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Food Processing - Meat Packaging

OZONE APPLICATIONS IN A READY-TO-EAT MEAT PROCESSING PLANT

This Pennsylvania plant, producing 25,000 lbs/day of ready-to-eat (RTE) meats, wanted to lower the levels of microorganisms on processing equipment and plant surfaces, and on the surfaces of processed food products (fresh and smoked pork sausage, bacon, skinless and natural-casing wieners, lunch meat, and hams). The existing process used an organic acid (sodium lactate) for sanitation. Ozone was tested for efficacy and cost savings, with singular success, and was installed full-scale in 2004.



THE OZONE SYSTEM

Ozone is dosed to recirculating water at 3.5 mg/L (ppm) ensuring a residual 2.0 ppm aqueous ozone level, thus providing the required reduction in microorganism levels in a short time (>30 seconds). The water storage tank contains an electronic dissolved ozone monitor/controller, set at 2 mg/L minimum and 3.0 mg/L maximum dissolved ozone. This maximum dissolved ozone concentration helps prevent ozone off-gassing at the points of use inside the plant.

Ozonation system plumbing is sized to return unused ozonated water to the storage tank within five minutes after water has left the tank. This ensures that aqueous ozone levels at the spray nozzles are maintained at or above 0.55 mg/L.

OZONE APPLICATIONS

Ozone-containing water now is used to cleanse equipment surfaces for pre-operational and in-process sanitation, in-process antimicrobial product washing (casing soak, product spray), for post-lethality treatment (of cooked foods), and wash-down of drains to control growth of *Listeria monocytogenes*.

Water containing a minimum 0.55 mg/L of ozone is used for the following purposes :

- Equipment sanitizer (hard surface)
 - Pre-operational sanitation
 - In-process sanitation
- In-process anti-microbial product wash
 - Casing soak
 - Product spray (showering)
- Post-lethality product treatment

As the product moves along the conveyor, it is sprayed at several locations with ozone-enriched water at low pressure (10-20 psi) to ensure good soaking, allowing ozone-enriched water to slowly flow over the surface, while killing surface microorganisms.

Ozone also can be used in conjunction with quaternary ammonium sanitizer as necessary, the sequence being: clean; rinse with ozone-containing water; then rinse with quaternary ammonium sanitizer (at 400 ppm).

OZONE BENEFITS

Adopting aqueous ozone has allowed replacement of older potable water sprays on processing belts. Ozone (having no residual effect on equipment or meat being processed) reduces/prevents bacterial build-up on production belts and prevents surface contamination of meat products, simultaneously eliminating the need for chemical sanitizers.

Washing with ozone-containing water does not affect organoleptic qualities of RTE meat products nor is the plant production rate affected by the ozone system.

Improved Antimicrobial Performance Due To Ozone

The figure below summarizes the average Adenosine Tri-Phosphate counts in 2003 (before ozone) vs those in 2004 (after installing ozone).

Cost Savings Due To Ozone

The centralized ozone system installed in 2004 for hard surface and direct product sanitation at a total installed cost of \$50,000 has been realizing \$124,000 annual savings just from elimination of organic acid. The equipment payback time (or ROI) was just over 4.84 months. Additional savings due to ozone include: reduced purchases of other chemicals, handling, reporting, and automatic operation. Ozone-washed products are USDA-organic approved, and there are no residual chemical byproducts.

HACCP PROCEDURES AND OZONE

The plant has adopted HACCP (Hazard Analysis Critical Control Points) procedures, as required for all meat processing plants, with the following ozone procedures now included:

Length of Product Exposure – Minimum 30 seconds contact time with all surfaces (meat products and equipment).

Ozone Concentration in Water – Minimum 0.55 ppm aqueous ozone concentration at points of application.

Pressure at Spray Nozzles – Minimum water flow at nozzles: 10 psi, measured at the point of application.

Spraying of ozone-containing water is conducted through non-shear, high flow, low pressure spray nozzles operated at 10-20 psi (validated periodically per plant HACCP procedures). Under these conditions, ozone does not de-gas from the water sprays.

The HACCP Critical Control Point is 2.0 ppm (mg/L) DO₃ (dissolved ozone) at 30 seconds (Ct value = 1.0 mg-min/L). The minimum level ensures that dissolved ozone levels at or above 0.55 mg/L are maintained at the nozzles. This concentration of dissolved ozone to be sprayed has been certified to provide an average 1.5 log reduction of *Listeria monocytogenes* on RTE meats (Buege et al., 2004).

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