USP technologies™
Solutions for a clean environment

CASE STUDY
INDUSTRIAL

INCREASED EVAPORATOR PERFORMANCE: STUBBORN SCALE REMOVAL USING HYDROGEN PEROXIDE

Project Scope

USP Technologies and a sugar beet processing plant in the US developed a cleaning strategy to use high concentrations of hydrogen peroxide to remove year-over-year burnt on scale inside multi-phase plate pack evaporators. This scale had caused reduced evaporation performance which resulted in evaporation becoming the rate limiting step in the sugar production process. Five plate pack evaporators were cleaned over a two-year period, resulting in increased sugar production. USP provided turn-key solution including chemical supply & inventory management, custom-built equipment, and local & remote technical support.

Background

Scale deposition in evaporators impedes heat transfer, slows processing, and can lead to degradation of product. Even after standard cleaning methods have been used (caustic wash, back-boiling, mild acid wash, and physical scrubbing), scale can persist and accumulate to make evaporation the rate limiting step of sugar beet processing and can require the replacement of the fouled heat exchange units. Plate pack evaporator fouling has limited mechanical cleaning methods and requires aggressive chemical cleaning methods that are effective in low or no flow conditions. To supplement caustic cleanings, a novel cleaning strategy using hydrogen peroxide in combination with surfactants/solvents was evaluated as a non-capital solution to remove scale buildup inside the evaporators.

Solution

The plant decided to implement a cleaning strategy using hydrogen peroxide to remove the organic scale. This approach was chosen due to hydrogen peroxide's ability to dislodge tough-to-remove scale by creating a physical scrubbing action on heat exchange surfaces.

$$H_2O_2 + contaminant \rightarrow O_2 + H_2O(Steam) + Heat$$

Method

Scale loss on ignition analysis and bench scale testing demonstrated localized reaction of hydrogen peroxide. Multiple methods and cleaning procedures were evaluated using high concentrations of hydrogen peroxide; critical operational and safety considerations were addressed prior to implementation.

In general, the cleaning method was to add water to the evaporators and begin recirculation. Then the peroxide was added to the desired concentration. Samples were collected throughout to monitor reaction progress. Once the cleaning solution had reached boiling temperatures, residual peroxide quickly drops to <50 ppm and the unit is left to cool before emptying the unit to wastewater.

Results

Over a comparable period, average evaporation rates in 2020, 2021, and 2022 were 579, 625, and 638 tons/hr, respectively; a 10% increase in a two-year period. In 2021, these improvements were used to realize a 6.5% increase in slice rate and in 2022 these improvements are helping to extract a higher percentage of sugar from existing beet crop with high water evaporation rates.

Conclusion

The use of hydrogen peroxide in the evaporator cleaning process proved to be an effective solution for the sugar beet processing plant. By removing organic scale from the evaporators, the plant was able to increase efficiency and sugar recovery, leading to significant financial benefits. This case study demonstrates the potential benefits of utilizing hydrogen peroxide in cleaning processes for organic scale buildup.

Because of the significant safety & operational considerations associated with this cleaning strategy, USP and our sugar factory partners believe it is critical that anyone wanting to do a similar cleaning to use a supplier intimately aware of the use of high concentrations of hydrogen peroxide.

Before

After

About USP Technologies

USP Technologies is the leading supplier of peroxygen-based technologies and services for environmental applications. We have been serving the water, wastewater, and remediation markets for over 20 years and have offices and field service locations throughout North America. Our consultative approach to problem solving includes application assessment, technology selection and development of a tailored treatment approach. Our full-service programs successfully integrate storage and dosing equipment systems, chemical supply, inventory and logistics management, and ongoing field and technical support. This approach provides cost-effective, "hands-off" solutions to our customers. USP Technologies also can provide access to experienced application partners for a turn-key program encompassing engineering, site characterization and technology selection, program implementation, execution, and report generation.

Getting Started

We look forward to supporting your treatment needs, whatever the scale. To obtain a streamlined treatment solution tailored to your specific project, give us a call at (800) 851-8527.

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