HACH ULTRA
EXCELLENCE IN PROCESS ANALYTICS

Application Note

Beverage No. 04

Dissolved carbon dioxide measurement in the brewing and beverage industry

- Continuous reading of dissolved carbon dioxide for process control
- Virtually maintenance-free, with negligible signal drift
- In-line measurement unaffected by suspended solids in the beverage
- Measure carbon dioxide in-line or in-package, uninfluenced by the presence of nitrogen or air

Application description

The dissolution of CO_2 is of considerable consequence to the brewing and beverage industries. There is a need to measure this gas both in-line and in the package.

Orbisphere has developed an analyzer that addresses both of these tasks, and can measure dissolved CO_2 accurately in the presence of other dissolved gases or air.

In line analysis

The Orbisphere 510 series CO_2 analyzer uses the principle of membrane diffusion thermal conductivity. Since the sensor uses a solid-state technology, it will work for many months before any maintenance is required. This, combined with a very rugged design, makes the analyzer ideally suited to in-line analysis.

As filling lines and plants become more dependent on instrumentation, an absence of signal drift becomes nearly as important as basic measurement accuracy. Since this analyzer drifts less than 1% between services, it can be used for reliable feedback control. The sensor only requires a supply of clean, dry nitrogen to be used as a purge gas at the rate of 20 ml/minute at 1–3 bar pressure.

The analyzer will measure from trace levels to 7 volumes of CO_2 in solution. It is installed directly into the line, rather than in sample loops, and accepts all normal CIP routines, including steaming. This ability is particularly important when measuring liquids containing suspended solids such as fruit pulp, since there is no separate sampling train that could become blocked. The analyzer is also unaffected by nitrogen (increasingly used by the brewing industry) or air (often found in soft drinks and beverages).

The analyzer can be calibrated in-line (where a measured CO_2 level can be entered), or calibrated against an absolute standard (i.e., gaseous CO_2.) An offset value can be entered while the sensor is in-line. This is very useful when there is a variable loss of CO_2 at the filler; due either to the performance parameters of the filler or the effect of headspace variation (especially if a Snift test is used to measure the packaged product.)

The standard method of measuring CO_2 has been the Snift test, whereby a package is shaken to equilibration and a pressure / temperature chart used to estimate CO_2. The Snift method has some errors associated with variable headspace volumes. These errors are eliminated with the use of the Orbisphere analyzer.

To achieve the best accuracy on systems where the temperature is changing rapidly, a separate temperature sensor that interfaces with the analyzer can be supplied.

Off line package analysis

Verification of the packaging process can be accomplished off-line, using the same type of Orbisphere carbon dioxide analyzer together with a beverage package sampler. The advantage of this measurement is that it shows how well the complete production process, including the filling machine, is performing.

To measure off-line, one should use a portable analyzer, model 3658, or model 510 with an external temperature sensor.

Before piercing, the package should be shaken vigorously to ensure equilibrium is achieved. The test then takes about 1 minute to perform, and requires a minimum package size of 150 ml.

On a routine basis, the only maintenance required is a daily flush with tap water.

See application note 12 for information about Orbisphere's "Package Analyzer" for complete, package CO_2, O_2, and N_2 gas measurements.

Recommended systems components

Model	Description
In-line Analyzer	
510/D00/xxC00000	Orbisphere 510 CO_2 (TC) instrument, 85-264 VAC, three 0/4-20mA analog outputs, RS485
31460	CO_2 sensor, membrane covered dynamic thermal conductivity (TC), with nitrogen purge, including protection cap; with external temperature sensor socket (used with 510)
29501.0	Stainless steel sensor socket with EPDM O-rings for welding to stainless steel pipe (in-line use)
32557	External temperature sensor for TC sensors (for in-line use)
32559	External temperature sensor for TC sensors (for off-line use)
29089	Pressure regulator and filter
Portable Analyzer	
3658/418	Portable CO_2 analyzer, sensor model 31478, RS232 (serial) output.
29972	Beverage package sampler for carbonated liquids