

Pollution Prevention for Clean-in-Place Systems for Food Manufacturing

Cleaning and maintenance of equipment in food manufacturing facilities is critical for food safety. It has associated costs, and environmental impacts due to water, energy and chemical discharge. This resource summary provides basic tips to reduce pollution from clean-in-place procedures in the food processing industry.



Clean-In-Place Systems

Clean-in-place (CIP) systems are widely used in the food and beverage industries. They make the cleaning and sanitation of tanks, pipelines, and process equipment easier by providing a process that requires no dismantling of the equipment.

Pollution Prevention (P2) Practices

Implementing P2 practices for CIP systems can lead to decreased natural resource and toxic chemical usage, decreased waste generation, and cost savings for your company. These types of practices begin with optimizing your CIP systems, choosing environmentally friendly chemical alternatives, and improving mechanical systems and pieces, where available, to reduce the burden on CIP systems.

Optimizing CIP Systems - There are several risks to inefficient CIP practices and systems such as decreased food sanitation and safety, increased production downtime, and increased usage of water and energy.

To be sure the CIP system is operating at peak efficiency consider implementing a monthly company performance audit and a third party performance audit if one has not been done recently. Effectiveness of CIP systems relies on many factors, but a few to be aware of include¹:

- Optimal solution temperature.
- Overuse of cleaning chemicals. Consider using an automatic dosing system to reduce the risk to employees and prevent the overuse of caustic cleaner, thereby minimizing the amount of cleaner purchased and discharged in waste water.
- Optimize cleaning cycle length and integration with production schedule to prevent down-time.

Multi-Use CIP Systems - Multi-use CIP systems cycle chemicals and water for reuse or treatment in a semi-closed system. This saves water, energy, and chemicals. When using this type of CIP system, use high pressure hoses or mechanical means to remove product during pre-CIP.²

Consider adding a tank to recover final rinse water to be used as the next cycle's initial rinse water. Cleaning reagents can also be recovered and renewed if sent to a recovery tank after CIP cycle and then passed through a filtration system.²

Pigging³ - The use of new pigging technology can decrease the burden on CIP systems, in turn decreasing the amount of chemicals and natural resources used during CIP procedures. Look into emerging pigging technologies such as flexible vane pigs, ice pigging, and air pigging to reduce the amount of product lost inside pipelines. Most pigs can be seamlessly integrated into CIP systems if current piping is compatible.

Environmentally Friendly Alternatives - Use non-traditional cleaning and sanitation methods for use on food contact surfaces, as approved by the FDA, such as ozonation where ozone-enriched water kills microbes as effectively as chlorine.^{4,5} Another alternative is the use of electrochemical activation (ECA) in place of caustic soda, acids, and sanitizers.⁶ Both of these options can reduce your toxic chemical use.

Success Stories: P2 in Food Processing

Tulkoff Food Products, Inc.,⁷ a manufacturer of various condiments, partnered with the Maryland MEP to identify and reduce various water, energy, and solid waste streams. This resulted in about \$100,000 and 3.85 million gallons yearly savings due to water conservation efforts alone.

Merrimack Ales,⁸ a microbrewery, tested ECA technology to potentially replace tank cleaner, acids, and sanitizer used in cleaning and sanitizing equipment during CIP processes. They found that it was possible to eliminate both from the process, excepting quarterly cleanings. Switching to the new technology would save over 50 percent in cost for chemicals, water, and energy. Along with cost savings, ECA would reduce the use of both the sanitizer and acid cleaner to quarterly cleanings which would reduce the use of acids, including nitric acid which is a Toxics Release Inventory listed chemical.



References

- ¹ Deakin University. *Clean in Place - A Review of Current Technology and its Use in the Food and Beverage Industry.*
- ² Hatlar Group. *Clean-In-Place Best Practices Guidelines.*
- ³ JHED. *Challenges in the Hygienic Application of Pigging Technologies to Maximise Waste Reduction in Food Manufacture.*
- ⁴ Food Engineering. *Tech Update: Clean-In Place Equipment.*
- ⁵ Jackson, James R. and Enriquez, Arturo. *Optimization of CIP Process for Ozone Sanitization Retrofit.*
- ⁶ ECA Consortium. *Benefits of ECA.*
- ⁷ Maryland Manufacturing Partnership (MEP). *Pollution Prevention Site Assessment (Tulkoff Food Products, Inc.).*
- ⁸ Toxic Use Reduction Institute. *Microbrewery Tests Less Hazardous Cleaning and Sanitizing Technology.*

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