Electro-Chemical Devices

Produce Washing and Clean-In Place Systems Disinfection Water Quality Analyzers

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Produce washing and equipment clean in place (CIP) systems play a vital role in food processing plants, ensuring that fruits and vegetables are clean and safe to eat after they are harvested, packaged and distributed to consumers. The failure to clean them or properly maintain clean equipment during their processing can lead to contamination from a variety of water-borne microbial pathogens.

Outbreaks of "food poisoning" from improperly washed produce or the failure to adequately clean handling equipment or contaminated process water can have deadly results. We've all read the headlines about produce recalls because of disease causing pathogens that are especially dangerous for people who are vulnerable to infection because of immature or compromised immune systems, including children, those with chronic illnesses and the elderly.

The Problems

The water used in produce washing (Fig 1) and food processing equipment cleaning processes is an especially important element in plant operations. Periodic water testing must be done to assure the quality of the incoming source, the effectiveness of the disinfection agents and the post process treatment of water that might be re-used and/or released back as plant effluent into the environment.

Figure 1. Produce Washing Systems

Without proper testing and analysis of the water component and levels of the disinfection agents with reliable liquid analyzers, the most sophisticated plant equipment is (unfortunately) going to be ineffective in preventing disease. For this reason, the principle of using clean water applies throughout the farm to table continuum, according to the U.S. Food & Drug Administration (FDA).

The FDA over past decades has issued a series industry guidelines and regulations to produce growers, processors, storage and distribution companies that are intended to keep produce free of the potentially contaminating sources of water-borne pathogens. Many of these complex regulatory requirements vary depending on the type of produce, from raw to fresh-cut, to cooked or canned and the actual type of plant and its equipment or processes.

In general, the FDA has stated that water used during the post-harvest handling of fruits and vegetables often involves a high degree of water-to-produce contact. Although water is a useful tool for reducing potential contamination, it may also serve as a source of contamination or cross-contamination.

Reusing plant process water without proper disinfection can, for example, result in the build-up of microbial loads, including undesirable pathogens from the crop. Plant operators should institute best industry practices to ensure that water quality is adequate for its intended use, both at the start, throughout and at the end of all post-harvest processes.

The FDA guidelines specifically recommend considering practices that will ensure and maintain water quality during produce washing processes. These practices include periodic water sampling and microbial testing, as well as changing water as necessary to maintain sanitary conditions, including the maintenance of sanitary water contact surfaces such as tanks, flumes, etc. These sanitary practices can include the use of antimicrobial chemicals in treatment water with chlorine and ozone both mentioned as effective treatment agents.

Solutions

Food processors have a variety of produce washing and equipment cleaning systems to choose from that are available from multiple manufacturers in the marketplace. Where necessary, the use of disinfectants such as chlorine, ozone, peracetic acid and other agents removes microbial pathogens from produce and assures process equipment remains clean.

The one thing all of these produce washing and equipment cleaning equipment systems have in common is the need to assure the water used is clean and that the disinfectants are at sufficient strength to do their job. Liquid analyzers (Fig 2) play an important behind-the-scenes role in maintaining plant water quality for the effective washing of produce and the cleaning of process equipment. They are

one of the go-to instruments that plant technicians rely on to monitor water quality in food processing plants.

Figure 2. ECD Analyzers for Produce Washing & Clean-in-Place Systems

While there any number of liquid analyzer manufacturers to choose from, the technologies, designs and manufacturing techniques do vary significantly. For example, the sensors of some analyzer manufacturers rely on consumable reagents in order to measure chlorine, ozone, pH and other industrial specific ions useful in determining water quality. Replacement reagents must be stocked, are expensive to purchase, take time to replace and require special handling for safe environmental disposal.

Chlorine Disinfection Analysis

High concentration chlorine (Cl_2) disinfection is utilized in a variety of food processing operations and produce packing lines. All of these Cl_2 disinfection techniques, however, require the introduction of liquid or solid Cl_2 into water tanks that are connected to washer or spray line systems.

Liquid chlorine and hypochlorites are generally used in the 50 to 200 ppm concentration range with a contact time of 1 to 2 minutes to sanitize produce surfaces and processing equipment. Hypochlorous acid (HOCl) is the form of freely available chlorine that has the highest bactericidal activity against a broad range of microorganisms.

