A Clean Sweep

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Equipment plays an essential role in modern food production, and an effective and reliable cleaning regime is integral to maintaining optimum equipment function. Just as processing equipment continues to become more automated, so do the methods responsible for cleaning it.

In the past, cleaning crews have been responsible for dismounting and disassembling equipment before scrubbing machines down with sanitizing chemicals — a process known as clean out of place (COP). But today more advanced cleaning options are becoming available, making equipment sanitization easier and safer.

How CIP Works

Clean-in-place (CIP) systems are gaining ground in food facilities due to their ability to wash equipment safely with repeatable results. In simplest terms, CIP systems work by using existing pump systems to introduce a controlled amount of cleaning fluid into the equipment. CIP systems are commonly designed to clean using automated cycles, which normally include a pre-rinse, a caustic or acidic chemical wash, and a post-rinse, depending on the application.

Dana Johnson, brewery and produce specialist for Birko, says that a food company’s size will impact the CIP method used in the facility. “Smaller food and beverage companies will simply add water and chemicals into a vessel that needs to be

cleaned, re-circulate the cleaning chemicals and sanitizer through the spray nozzle with a pump, and then discard the solution when finished."

In contrast, Johnson says larger food companies often employ more advanced CIP systems, which dose chemicals in the proper concentration to their respective tanks. The tanks most often are hard-piped to the equipment that needs to be cleaned. In such cases, there are often two tanks: one for "clean" caustic and one for slightly used caustic that is designed for what Johnson calls "sacrificial cleaning." The first round of caustic removes contaminants — including bacteria and various buildups — from the equipment before being discarded. The equipment is then washed again with clean caustic. The second round of caustic is usually relatively clean and is generally recycled to a "dirty" caustic reservoir to be reused.

When implementing a new CIP system, it is crucial for companies to determine the effectiveness of the process and make any necessary adjustments. Plant operators should review factors such as the size of the vessel being cleaned, size and location of cleaning entry, possible internal obstructions, drain size, and existing pressure and flow capabilities of CIP pumps.

Johnson says one important method of determining the effectiveness of a CIP system is adenosine triphosphate (ATP) testing, which is used to test final rinse water to establish whether any remaining contaminants are present. If contaminants are detected in the final rinse water, the vessel or lines probably need to be re-cleaned.

Benefits of CIP

The most evident benefit of CIP equipment is that the process is automated, says Drew Delaney, Executive Vice President of Gamajet Cleaning Systems, Inc. "Automating the cleaning process provides repeatable, reliable cleaning results."

Removing the need for manual cleaning also enhances employee safety, says Robert Delaney, Chairman of Gamajet. "Confined space entry into the vessels is eliminated, thereby improving employee safety."

Equipment that cannot easily be cleaned by hand can be accommodated through CIP methods. Johnson says line hoses and fillers are often designed as CIP, as they cannot effectively be soaked or scrubbed manually.

In addition to increasing maintenance efficiency and plant safety, CIP equipment also can help manufacturers meet sustainability initiatives, as it often requires less water than foaming and rinsing methods. "In regards to the CIP process, the focus is to use less water, time, chemicals and energy to clean the process equipment," Drew Delaney says.

Specific Industry Applications

Breweries

Johnson says CIP equipment can be especially effective for cleaning brewery equipment such as kegs. Traditionally, brewers have used hot water and caustic liquid cleaning solutions to sanitize kegs. Caustics have been the cleaning solutions of choice for brewers because they are relatively inexpensive, can be reused and remove protein-based contaminants common to breweries.

Caustic solutions, however, are not most effective at addressing calcium and magnesium hard water scale deposits. Calcium oxalate, or beerstone, is of particular concern for brewers.

To remedy beerstone buildup, more brewers are turning to combined acid and detergent cleaning solutions, Johnson says. “[Acid and detergent cleaning] is working very well to remove soil from kegs.”

Unlike caustic solutions, acid and detergent are not neutralized by carbon dioxide, and acid and detergent recycle much better than caustic, as the soil does not substantially neutralize the acid, Johnson says.

Beerstone is more effectively removed by acid than caustic, so the acid-detergent combination better removes and prevents beerstone from returning. “The bottom line is that keg cleaning with acid and detergent is not only very effective, it is very cost effective as well,” Johnson says.

Frozen Foods

More frozen food companies are beginning to invest in CIP equipment, says Paul Osterstrom, Vice President of Sales Support and Competence Centre of Americas for GEA Refrigeration North America, Inc.

“As food safety requirements have increased due to recalls and increased demands for food safety, [food companies] are realizing that hygiene as a part of frozen food environments is critical, so they are making the investment in CIP equipment,” Osterstrom says.

Installing CIP equipment in frozen food processing facilities can have numerous benefits, including improved cleaning consistency and thoroughness. Osterstrom says utilizing CIP systems can also help food manufacturers close deals with customers. “If food processors can show potential customers how well food is stored and frozen, especially the cleanliness of the environment, it will really help [them] win the sale.”

While CIP offers many benefits, there are special considerations that need to be made before placing new systems alongside existing freezing equipment. For instance, a new CIP system may not work properly with an existing freezer.

Osterstrom recommends that companies purchase a freezer designed specifically for CIP. Such freezers should be welded with non-hollow structures and seamless welded stainless steel enclosures. Features such as a re-circulating, “dishwasher-type” system help ensure optimum cleaning, Osterstrom says.

Items to Consider

Food processors looking to bring CIP equipment into their facilities should consider all possible risks, Johnson says. Often 180°F caustic solution, which can be hazardous to employees if a line bursts or a spill occurs, is used during CIP processes.

Biofilm, or bacteria clusters, can sometimes build up in vessels, tanks and lines, which can “lead to shelf-life issues and, in some cases, a health threat to the consumer, depending on the kind of food or beverage being produced,” Johnson says.

In general, the benefits of CIP outweigh the risks, Drew Delaney says. “In many cases, the alternative to CIP is much more dangerous. Manual cleaning can place personnel in a dangerous environment during the cleaning process.”

Once a company decides to incorporate CIP into its plant, the possibilities are virtually endless, Drew Delaney says. “Any tank or vessel where product is mixed or

stored is a

viable application for CIP.”

Some of the most common equipment designed for CIP include:

1. Process vessels.
2. Holding tanks.
3. Ribbon blenders.
4. Bins.
5. Totes.
6. Barrels.
7. Drums.

CIP options range from simple spray balls to rotary impingement devices, Drew Delaney says, but he suggests manufacturers consider all options in order to select the most cost-effective solution for their plant.

“Many times, the least expensive solution will end up costing more money over the long term due to wasted resources and high costs of operating the equipment,” he says. “Complete cost of ownership should be evaluated to ensure the solution is sustainable over time.”

Processors automating their cleaning processes using CIP should seek expert advice to help determine the right chemicals, pumps, valves, hoses and spray nozzles for their specific equipment.

One of the most important steps when incorporating CIP into a facility is to check regulatory requirements, Osterstrom says. Manufacturers should review cleaning requirements not only for every food application, but those specific to the type of food being processed.

Ultimately, consumer health is of the utmost importance when it comes to choosing a CIP solution, Osterstrom says. “Food safety and the wellbeing of our fellow consumers is the primary consideration.”

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