

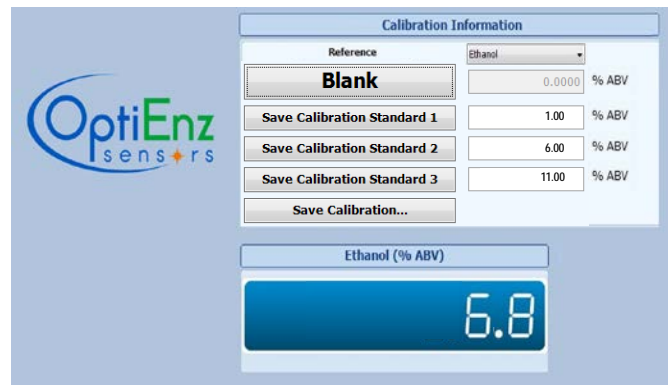
# Measuring Ethanol in Beer at New Belgium Brewing Company



## PRODUCT OVERVIEW

The OptiEnz Analyzer for Ethanol provides an easy-to-use, low-cost, bench-top instrument for use in the brewing industry. Fast, accurate, and precise ethanol measurements allow brewers to monitor their fermentations and ensure that their final product meets industry regulations for packaging and distribution.

The OptiEnz Analyzer includes an instrument with an attached sensor probe, replaceable sensor caps, and a PC-based software application. Ethanol concentration can be determined in three to four minutes for beer samples, and only a small sample volume is required. Simple calibration and assay protocols allow the instrument to be easily operated and eliminate the need for a specialized technician or expensive off-line analysis. Minimal sample pretreatment is required and measurements are not impacted by complex components in beer (e.g., suspended yeast or hops).



## APPLICATION

The OptiEnz Analyzer for Ethanol was used at New Belgium Brewing Company to measure the ethanol concentration in seven packaged beers and four in-process beers. The ethanol concentration of the selected beers ranged from 4.8 to 8.1% alcohol by volume (ABV). Ethanol measurements made using the OptiEnz Analyzer were accurate and precise (reproducibly within 0.3% ABV of the reported concentration).

## PRODUCT SPECIFICATIONS

Detection Range	2 -12% ABV
Accuracy	±0.3% ABV
Measurement Time	3 - 4 minutes
Calibration Time (Every 40 Samples)	10 minutes
Sample Volume	10 µL
Sample Temperature Range	1 - 55 °C
Sample pH Range	2 - 8
Sensor Cap Usage Lifetime	100 samples

## MEASUREMENT METHODS

### Calibration

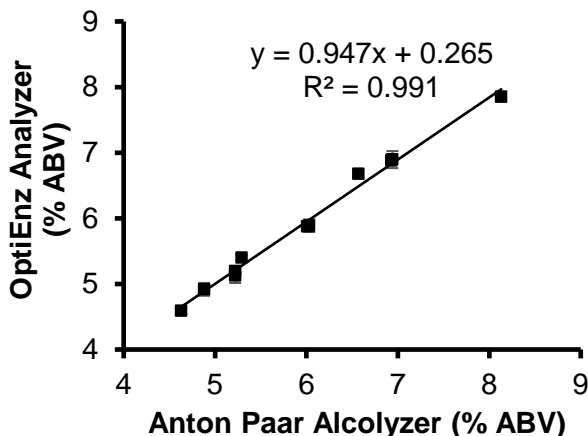
A 10-minute calibration was performed at 0, 1, 6, and 11% ABV. A calibration is sufficient for 40 sample measurements or four hours of use.

### Measurement Protocol

- 1) The sensor probe was inserted into a buffer solution and allowed to equilibrate for 5 minutes. Addition of 10  $\mu$ L of beer sample provided a 1:5000 dilution (2-12% ABV detection range).
- 2) Ethanol concentration measurements were recorded for each of the three replicate sensors.
- 3) The sensor cap was rinsed with water before inserting into the next sample.

## MEASUREMENT RESULTS

For this study, each OptiEnz sensor cap contained three ethanol sensors. The triplicate measurements were averaged to obtain a single measurement for each beer sample. For comparison, samples were also evaluated by New Belgium Brewing Company technical staff using an Anton Paar Alcoalyzer. OptiEnz Analyzer measurements were linearly correlated with Anton Paar Alcoalyzer measurements ( $R^2 > 0.99$ ) and were within 0.3% ABV of Anton Paar Alcoalyzer measurements for all eleven samples.



Ethanol concentration measurements in eleven New Belgium beer samples.

Sample Number	OptiEnz Analyzer (% ABV)	Anton Paar Alcoalyzer (% ABV)	Accuracy <sup>1</sup> (% ABV)
1	4.9	4.9	0.0
2	5.4	5.3	0.1
3	5.2	5.2	0.0
4	5.1	5.2	0.1
5	5.9	6.0	0.1
6	6.9	6.9	0.0
7	6.9	6.9	0.0
8	6.7	6.6	0.1
9	5.9	6.0	0.1
10	4.6	4.6	0.0
11	7.8	8.1	0.3

<sup>1</sup>Accuracy defined as the absolute difference between the OptiEnz Analyzer measurements and Anton Paar Alcoalyzer measurements.

## CONCLUSION

The OptiEnz Analyzer for Ethanol provides a fast and easy method for accurately measuring ethanol in both finished and in-process beer samples. The measurements made with the OptiEnz Analyzer matched the measurements made on an Anton Paar Alcoalyzer by New Belgium Brewing Company staff. All measurements were within the 0.3% ABV labeling requirement as defined by the Alcohol and Tobacco Tax and Trade Bureau.

OptiEnz Sensors is pleased to be offering this analyzer as a low-cost option for brewers to measure ethanol in their products.

## CONTACT INFORMATION

For further information regarding product details, product applications, and pricing please contact OptiEnz Sensors:

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