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Non-invasive, Selective Measurement for CO_2 in Package Expands Brewers' Quality Control Toolbox

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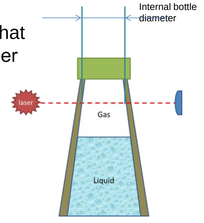
Challenge

When producing beer and carbonated soft drinks, water or wine, the carbon dioxide (CO_2) content is a key quality parameter and decisive to the product's taste. Beverage manufacturers frequently measure and control the CO_2 content during production and beyond to determine the shelf-life of packaged products.

Brewers and carbonated drink manufacturers have long sought an option for CO_2 measurement that does not require piercing the package, and is suitable for all bottle closures including swing top, natural cork and sport drink caps.

Technology Advancements

Non-invasive measurement
This technology provides a testing option that doesn't require piercing the package. A laser transmitter sends a beam through the headspace of the package to a receiver. At a particular wavelength, the CO_2 molecules in the headspace absorb the infrared light of the laser.



Based on the width of the absorption lines and the intensity, two (2) measurements are determined

- **Total non-selective pressure**
  - the sum of the equilibrium pressures of all the gases present in the headspace - such as oxygen (O_2), nitrogen (N_2) or hydrogen (H_2)
- **CO_2 selective pressure**
  - the CO_2 equilibrium pressure of the packaged product

Along with the infrared measurement of temperature, a selective CO_2 content and non-selective CO_2 content is calculated. The measurement is independent of the bottle's color or material.

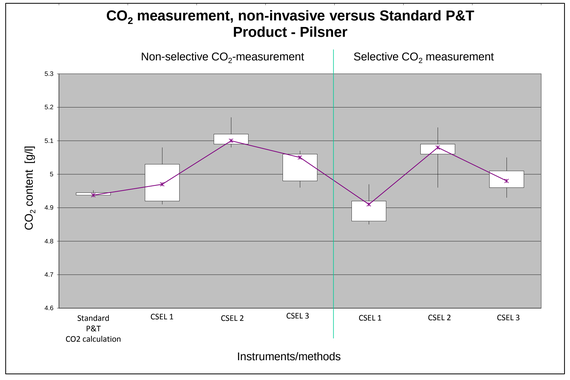
Standard P&T versus non-invasive CO_2 measurement

Standardized Measurement Methods
The standard CO_2 measurement of packaged beverages as registered in the Methods of Analysis of the ASBC and the Analytica-EBC is based on contact pressure and temperature measurements, and calculation of CO_2 content.

The non-invasive CO_2 measurement determines pressure and temperature of the package and calculates the CO_2 result similar to the standards set by ASBC, EBC and customer specific CO_2 calculations.

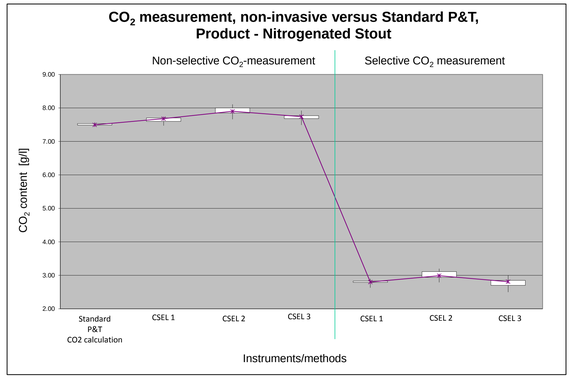
Test 1 – Pilsner
CO_2 measurement, non-invasive versus standard P&T

Several samples of pilsner beer were measured with non-invasive technology using three (3) CO_2 meters, type Haffmans CO_2-Selector, and the selective and non-selective results were recorded. The same samples were measured with the standardized pressure/ temperature method using an invasive Haffmans Inpack, type ICD.



Test 2 – Nitrogenated Stout
CO_2 measurement, non-invasive versus standard P&T

Several samples of nitrogenated stout beer were measured using the same procedure as in Test 1.



Test 1 Results
All CO_2 measurement results for the standard P&T method and non-invasive measurement are very similar.
Furthermore, the non-selective and selective results are similar, as expected, in a pilsner that is produced with CO_2 only.

Test 2 Results
The non-invasive/non-selective CO_2 measurement results and the standard P&T method are very similar, and do not compensate for the equilibrium pressure of the N_2.
The non-invasive/selective CO_2 measurement results give a much lower CO_2 content. These results are correct because they are not influenced by the N_2. This shows that the non-invasive CO_2 measurement is perfectly suited for selective CO_2 measurement of beverages that contain N_2.

Conclusion

The combination of total pressure measurement with a CO_2 pressure measurement makes non-invasive technology suited for a wide range of carbonated beverages from 0.4 to 13 g/l and CO_2 measurement of nitrogenized beverages, packaged in bottles with various closures. Non-invasive technology is not suited for cans.

CO_2 results are comparable with the P&T standards that are well established in the brewing and beverage industries. Slightly higher CO_2 variations/lower accuracies are experienced.

Compared to destructive CO_2 measurement options, the non-invasive technology allows for a sustainable CO_2 content measurement of bottled beverages, saving on samples, sample storage, product loss, and labor.

For freshly filled bottles and shelf-life determination, tracking the degradation of CO_2 content with non-invasive, selective measurement for CO_2 in packages this equipment expands brewers' quality control toolbox.

Haffmans CO_2-Selector

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