

Improving the bottom line

U.S. Water suggests alternatives for traditional cleaning methods utilised in fuel ethanol production

Bacterial issues in a fuel ethanol production plant can have expensive consequences, including increased chemical costs and, eventually, revenue lost. It is common practice for plants to employ a clean-in-place (CIP) programme to protect the product against bacteria.

A traditional cleaning aid in fuel ethanol production is a 3-5% caustic solution (sodium hydroxide) used to reduce and remove organic fouling and soil residual from the cook and fermentation process. A sodium hydroxide cleaning programme can be successful in minimising bacterial overgrowth during fermentation as it removes the food source of the bacteria, without directly targeting the bacteria. A plant's efficiency can also improve by removing the bacteria's organic layers that form on the surface of

exchangers and coolers.

Although adequate, sodium hydroxide does have its drawbacks. The spent CIP solution is typically diluted out in the process and the residual sodium left behind recycles through the process again and again, increasing sodium levels. Studies show that high concentrations of sodium can cause yeast inhibition. It is not known specifically what the tolerance level of sodium is, but many believe that levels of 500 parts per million (ppm) can be toxic to yeast. Sodium hydroxide is also limited by temperature due to potential negative metal interactions with carbon steel pipes and tanks.

A proven solution

In an effort to identify an alternative to sodium hydroxide-based solutions, U.S. Water conducted a trial

at a 50 MMY plant over the course of three weeks with the goal of eliminating the need for 5% caustic in the plant. The trial's cleaning solution of an iodine complex (U.S. Water's ProClean 253) was developed and incorporated into the CIP programme. The trial solution was utilised to clean the plant's mash trains A and B, prop tank, fermenter fill lines, headers and fermentation vessels via spray balls. As with spent CIP

in sodium hydroxide solutions, the spent iodine solution was returned to the tank. The tank was tested for iodine levels after each cleaning and refreshed with a dose of iodine complex to bring the tank back to the target ppm for the next cleaning. As displayed in Figures 1 and 2, and Table 1, there were no changes in the fermentation process overall.

Figure 1 shows that lactic acid production during the trial of the ProClean 253 was very

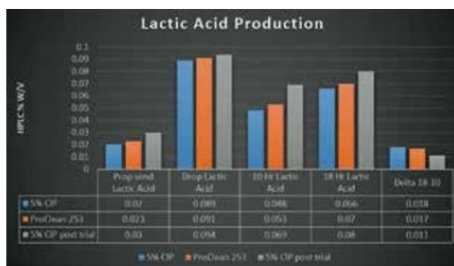


Figure 1. Bacterial control

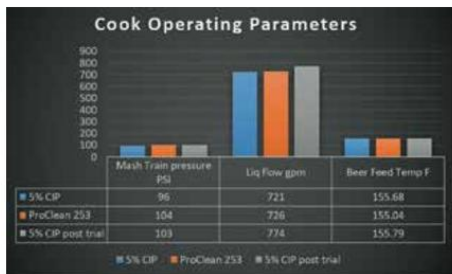


Figure 2. Cook process parameters

similar to the pre-trial 5% CIP readings. Post-trial 5% CIP values were also very similar.

Figure 2 indicates there were also very few changes in the performance of the mash trains. Pressures did not increase significantly and beer feed temperatures were the same.

As the trials above indicate, there was no significant change in the overall fermentation results or in the performance of

the heat exchangers/mash coolers. Sodium levels were also lower during the trial period. A cost saving of 66% on an annual basis can be seen when removing 5%

Sodium in ppm	Liquefaction	Beer well	Syrup
Pre-trial	154	421	1,796
Trial	73	212	879
Post-trial	130	323	1,345

Table 1. Sodium levels in process

caustic from the process and replacing it with a 2,000 ppm dosage of ProClean 253.

Margins in the ethanol production world are currently low and fluctuate with the ever-changing fuel and grain markets. Reducing input costs and increasing yields are more important than ever to help improve the bottom line of any plant's financial statement. By using an alternative solution for bacterial control to improve fermentation efficiencies, producers can reduce organic fouling and soil, reduce the sodium load in fermentation, and reduce chemical costs.

U.S. Water's ProClean 253

- Cleaning aid comprised of an iodine complex, as well as a surfactant
- Can be used as a post CIP rinse or as a CIP replacement
- Can reduce residual soil after CIP
- Reduces the probability of infection during the critical start-of-fill of propagators and fermenters
- Can inhibit the formation of mineral scales
- Low-foaming when applied as directed
- Will not harm *S. cerevisiae* when applied as directed
- Concentrated for efficient handling, storage and shipment. ●

For more information:

This article was written by Jennifer Braun, technical field manager at U.S. Water. Visit: www.uswaterservices.com



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