more rapidly and easily than traditional methods. It is also possible to perform sulfur dioxide analysis, in addition to many other parameters in beer.

References

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Li, Y., & Zhao, M. (2006). Simple methods for rapid determination of sulfite in food products. Food control 17, 975-980.

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