



Measuring Color Intensity of Beer by UV/Vis Analysis

Introduction

Beer has been around for thousands of years (approximately 7,000, more or less), and will most likely continue to be here for generations to come. Today's beer market has become extremely diverse, offering everything from the alcohol-free to low-carb to raspberry-chocolate flavored beers. Today, multinational corporations tend to dominate the multi-billion dollar industry, although there is also a surge of smaller craft breweries, which infuse the market with new and innovative beer creations.

In order to ensure both the quality of the beer being produced and in order to be able to maintain consistency of the quality from batch to batch, a large variety of analytical methods and devices are available to breweries. The European Brewing Convention (EBC) and the American Society of Brewing Chemists (ASBC) are examples of brewer's organizations which have set and provide testing guidelines and which recognize UV/Vis spectroscopy as a reliable method for testing beer.

The goal of every production run is to ensure that the final product possesses the desired color, appearance, flavor, texture, and overall impression. UV/Vis spectrophotometers offer relatively inexpensive and uncomplicated methods for measuring and analyzing several, according to the ASBC at least 12, of the parameters crucial to the quality of production. These parameters can be monitored continuously in every phase of the brewing process. They include among others: absorbance integral, Free Amino Nitrogen (FAN), alcohol, carbohydrate and protein content, color, and bitterness.

Challenge

Determination of the color intensity of beer samples for quality control.

Solution

Absorbance measurements with UV/Vis spectrophotometer SPECORD PLUS for fast and simple determination of the color intensity.

Analytik Jena offers a comprehensive UV/Vis portfolio of high quality UV/Vis spectrophotometers, accessories, and software, making the analysis and measurement of several parameters critical to quality precise, fast, and efficient.

Materials and Methods

This application note focuses on the color measurements which can be made using the SPECORD PLUS family of UV/Vis spectrophotometers.

The determination of the color of the beer plays a crucial role for the quality control throughout the production process, as well for the final product. The color is the first impression of the finished product that the consumer receives before consumption. Based on the type and/or brand of beer the consumer expects a certain appearance.

For the determination of beer color, the absorbance value at 430 nm is measured. The color, or more precisely the color intensity, can be described by the EBC (European Brewery Convention) units, which indicates how much light is absorbed by the beer sample.

The absorption at 700 nm is also recorded, as this value can be used to determine whether the sample is turbid. A sample is classified as turbid if the following criteria is fulfilled:

$$\text{Absorbance at 430 nm} \times 0.039 \geq \text{Absorbance at 700 nm.}$$

Turbid samples must be further prepared (i.e. filtered) until no longer turbid. Otherwise, the color determination based on the absorbance value at 430 nm is not valid.

Samples and Reagents

The following beers were analyzed:

- Beck's
- Pilsner Urquell
- Jever

Distilled water was used as reference.

Sample Preparation

Beer was opened and poured into smaller vessels and allowed to air for approximately one hour, during which time it was stirred and shaken in order to promote outgassing of the carbon dioxide and removal of foam (Fig. 1).

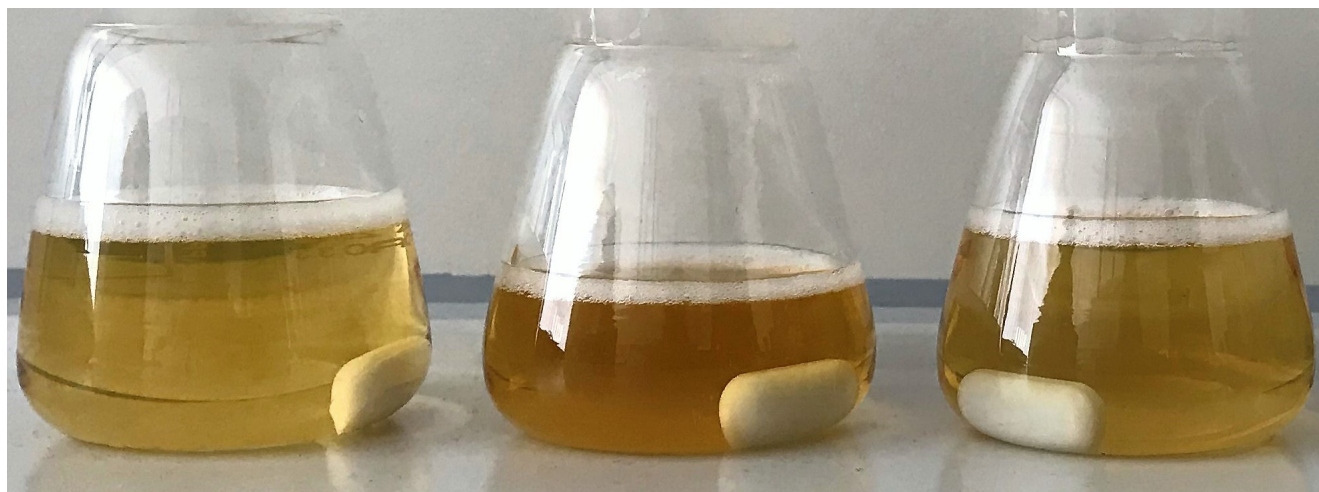


Fig. 1: Sample Preparation

Instrumentation

The measurements were performed using the SPECORD 200 PLUS with standard 1 cm cuvettes. The other spectrophotometers of the SPECORD PLUS family can also be used to perform these measurements.

- SPECORD 50 PLUS
- SPECORD 210 PLUS
- SPECORD 250 PLUS

Results and Discussion

Each beer sample was measured 3 times. In accordance with MEBAK, in which a 1 cm cuvette is stipulated, the following calculation applies for the determination of the beer color: Absorbance of the beer at 430 nm x 25 = Color in EBC units

Table 1: Results of measurements

Sample Name	Dilution Factor	Abs (430 nm)	Standard Deviation (400 nm)	Abs (700 nm)	Standard Deviation (700 nm)	Turbid	Color (EBC)
Beck's	1	0.29	0.00	0.01	0.00	No	7.17
Pilsner Urquell	1	0.50	0.00	0.01	0.00	No	12.47
Jever	1	0.31	0.00	0.01	0.00	No	7.67

Conclusion

UV/Vis spectroscopy is recognized as a reliable method for testing beer and is used throughout the production process of beer to maintain consistency of the quality from batch to batch. UV/Vis spectrophotometers offer relatively inexpensive and uncomplicated methods for measuring and analyzing several parameters crucial to quality.

Combined with an extensive portfolio of accessories, the SPECORD PLUS family of spectrophotometers offers the necessary accuracy, precision and versatility for this application.

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