

Dissolved Ozone Measurement

In Bottled Water

Background

Ozone (O_3) is an unstable tri-atomic form of oxygen. It is a very strong oxidizing gas that is injected into water to remove organics that may contribute color, odor or taste. Most importantly, ozone sanitizes the water, rapidly destroying any microbiological contamination. Dissolved ozone reverts back to harmless oxygen in a matter of minutes, depending on the temperature and pH of the water, so it must be generated and measured very close to the process. A benefit of ozone is that it leaves virtually no harmful breakdown products.

Ozone generators operate by passing dry air or oxygen next to high voltage electrodes where a corona discharge converts some of the oxygen to ozone much as occurs in a lightning storm. That gas mixture is then contacted with the water, either in a tank diffusion system or in a pipe with venturi injector. Intimate contact is made to maximize the dissolution. There are newer generation techniques that can

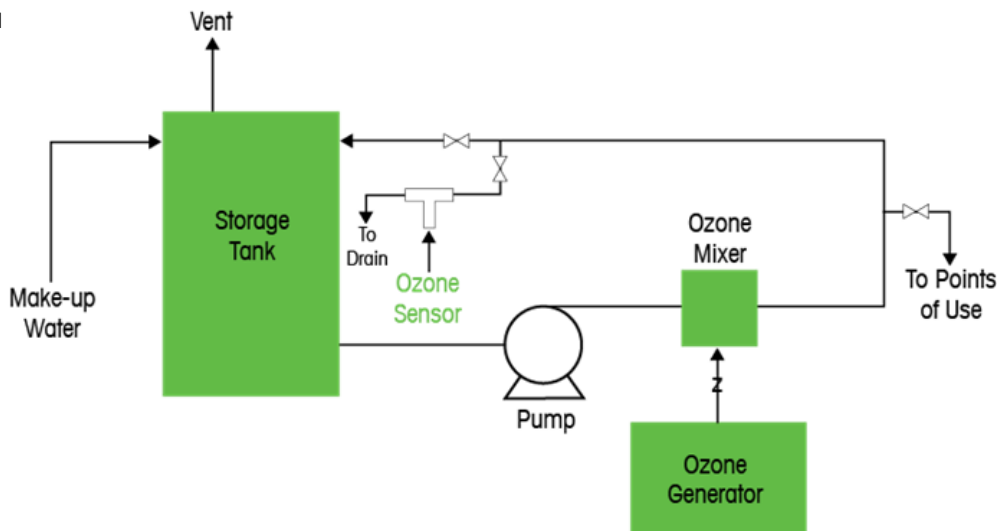
produce ozone directly in the water and reduce the possibility of atmospheric losses.

Ozonation of Bottled Water

Bottled water is most commonly of two types: mineral water which comes from a natural source and is not altered significantly, and purified water which is treated with reverse osmosis and other steps to adjust the mineral content. Both must be sanitized with ultraviolet light or ozone.

Bottled water processing has embraced ozone as the best way to sanitize the system, the water, the bottle and its seal to achieve the longest possible shelf life. For this application, a dissolved ozone concentration measurement is made to assure an adequate level of sanitization has been achieved. The ozone sanitizes and then dissipates inside the bottle. The ozone level allowed in bottled water by the US FDA is 0.1 to 0.4 mg/L (ppm).

Figure 1 - Typical bottled water ozonation system





Higher levels of ozone can be injected upstream, but excessive amounts are discouraged for several reasons. An excess of ozone requires venting and destruction to prevent escape to the atmosphere which can result in health hazards. Excess ozonation in mineral waters containing bromides will oxidize them to bromate which is a suspected carcinogen. Bromate is limited to less than 10 µg/L (ppb) by the US EPA for drinking water and by the FDA for bottled water. In addition, high ozone levels can cause deterioration of some polymer materials used in process systems and packaging.

Dissolved Ozone Measurement

For the reasons given above, on-line monitoring and control of ozonation have become standard practice. Dissolved ozone instrumentation is available ranging from sophisticated high cost, maintenance-intensive equipment giving good performance, to low cost, less

reliable equipment with flow sensitive readings. For measurements with excellent performance, high reliability and infrequent simple maintenance at reasonable cost, METTLER TOLEDO Thornton offers dissolved ozone measurement in a choice of six multi-parameter instrument platforms.

METTLER TOLEDO Thornton instruments can measure any combination of dissolved ozone, conductivity, pH, ORP, dissolved oxygen, and TOC. These measurements can be made with the transmitter and sensor combinations described in Table 1 below.

For cost-effective bottled water applications, a 2-channel M200 multi-parameter transmitter that measures dissolved ozone and pH or, if only dissolved ozone measurement is required, a 1-channel M200 transmitter is recommended.

Table 1

Transmitter	Sensor Accomodation
4-Channel M800 Water	2 Optical Dissolved Oxygen, plus 2 pH, ozone, TOC or conductivity
2-Channel M800 Water	1 Optical Dissolved Oxygen, plus 1 pH, ozone, TOC or conductivity
2-Channel M300 Water	2 pH, ozone, conductivity or amperometric dissolved oxygen
1-Channel M300 Water	1 pH, ozone, conductivity or amperometric dissolved oxygen
2-Channel M200	2 pH, ozone, conductivity or amperometric dissolved oxygen
1-Channel M200	1 pH, ozone, conductivity or amperometric dissolved oxygen

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