Monitoring Beverage-Grade CO_2

Designing a Useful Solution

A Special Applications Report from GOW-MAC

Series 23-550-BG Total Hydrocarbon Analyzer

Series 200 AHC Gas Analyzer

Drinking naturally carbonated mineral water was popular in Europe early in the 18th century. If bathing in natural mineral springs was therapeutic, it was surmised that drinking the bubbly mineral waters must be therapeutic as well. Carbonated mineral water was sought after for health, well-being, and refreshment. Today, these naturally carbonated mineral waters are still bottled and shipped from several points in Europe (and elsewhere).

For the carbon dioxide business in the 21st century, the real fun began during the latter half of the 18th century, when scientists made important progress in imitating naturally occurring carbonated mineral waters. In 1767, Englishman Joseph Priestley first discovered a method for infusing water with carbon dioxide (CO_2) to make carbonated water. Later work by Bergman, Schweppe (yes, THAT Schweppe), and Jedlik contributed to the development of the carbonation process we use today.

Carbonation Contamination

A daily concern within the soft drink manufacturing industry is contamination of the finished product by aromatic hydrocarbons. This type of contamination is a direct result of the carbonation process, where the aromatic hydrocarbons are present in the liquid CO_2 (LCO_2) used. The International Society of Beverage Technologists (ISBT) specification for aromatic hydrocarbons deals only with benzene, but other contaminants are also present.

The current specifications for benzene, as established by the World Health Organization and the US Food and Drug Administration, are 5 parts per billion (ppb) for bottled water and 10 ppb for drinking water. The ISBT has set a maximum limit of benzene in beverage-grade carbon dioxide at 20 ppb for soft drinks.

Finding the Analytical Solution

With the right analytical tool, commercial CO_2 supplier companies and distributors can choose to be proactive and provide assurances that benzene contamination is at or below the target limits.

Monitoring benzene in CO_2 requires an analyzer capable of unambiguously speciating and quantitating the benzene impurity, with the option of identifying toluene, ethylbenzene, and the xylenes. Ideally, the analyzer should function as a stand-alone system, be easy to operate, and have the ability to run on a continuous basis to meet the needs of the CO_2 production or beverage bottling facility. Analysis time must be fast, and the price within reach of bottlers and CO_2 suppliers.

Gas chromatography (GC) was considered a viable technique to address these needs. GC could easily perform the required separation. But GC is difficult to deploy in an application where continuous measurement is desired. In addition, the detection strategy needed to monitor more than benzene alone would be complex. Possibly most important, GC requires a dedicated operator's attention and regular instrument maintenance.

At GOW-MAC (*www.gow-mac.com*), we design and manufacture GCs, and we also design and manufacture dedicated gas analyzers.

The requirements needed in the beverage industry led us to the development of an entirely new line of gas analyzers for the beverage industry and suppliers of beverage-grade CO_2. GOW-MAC's 200 Series of Gas Analyzers handle not only benzene analysis, but also the determination of other impurities in beverage-grade CO_2, including aromatic hydrocarbons (BTEX—benzene, toluene, ethyl benzene, *o*-xylene, *m*-xylene, and *p*-xylene), acetaldehyde, and total sulfur.

Analyzer Details

The GOW-MAC Series 200 Analyzers far exceed all ISBT Method 11, 12, 13, and 14 performance criteria for selective measurement of acetaldehyde, benzene, BTEX, and total sulfur content in beverage-grade CO_2.

In addition, the Series 200 family of analyzers complements the Company's Series 23-550-BG Beverage Grade Total Hydrocarbon Analyzer. The Series 23-550-BG meets the requirements of ISBT Method 10 for "Total Volatile Hydrocarbons by THC Analyzer."

These instruments are for both the CO_2 producer and the bottler. They accept samples from a variety of sources (cylinders, bulk tanks, trucks, rail cars) and perform continuous, unattended sampling and analysis. Ease of operation and reliability make them useful alternatives to systems that require hands-on chromatography experience on the part of the user.

Instrument design incorporates simplicity, reliability, and easy setup, operation, and maintenance. Specifically designed as rugged, low cost, low maintenance, simple-to-use turn-key systems, the 200 Series instruments require minimal operator interaction. They are engineered for hands-free application through the use of a computerized user interface.

The Series 200 Analyzers use specific detectors—photoionization, flame ionization, and flame photometric—for selective and sensitive detection. Calibration and sample introduction are totally automated. Continuous stream or batch sampling operations can be performed. Analyzer outputs connect to customer systems such as SCADA, data-loggers, PLC's, and any PC-based data collection system.

The success of a drink brand depends ultimately on the quality of its ingredients and its consistency. The 200 Series analyzers are a simple, reliable, and proactive approach to product quality. They build quality assurance into a critical part of the process … before the bottles are filled. ■

For more information on the 200 Series beverage-grade CO_2 analyzers, contact Ken Fincke at (610) 954-9000 or visit www.gowmac.com.