ETHANOL EDGE

Phibro EthanolPerformanceGroup

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PROCESS CLEANING AIDS

Fermentation experts agree a proper Cleaning-in-Place (CIP) process can help maximize a plant's profitability, by reducing the cost of chemicals and increasing alcohol production. But, how do you know if your CIP process is maximized? What if you could save money and potentially increase your plant's ethanol production?

In this issue of Phibro's Ethanol Edge, we will explore the importance of CIP and how cleaning aids can improve CIP results.

Cost of Poor Cleaning

High concentrations of carbohydrates and sugars in the mash produce a perfect environment for bacteria growth. Bacteria, small by nature, hide in nooks and crannies and in imperfections on surfaces that look smooth to the naked eye. Even more troublesome are plate and frame heat exchangers, which provide large surface areas for bacteria to hide and multiply.

If bacteria levels are not maintained at acceptable levels, ethanol production drops. For example, a 2% drop in yield would cost a 100 MM gal/yr plant $ 3 MM per year (@ $ 1.50/gal) in lost revenue. It's a costly problem, but one that is manageable. Your Phibro representative can work with you to check the estimated cost of bacterial levels in your plant using Phibro's cost calculator.

The CIP Process

The CIP process relies on contact time, concentration and the temperature of a caustic solution (e.g., sodium hydroxide) to kill bacteria left behind once the fermentation cycle is complete. CIP kills bacterial populations so the next fermentation cycle starts with low bacterial levels.

In most modern ethanol plants, the CIP process is automated and starts with a 50 percent solution of caustic pumped to a tank and diluted with water until it reaches 5 percent caustic concentration by volume. The diluted solution is heated to a temperature of 180° F; circulated through process lines and heat exchangers that carried mash/stillage and then forced through spray nozzles contained within the fermentation vessel. The circulation segment typically lasts for two hours. After this, the caustic solution is removed during a rinse cycle, which is critical because any caustic solution left will negatively affect the yeast when the propagator is dropped to the fermenter.

What Reduces CIP Effectiveness?

Here are a few things to keep in mind to prevent an ineffective CIP:

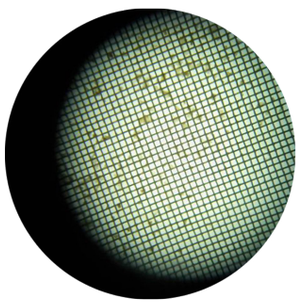
- Plants with less automation rely on close oversight of each element of the CIP process. Timing and chemical rates can vary and, therefore, decrease the effectiveness of the process.
- Mechanical issues, such as plugged spray nozzles or failed pumps, can cause problems and affect whether a complete CIP cycle is performed.
- Caustic strength is not checked on a consistent basis.
- Formation of biofilms can significantly reduce CIP effectiveness. When a biofilm is established, a plant may have to disassemble equipment and conduct a manual cleaning to completely remove the source of bacterial

contamination. Often, biofilm contamination is not discovered until a plant is shutdown for extended maintenance procedures.

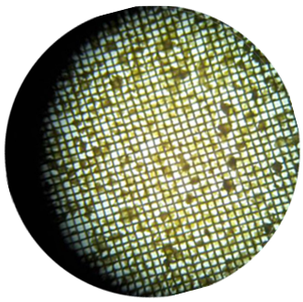
Depending on the price of caustic, a 100 MM gal/yr plant will spend $300-$500 K per year in caustic ($350 per dry ton).

Improving Your CIP

The concept of utilizing a wetting agent has been around for a long time. Recently, Phibro's Ethanol Performance Group has seen the positive effects that wetting agents can have in a CIP at ethanol plants. Wetting agents, such as nonionic or anionic surfactants or detergents can be safely added to the CIP process. Wetting agents work by improving the penetration of the caustic soda. Aqueous-based solvents, such as caustic, are sometimes repelled by deposits that are hydrophobic. This repellency to water is the same phenomenon that causes surface tension and allows insects to walk on the surface of water. Reducing the surface tension allows the caustic to enter grime deposits separating them from the metal. These detergent additives can also improve the ability of caustic to remove all foreign material, including some types of biofilm.



TREATED WITH CA-286 UNDER LOW MAGNIFICATION.



TREATED WITH CAUSTIC ONLY UNDER LOW MAGNIFICATION.

An ethanol plant can receive a number of benefits by incorporating a wetting agent in the CIP process.

Benefits include:

- Lower rate of infections: Biofilms are a constant source of reinoculation for infections that affect an ethanol plant's productivity and profitability.
- Higher ethanol production: If a plant's CIP process cycle time can be reduced without lowering its effectiveness, then a greater output of ethanol may be attainable.
- Reduction in antimicrobial use: Antimicrobial use is a direct function of bacterial infections caused in part by poor cleaning.
- High ROI: A 20 percent in caustic use (5% to 4%) for a 100 MM gal/yr plant, may result in a savings in excess of $ 74 K/yr .

Plant Capacity - 100 MM Gal/yr	
Cost of caustic (50%)	$0.09/LB
5% caustic solution for CIP	$402,000/YR
Total CA-286 usage	4,000 LBS/YR
Estimated Annual Cost of CA-286	$6,300/YR
Reduction of caustic usage with dosage of 100 ppm CA-286	20%/YR
Estimated Annual Net Savings with CA-286	$74,000
**Calculation based upon actual usage in ICM designed plant. This is for illustration purposes only.*	

The use of process cleaning aids is not new. Process cleaning aids are commonly used in cleaning process vessels used in the food industry. Their use in ethanol production is growing and more evidence of their positive effects is coming to light.

Phibro's Ethanol Performance Group is proud to bring another solution for maximizing fermentation. We now offer our own process cleaning aid, CA-286. It is another tool that customers can rely on to reduce harmful microbial growth in ethanol plants. CA-286 is available by contacting your Phibro representative or by calling 800-223-043