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Beverage Industry

OZONE: A powerful tool for sustainable plant sanitation

THE BEVERAGE INDUSTRY FACES IMPORTANT MARKET, ECONOMIC, societal and environmental challenges. For example, the rising costs of ingredients and energy are placing tremendous pressures on profits. Dwindling supplies of fresh water and corporate sustainability goals are yielding new operational challenges. In addition, consumer concerns regarding food safety require increasingly stringent and vigilant plant sanitation practices.

Ozone reduces the use of water, energy and chemical sanitizers

New approaches to beverage plant sanitation utilizing ozone-injected water hold the potential to increase the efficacy of plant sanitation while reducing the consumption of water, energy and traditional chemical sanitizers. These benefits can improve the utilization of plant and labor, which ultimately increase production efficiency, plant output and profitability.

Ozone has been used to disinfect municipal water throughout the world for more than a century. Ozone was also approved by the USDA for use as a disinfectant in 1996. In 1997, the FDA declared ozone to be "generally regarded as safe" (GRAS) and approved ozone for food contact in 2001. Since the 1970s, the shelf life of bottled water has been ensured through low-level dosing with ozone during bottle filling. As the awareness of the power and benefits of ozone grows, it is being applied to an ever expanding range of sanitation processes in produce, food, beverage and dairy processing.

But what is ozone? Ozone, the tri-atomic form of oxygen (O_3), is a very powerful oxidizer with twice the oxidizing potential of traditional sanitizers. In most food and beverage plant sanitation applications, ozone gas is dissolved into water through a process called mass transfer. Dissolved ozone — typically at a concentration of one to two parts per million (ppm) — is applied for one to five minutes.

Ozone destroys common pathogenic organisms through natural processes of oxidation, disinfection and decomposition to divalent oxygen (O_2). In these reactions, the third oxygen atom is transferred, with a large release of energy, from ozone to the molecule being oxidized. When ozone oxidizes molecules on the outer surfaces of microorganisms, the resultant energy transfer ruptures

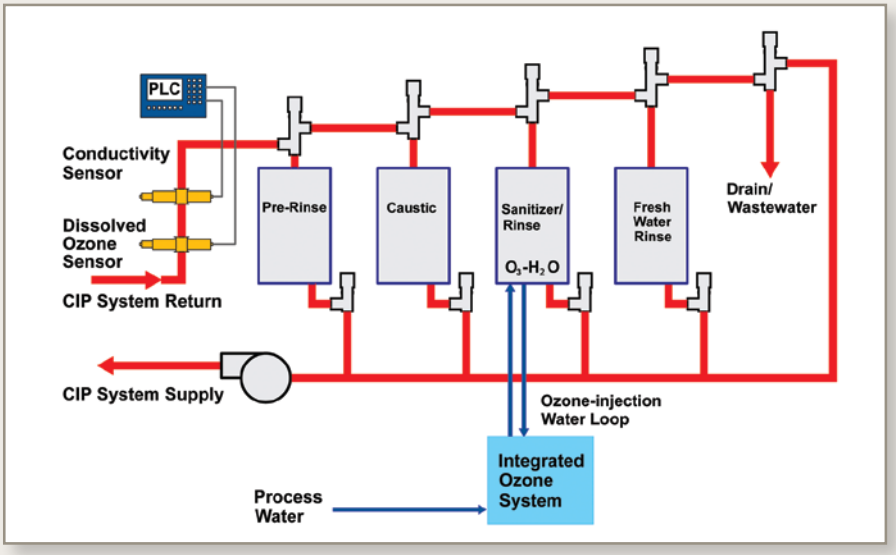

Diagram of an ozone-CIP system

the outer membranes of microorganisms and destroys the genetic material and proteins inside the cells.

The sanitizing and disinfecting power of ozone has been shown to increase the efficacy and effectiveness of beverage plant sanitation. In a recent pilot study at a soft drink plant, an integrated ozone system delivered ozone-injected water to an automated clean in place (CIP) system. Cold ozonated water replaced the traditional hot chemical sanitizer in the CIP protocol. Microbiological tests for a three-step ozone-CIP process were at 97 percent negative vs. 81 percent negative for a traditional five-step hot CIP protocol.

Ozone-enhanced sanitation uses less energy than traditional methods. Ozone is more stable and effective at lower temperatures. This property allows ozonated water to be applied at lower temperatures and effectively replace hot water and chemical treatments, as well as steam. Typical ambient water temperatures (60-75 degrees F) are ideal for ozone sanitation. The net effect has significant energy savings and a smaller carbon footprint. For example, the ozone-CIP pilot study discussed earlier yielded estimated annual energy saving of nearly $72,000.

Ozone-based sanitization also can reduce the chemical footprint of beverage plants by reducing the consumption of traditional sanitation chemicals and yielding few undesirable byproducts. Treating wastewater with ozone may also improve wastewater quality by reducing the chemical and biological oxygen demand.

Ozone-based sanitization saves water by effectively rinsing and disinfecting in one step without flavor carryover or residual chemical tastes and odors. In ozone-powered CIP systems, typically one or two rinse steps can be eliminated from the CIP protocol, decreasing water consumption by as much as 40 percent. Tastes, odors, and colors of preceding products and chemical sanitizers are effectively eliminated by ozone sanitation. After oxidation, ozone returns to normal divalent oxygen (O_2) with no after-taste or odor. Any residual ozone in the waste stream can be neutralized by exposing it to ultraviolet light.

Ozone-based sanitization also saves time. In the ozone-CIP pilot study, the CIP run time was reduced by two-thirds, from three hours to one hour. Line utilization and plant productivity was increased by significant reductions in sanitation process times and the elimination of CIP temperature ramp-up periods.

When all of theses benefits are taken together, it is readily apparent that ozone holds tremendous potential to provide truly sustainable sanitation for beverage and other industries. Ozone is powerful tool for beverage production. **BI**

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