

Vegetable Processor Discovers Unique Benefits of Safe and Reliable Chlorine Dioxide Disinfection System



GOAL

- » Achieve lower Listeria levels and reduce bacteria counts in frozen spinach and vegetable products.
- » Improve the safety and reliability of the plant's disinfection program.

SITE

A mid-Atlantic spinach and vegetable processing facility.

HISTORY

A mid-Atlantic spinach and vegetable processor utilized a disinfection program that included chlorination with calcium hypochlorite ($\text{Ca}(\text{OCl})_2$) tablets for primary vegetable wash and flume steps. After blanching, the disinfection protocol was followed with 2% stabilized chlorine dioxide (ClO_2) in the flume and a final spray application of ClO_2 directly onto the product before the freezing process. While the facility's disinfection protocol maintained bacteria counts within acceptable levels, customers requested that the counts be lowered so they could pursue more profitable market opportunities within the prepared foods segment of their industry.

The processing regimen coupled with seasonal factors also presented a challenge when it came to ensuring that the existing disinfection program remained consistent. As a result, there were variations in product quality between the spring and fall seasons. Finding a more effective disinfection program would not only provide greater reliability during the time-sensitive processing seasons, it would satisfy customer demand for higher quality products that could be marketed in the more profitable cold-blending market.

The Problem

Today, vegetable processors are being asked to help their customers eliminate the cook step in many prepared foods. Customers are willing to pay more for products that meet higher quality standards. If the vegetable processors can provide a product with ultra-low bacteria counts, their customers can eliminate cooking and proceed directly to a cold-blend step for prepared microwavable foods and foods reheated in applications where sanitization is not always achieved. Eliminating the cook step not only saves energy, it also reduces the labor, equipment and time required for the extra processing.

When asked to provide a higher quality spinach product, the mid-Atlantic processor turned to Bolinski Consulting, LLC in Medford, New Jersey. After reviewing the existing process and application goals, Bolinski teamed with Water Dynamics in Whippany, New Jersey, and introduced the processor to PureLine's Pure ClO_2 TM Electrochemical HP-40 Generator. Pure ClO_2 Electrochemical Generators produce 99.5% pure chlorine dioxide that is ideal for disinfection.

The Solution

PureLine's Pure ClO_2 HP-40 Generator was selected to replace both the calcium hypochlorite and the 2% stabilized ClO_2 product at the plant. The Pure ClO_2 HP-40 Generator produces up to 40 lbs/day of pure ClO_2 gas that can be pumped to multiple injection points within the plant. Unlike older, inefficient and labor-intensive chlorine dioxide technologies that require multiple-chemical precursors and are notoriously unreliable and difficult to maintain, PureLine's electrochemical generators use a single precursor chemical to dramatically improve reliability, safety and purity.

PureLine's unique, patented electrochemical generators use a safe and economical liquid chlorite solution to produce 99.5% pure, chlorine-free chlorine dioxide. In addition, electrochemical technology actually uses very little electricity. The HP-40 can produce 40 lbs/day of ClO_2 from a single-phase, 30-amp circuit costing about \$7.00 to \$8.00 per day in electrical operating costs.



Pure ClO_2 TM HP-40

Pure Results

PureLine's PureClO₂ Electrochemical HP-40 Generator immediately replaced the dry calcium hypochlorite process and eliminated multiple open batch-mixing tanks. It also eliminated the daily labor associated with maintaining the dry mix system. Moreover, eliminating the dry Ca(OCl)₂ improved overall EH&S by eliminating the inhalation hazard associated with dry Ca(OCl)₂, reduced chemical handling and eliminated the corrosivity of the open calcium hypochlorite batch tanks and piping in the plant.

Pure chlorine dioxide from the HP-40 generator also replaced the 2% stabilized chlorine dioxide product that was used after blanching in the flume and as a final spray before freezing. A 1.0 ppm dose of chlorine dioxide improved primary wash and pre-blanch flume disinfection so dramatically that the plant was able to eliminate the final spray application with 2% stabilized ClO₂, thus reducing maintenance and enhancing process reliability.

Unlike other oxidizers, chlorine dioxide is a strong yet selective oxidizer that works over a wide pH range. Chlorine dioxide oxidizes, it does not chlorinate. Chlorine dioxide's superior disinfection strength comes from the availability of five electrons versus two electrons available with chlorination. It also has a unique selectivity for many of the chemical bonds associated with bacteria. These bonds include amino acids containing sulfide groups, phenols, and di-sulfide bonds essential for protein synthesis.

In contrast, chlorine and hypochlorite work by producing hypochlorous acid through a pH sensitive reaction. When present, the hypochlorous acid attacks nearly every organic and inorganic species present, including plastic, mild and stainless steel process piping. Only PureLine's unique electrochemical ClO₂ generation technology produces chlorine-free ClO₂ so it is far less corrosive to stainless steel and other soft metals in the plant. As a result, the plant hopes to see a long-term reduction in the maintenance of wear parts due to lower corrosion rates associated with ClO₂.

In addition to realizing the desired process benefits, it was discovered that the ClO₂ was an excellent replacement for Ca(OCl)₂ previously used for well-water disinfection. In water treatment, ClO₂ is able to disinfect without reacting with organics and contributing to the formation of halogenated byproducts such as THM. Moreover, like chlorination, chlorine dioxide is also able to oxidize ferrous iron to ferric iron—an issue in many well waters, including this application.

CONCLUSION

By using PureLine's Pure ClO₂ Electrochemical HP-40 Generator, the spinach processor has successfully lowered Listeria and overall bacteria counts, and achieved its goal of meeting market demand for higher quality, Listeria-free spinach. Using PureLine's chlorine dioxide technology, the plant has seen a consistent and reliable improvement in the facility's overall bacteria counts. Chlorine dioxide has facilitated the optimization of plant processes, which in turn have eliminated several labor-intensive steps such as calcium hypochlorite mixing and spray bar maintenance. Chlorine dioxide has also proven to be an effective disinfectant in other areas of the plant—including process and well-water treatment. As a result, the plant is investigating the use of additional generator capacity for cooling tower disinfection and waste treatment odor control in an effort to further simplify and improve plant processes using chlorine dioxide.



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