HACH ULTRA™

EXCELLENCE IN PROCESS ANALYTICS

Application Note

Beverage No. 03

Dissolved nitrogen measurement in the brewing industry

- Continuous reading of dissolved nitrogen gives real-time results
- Virtually maintenance-free operation
- Simple calibration procedure
- Measure nitrogen in-line or in-package, with no influence from carbon dioxide

Application description

The use of nitrogen in the brewing industry is becoming widespread in many processes for the following reasons:

- N_2 is dissolved to high levels in very dark “stout” beers, so that a very thick, creamy head is achieved (similar to that of cask beer). This use is now expanding to include other beers.
- N_2 is widely used instead of carbon dioxide to flush tanks free of oxygen prior to beer filling (nitrogen is less expensive than carbon dioxide).
- N_2 is becoming widely used in gas-stripping style de-aerators (in preference to carbon dioxide) to remove oxygen from brewing water.
- N_2 is used as the “jetting” gas in can fillers so that air is blown out of the headspace before putting on the lid.

Liquid N_2 can be used at the filler to remove air and add N_2 to the can (nitrogen rigidifies thin aluminum cans).

In line analysis

The Orbisphere 3610 series nitrogen analyzer uses the principle of membrane diffusion thermal conductivity. Since the sensor uses 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.

Measurement is normally made:

1. At the point where N_2 is injected into the beer and provides the signal to allow feedback control;
2. After high gravity beer has been diluted with brewing liquor which has been de-aerated with N_2;
3. After the buffer tank supplying the filling machine; and
4. In the finished package.

It is important to remember that nitrogen is insoluble, thus only small amounts need to be added before saturation of the beer occurs. In many cases, N_2 is added so that more than 1 bar partial pressure of N_2 occurs in solution, and high operating pressures need to be applied to all the process tanks. Great care must be taken when transferring the beer, because it is very likely to de-gas (particularly if pumped) and it is very difficult to subsequently force the N_2 back into solution.

If the brewery has difficulty controlling dissolved N_2, then the problem can be better identified by using in-line analyzers after each tank. 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 nitrogen 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. The analyzer is situated at a workstation to allow the measurement of finished packages.

When measuring in beverage packages, it is important to apply a forcing gas pressure higher than that of the sample's as it is pierced, in order to avoid degassing of the sample (the presence of bubbles would lead to incorrect results).

On a routine basis, the only maintenance required is to flush the system daily with tap water. See also Application Note 2.02 for information about Orbisphere's "Package Analyzer" for complete, automatic package gas measurements.

Recommended systems components

Model	Description
3610/5xx	Instrument, Substance measured: Nitrogen, one-channel analyzer, available in a number of different configurations
3654	Instrument, Substance measured: Nitrogen, Configuration: Portable battery powered, Number of channels: 1, Membrane: 29561A, RS232 (serial) output, Special sensor: 31570
31560	TC Sensor, Substance measured: Nitrogen, Purge gas: Carbon dioxide, Protection cap provided, Sensor Cable to be ordered: 32505.03, with external temperature adapter, Maximum pressure: 20 bar, External Temperature sensor to be ordered: 32557/32559
31570	TC Sensor, Substance measured: Nitrogen, Purge gas: Carbon dioxide, Protection cap provided, Maximum pressure: 10 bar, External Temperature Sensor Included, Used with instruments: 3654 N_2
32505.03	Sensor cable, 3 meters (lengths to 500 meters available)
29501	Sensor socket (in-line use)
32557	External temperature sensor for TC sensors (for in-line use)
29089	Pressure regulator and filter
29972	Beverage package sampler for carbonated liquids (off-line use)
32559	External temperature sensor for thermal conductivity sensors (off-line use), T-piece for connection to 6-mm tubing included