CO_2 Monitoring in the Beverage Industry

The carbonating process

Everybody loves a refreshing sparkling drink during the summer heat.

CO_2 not only causes the sparkling effect found in carbonated beverages, but also helps to preserve the freshness of the beverage. A chemical reaction between CO_2 and water forms carbon acid which has an antibacterial effect in addition to the fizzy effect of soda drinks.

These soda beverages are treated with a carbonating process just before the final bottling or canning. Carbonating systems consist of a booster pump, a CO_2 saturator, a carbonating tank and an optional CO_2 analyzer to check the carbon acid content of the final product. With the aid of a booster pump the beverage mixture is conveyed to the saturator which operates according to the Venturi principle. It is important to maintain a constant flow and velocity of CO_2 through the saturator. The Venturi effect generates a partial vacuum at the smallest cross section of the saturator which causes a reduction of the pressure level. This suction effect causes the CO_2 to mix with the beverage liquid. The short-time increase of the flow velocity guarantees a fine distribution of the gas and homogenous mixing.

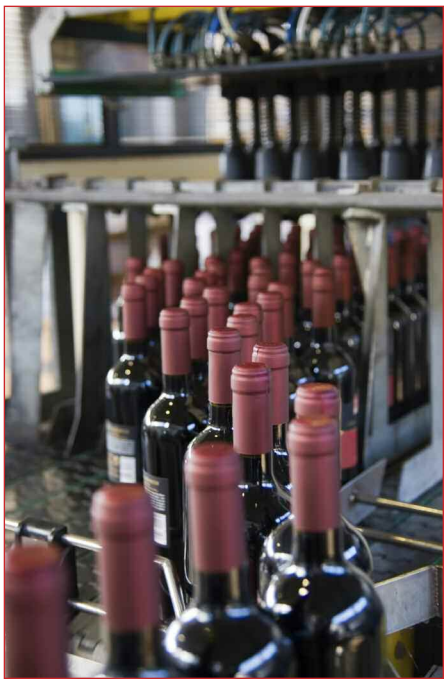
The mixing process also requires the tank pressure to be set slightly higher than the saturating pressure of a specific product. After the beverage goes through the CO_2 saturating process, it is bottled or canned immediately to preserve the fizzy effect.

continued

Stainless steel fermentation vessels . . . a modern brewery in Norway.

Facts & Figures

- A large bottling line can fill up to 30,000 bottles or cans an hour.
- Coca Cola operates 900 bottling and manufacturing plants around the world.
- Mexico leads in per capita consumption of Coca Cola beverage products at 745 8 oz. servings per year compared to the United States at 401 servings.
- The top 5 states in the US for soft drink consumption in order highest to lowest are Mississippi, Tennessee, Nevada, Oklahoma and Georgia.



A bottling line.

Why the need to monitor CO_2 in a beverage plant?

The carbonating processes is where the majority of CO_2 is used in the beverage industry. In addition, the gas also shows up in fermentation and refrigeration. CO_2 is omnipresent in nearly all beverage production and storage facilities.

A high concentration of CO_2 in closed areas where workers are present can be lethal at high levels of concentation. Excessive CO_2 levels can lead to bad headaches, drowsiness, unconsciousness and even sudden death. The effect of varying levels of CO_2 can be summarized:

- Normal outdoor level: 350 – 450ppm
- OSHA maximum standard: 1000ppm
- General drowsiness occurs: 1000 – 2500ppm
- Adverse effects on health: 2500 – 5000ppm
- Intoxicating feeling, nausea, increased pulse rate: 30,000ppm
- Headache and impaired vision: 50,000ppm
- Loss of consciousness and death: 100,000ppm

The gas can not be recognized by an odor nor by visual appearance. Soft-drink factories, breweries and wineries require an accurate and reliable CO_2 control and alarm system to maintain a high standard of operational safety. To ensure hygienic conditions and to reduce the risk of CO_2 incidents, bottling lines where CO_2 is prevalent are often operated in separate and isolated areas of a factory.

There is always a controlled minimal release of CO_2 during the bottling or canning process of sparkling drinks, but the amount of gas can add up considering that industrial lines are able to fill up to 30,000 bottles per hour. A tiny amount of CO_2 is released to the surrounding atmosphere with each bottle as it is filled.

Another risk is in the delivery of large CO_2 gas containers to the beverage factories. During transport or storage of the gas containers, there is always the risk of a thin crack or a damaged valve occurring causing gas to escape unnoticed.

Drinks which are not meant to be carbonized such as beer or wine also emit CO_2 during the fermentation process. The release of gas during the fermentation process is closely controlled. It is important to monitor the level of CO_2 in rooms where fermentation is occurring to ensure a safe working environment.

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