PROCESSING TIP...

EFFICACY OF ANTIMICROBIAL PRODUCTS USED DURING PROCESSING

Antimicrobial compounds have been used for disinfecting products and equipment surfaces for many years. Some of the antimicrobial compounds that have been approved for use are: hot water, steam, lactic acid spray, acetic acid spray, citric acid spray, trisodium phosphate, chlorine dioxide, aciduluted sodium chlorite, and sodium hypochlorite (bleach). Hot water is generally not used with poultry products because hot water can scorch surfaces, resulting in a "cooked" appearance. This is especially crucial if the end product is to be deboned unfrozen or fresh breast fillets. Steam pasteurization procedures have recently been developed and have been shown to be very effective against bacteria; however, applying steam to individual carcasses moving down a processing line at 70 to 140 carcasses per minute is challenging. Thus, the industry has been slow to incorporate this type of treatment.

Organic acids are excellent for killing bacteria because they penetrate and disrupt the cell membrane and dissociate the acid molecule, thereby acidifying the cell contents. They are stable in the presence of organic material, such as blood or feces and they are fairly inexpensive to use. Acids are susceptible to water pH problems (such as high incoming water pH), they may cause product defects, such as off flavors, odors, and colors, even when used at low levels. Additionally, organic acids may corrode equipment.

Trisodium phosphate (TSP) is fairly new to the market and is becoming more widely accepted and used, because the USDA is encouraging its use within the industry. TSP is costly to use because of the quantity needed to disinfect carcasses. There are negative aspects to using TSP in poultry processing plants that should be considered. Residual TSP on carcasses causes the chiller water pH to increase dramatically. In plants where TSP is used, the chiller water will generally be in the pH range of 9.7 to 10.5. This is extremely high and completely eliminates the ability of chlorine to become its effective form, hypochlorous acid. Hypochlorous acid forms most effectively when water is in the pH range of 6.5 to 8.0. Thus, plants using TSP may as well be dumping their bleach down the drain. This is not a desired situation because chlorine is very effective against Salmonella. In fact, plants in the Southeastern U. S. that have installed a TSP system have often seen their Salmonella prevalence increase when compared to levels prior to using the TSP. This is most likely due to the TSP washing Salmonella off of one carcass and it is then able to spread to other carcasses. Scientists have reported that Listeria monocytogenes is resistant to the effects of trisodium phosphate (TSP), and exposure to a high (8%) level of TSP for 10 minutes at room temperature is required to reduce bacterial numbers by 1
log10 after a colony has grown on a surface and a protective layer (biofilm) has been formed.

Chlorine dioxide has been evaluated in processing plants and seems to be effective for killing bacteria at very low concentrations; however, it is expensive to generate and very difficult to maintain at a particular concentration in chiller water. Some USDA inspection personnel have been reticent to allow its use in plants.

Acidulated sodium chlorite has recently been approved for use and high concentrations (1,100 ppm) are permitted. To this date, very few poultry companies have embraced this chemical as a suitable disinfectant for product surfaces because it has only recently been approved.

Sodium hypochlorite (bleach) is by far the most widely used chemical sanitizer in the poultry industry. It is excellent for killing bacteria and is inexpensive; however, as mentioned previously, it forms its most effective bacteriocidal agent, hypochlorous acid, in the pH range of 6.5 to 8.0. Thus, when used in combination with a TSP system, bleach is generally ineffective. Chlorine is inactivated in the presence of organic material. Residual blood and feces in the chiller can greatly affect how well chlorine is able to kill bacteria on carcass surfaces. It is essential to maintain proper flow rate in the chiller to reduce organic material sufficiently to allow the chlorine to be effective.

Other compounds that are currently being investigated as to their effectiveness for destroying pathogenic bacteria include: hydrogen peroxide, ozone, periacetic acid, cetylpyridinium chloride, and sodium bisulfite to name a few. Although these compounds are effective at killing bacteria, if improperly used, they may have a detrimental effect on sensory qualities. Off-flavors, colors, and odors, are often the result of improperly used antimicrobial treatments. Some antimicrobial compounds such as organic acids, ozone, hydrogen peroxide, and chlorine may damage processing equipment surfaces and may be a problem with regard to worker safety. Moreover, many of these novel compounds are expensive to use and may be difficult to generate or maintain at an appropriate level.

The factors that influence sanitizer effectiveness are exposure time, concentration, temperature, water hardness, how firmly bacteria are attached to the product, whether or not the bacterium has produced a biofilm, the pH of the water, and the presence of fat or other organic material (blood or feces). Bacterial death when exposed to a sanitizer follows a logarithmic pattern. Ninety percent are killed during a particular unit of time. The next 90% are killed in a similar unit of time. This leaves only 1%, which are difficult to kill. Bacterial factors may also affect how well a sanitizer is able to kill the organism. The age of the bacterial cell, whether the cell can form spores and other physiological factors all affect how destructive a sanitizer may be to a particular bacterium. In general, death rate increases as environmental temperature increases. High temperatures lower surface tension, increase pH, and decrease viscosity, allowing the sanitizer to be more effective. Small changes in pH can affect the sanitizers ability to kill bacteria. Chlorine and iodine significantly decrease in activity as pH increases (becomes more alkaline).

Sanitizers that are not compatible with iron, calcium, and magnesium salts cannot be used with water containing these minerals. Generally, these sanitizers must be mixed with water that has less than 200ppm Ca or a chelating agent must be used.

Selecting the appropriate disinfectant is often a difficult decision. New products are continually being produced and approved for use; however, food companies must carefully weigh the advantages and disadvantages of sanitizers prior to instituting use. Often, price is a major component of the decision because cost may be prohibitive for many companies and they will not choose it. This area of research is expanding and the search for the "magic bullet" chemical will continue as companies face ever increasing challenges from the public, interest groups, and the media to produce "pathogen free raw product". To date, there is no "magic bullet" chemical; however, proper use of the available antimicrobial chemicals will ensure continued production of safe, wholesome poultry products.

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**Consult with your poultry company representative before making management changes.**

“Your local County Extension Agent is a source of more information on this subject.”