Ozone Used in the Chicken Farm

Abstrac

Bacterial contamination is a major concern in the food industry. Even small amounts of *Salmonella, Campylobacter,* and other microorganisms can cause widespread illness after an infected product enters the market. Because of this, there are many guidelines and procedures in place to minimize potential contamination in food processing plants. Ozone is becoming more widely used in farms and factories to prevent contamination. Because of its reactivity, it is a very effective sanitizing agent, killing a larger percentage of microorganisms than other common disinfectants such as chlorine and formaldehyde.

Background

Campylobacter is a gram negative rod-shaped bacterium. It thrives in moist, reduced-oxygen conditions. It is carried in the intestinal tracts of livestock, especially chickens, making it a major cause of bacterial diarrheal illness. Exposure to air, drying, and low pH can hinder the growth and spread of *Campylobacter* (Curtis and Butler). Freezing can deactivate the bacteria, but it doesn't kill them with a return to room temperature, so heating is a more effective mode of killing and preventing the spread of *Campylobacter*.

Ozone is becoming a prevalent method of preventing *Campylobacter* contamination in the poultry industry. Ozone is a molecule composed of three oxygen atoms. It can act as an oxidant and disinfectant (Spartan Water Treatment). Ozone readily decomposes to O_2, producing a very reactive free oxygen atom, which can cause lysis, the disintegration of bacterial cell walls. It is produced by exposing oxygen (either from air or in its pure form) to radiation, causing an oxygen to break off from the rest of the ozone molecule. Because of the short-lived nature of ozone, it must be generated on-site, leading to higher operating costs than other modes of disinfection. Despite some drawbacks, ozone's strength as a disinfectant has

led to its increased use in wastewater treatment and produce and livestock decontamination. (Boglarski and Telikicherla)

Points of Contamination

As few as 500 *Campylobacter* – the equivalent of 1 drop of contaminated raw chicken juice can cause illness in a person. **(**Keener, Bashor, Curtis, Sheldon, and Kathariou) This makes it crucial to limit the contamination and spread of *Campylobacteria* in poultry. Because the bacteria live in the intestinal tract of chickens, the major source of contamination is through exposure to feces. Pre-harvest, an infected chicken can quickly infect the rest of the population. After slaughtering, there are numerous possible points of contamination, including fecal contamination of the skin and feathers, intestinal breakage, and exposure to contaminated equipment or other infected carcasses. In addition, defeathering and scalding the carcasses opens up follicles, giving *Campylobacter* a place to hide from further methods of cleaning. After slaughtering, the birds are washed and immediately chilled. This becomes yet another potential point of contamination of the poultry.
Ozone can be put in the water that chickens drink as well as in the surrounding air. This produces healthier chickens, as it ensures that they are not infected by unclean water. Earth Safe Ozone measured the effects of its UltraPur ozonation system on three different farms, with an average flock size of 80,000 each. Several parameters including % of birds alive, average weight, and bacteria count were measured a year before and after the installation of the UltraPur system. The percent of birds alive rose from an average of 96.1% to 97.2%, which is an increase of about 900 chickens. The average chicken weight rose from 4.05 lbs to 4.15 lbs. The total bacteria decreased from over 100 ppm to less than 2 ppm. The decrease in total bacteria shows the effectiveness of ozone as a sanitizer, while the increase in average weight and % alive shows that ozone also makes the chickens healthier overall (Earth Safe Ozone).

Another major use of ozone in the poultry industry is in disinfection of the carcasses post-harvest. Ozone will not only kill *Campylobacter*, but all other known pathogens as well. Ozone is sprayed directly on the carcasses, the transportation equipment, and cutting utensils. In addition to its disinfecting properties, ozonated water is also sprayed on machinery to minimize filth residues from fats, oils, and grease. Since ozone produces no harmful byproducts, machinery does not require further rinsing after sanitation. This in turn makes it a safe alternative to formaldehyde and chlorine for the workers applying the ozone disinfectant. An ozone disinfection system is easy to implement in current processing plants as it can be put into any existing gas or aqueous dispensers.

Because of ozone's reactivity, it is also much more efficient and effective at decontamination. J.C. Morris developed a lethality coefficient to show the effectiveness of ozone as a disinfectant. The lethality coefficient is determined by the residual concentration and the length of time required to kill 99% of microorganisms. The higher the lethality coefficient, the stronger the sanitizing effects of the disinfectant. For enteric bacteria, ozone has a lethality coefficient of 500, while chlorine (in the form of hypochlorous acid) has a value of 20. Other methods of chlorination even lower lethality coefficients. This demonstrates that, in a shorter time frame, ozone can kill a larger percentage of microorganisms than the alternatives (Spartan Environmental Technologies).

Conclusion

Pathogens have been and will continue to be a major issue in the food industry at all levels, especially *Campylobacter* with its ability to spread with ease and extremely low amount required to cause illness. Whether the disease is at the farm, at the slaughterhouse, or in the transportation/distribution centers millions of people could be at risk. Ozone provides a relatively easy alternative for cleaning or decontaminating the poultry and the equipment used on the poultry, especially since it can be included with almost any pre-existing aqueous or gaseous substances used in sanitation. It is worth noting though that the company should take efforts to figure out approximate amounts of ozone required, as a way to reduce both unnecessary ozone costs and unintended remnants of ozone particles or free oxygen atoms. In the long run, ozone is generally a healthier sanitation substance than most other substances currently being used in the food industry and it is well worth the extra cost for its efficiency.