ECD's FC80 High Range Free Chlorine Analyzer, for example, monitors free chlorine in produce disinfection supply water, cleaning and disinfection of water supply lines, and cleaning solution water samples from 0.05 – 200 ppm Chlorine (Cl_2). The FC80 offers a reagent-free design that is ideal for the monitoring Cl_2 levels in disinfection processes to help ensure the elimination of disease-causing pathogens including *E. coli, Cyclospora, Salmonella and* Hepatitis.

This analyzer's advanced panel mount design includes built-in flow control, which eliminates the need for complicated pressure regulators and rotameters. Built-in automatic pH compensation also eliminates

the need for expensive reagents to reduce maintenance and life-cycle costs.

Ozone Monitoring

Ozone (O_3) is a colorless to pale blue gas that in low concentrations gives off an irritating acidic odor. It is a strong oxidizer, stronger than either chlorine or chlorine dioxide. O_3 reacts quickly and disintegrates into oxygen gas without the formation of harmful disinfection byproducts (DPB's) common to chlorine disinfectants that require additional costly treatment. It also increases the amount of oxygen in the water. While its use is growing in municipal drinking water plants, other uses include food processing.

ECD's OZ80 Ozone Analyzer offers a reagent-less design for low operating costs and comes with a choice of three factory calibrated measurement ranges designed to help busy process engineers achieve accurate measurement with a simple system that can be up and running in less than 15 minutes.

Unlike conventional analyzers that come with multiple components that must be installed and then require field calibration, this analyzer is factory assembled and factory calibrated prior to arriving at the plant. All the technician needs to do is mount the panel and connect the drain lines, plug in the power cord and select the outputs on the display as 0 to 2.0 ppm for water disinfection or 0-20.00 pm for oxidation disinfection operations.

Peracetic Acid Analysis

Peracetic acid is a colorless liquid with a characteristic pungent odor similar to vinegar.
PAA is produced by a reaction between hydrogen peroxide and acetic acid. Produced typically as an equilibrium solution combining these agents, PAA is supplied in concentrations of 5 to 15 percent.

PAA is a powerful oxidizer that eliminates pathogens and is stronger than either chlorine or chlorine dioxide. It simplifies process monitoring to ensure disinfection without the need for potentially harmful disinfection byproducts (DPBs). It decomposes naturally into acetic acid and water and does not form a residual that has to be removed from the treated water.

ECD's PA80 Peracetic Acid Analyzer features multiple PAA measurement ranges: 0-20, 0-200 and 0-2000 ppm. Providing multiple measurement ranges allows plant engineers to select the monitoring range that best fits the requirements of their

product batch recipes, their processes and equipment cleaning requirements. Relying on precision amperometric PAA sensors that are flow sensitive, the PA80 provides accurate measurement with a minimum flow rate past the sensor of 0.5 ft./sec; above this flow rate the output is virtually flow independent.

Hydrogen Peroxide Analysis

Hydrogen peroxide (H_2O_2) is a strong oxidizing agent. This chemical is a colorless, bitter-tasting liquid, which smells similar to ozone. H_2O_2 is used as an alternative to chlorine due to its bleaching characteristics. Unlike chlorine, H_2O_2 has no toxic residue, and is the main choice when it comes to food process applications. H_2O_2 is soluble in water, so aqueous solutions of proper dosing are needed to meet food processing standards.

Hydrogen peroxide is used frequently in the food processing industries. Proper dosing of H_2O_2 is very important in maintaining a safe and healthy plant environment along with the output of products that meet cleanliness and purity standards. When H_2O_2 is handled properly, it is a safe and an easy to use chemical.

ECD's HP80 Hydrogen Peroxide Analyzer offers a wide range of measurements available, from ppm levels to percent levels. The HP80 comes ready to use out of the box in a simple panel mounted design. This design eliminates the need for the additional process sampling equipment needed on some hydrogen peroxide analyzers in the industry. The highly reliable HP80 ensures proper monitoring of hydrogen peroxide for food processing plant needs.

Conclusions

Maintaining water quality is essential in produce washing operations and in ensuring the proper cleaning of plant equipment. Liquid analyzers are the behind-the-scenes instruments responsible for ensuring proper levels of disinfection agents such as chlorine, ozone or peracetic acid are at sufficient strength. Without the reliable analysis of disinfection agent strength, the best processing equipment and facility employees are no match for water-borne pathogens.