Post Processing Pasteurization of Processed Meats

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Introduction

Listeria monocytogenes became recognized as a foodborne pathogen in the early eighties. After several foodborne outbreaks the federal regulatory agencies established a "zero tolerance" for *L. monocytogenes* in ready-to-eat products. These events precipitated a new mindset by the meat industry that sanitation did not just involve food-contact surfaces, but rather the cleaning and sanitizing of the whole plant environment was necessary. Efforts to eradicate *L. monocytogenes* often involved clean room type sanitation standard operation procedures (SSOP's). These include rooms with positive air flow, sanitizing dips for hands and footwear, donning special clothing, and restricting access. Even with these, an occasional low level incidence of *L. monocytogenes* contamination can occur. Recent foodborne outbreaks and product recalls due to *L. monocytogenes* contamination have refocused the meat industry on potential post-processing intervention technologies. Post-processing intervention technologies would be used in an attempt to reduce or eliminate the hazard for those meat products that are unavoidably handled after the initial thermal processing. Potential technologies include: UV light; antimicrobial films, irradiation, non-thermal processing methods such as pulsed electric field (PEF), oscillating magnetic fields (OMF), and high pressure processing (HPP), and thermal processing methods using steam or hot water. The status, benefits, and potential of each of these technologies will be discussed.

Post-Processing Intervention Technologies

UV Light

High intensity UV light can be used in either a continuous or pulsed application. UV light has the potential for microbial surface reduction on foods, packaging materials, and food contact surfaces. It is effective against a broad spectrum of microorganisms. Complex or irregular-shaped food surfaces may possess light blocking folds or fissures that protect microorganisms from exposure.

Antimicrobial Packaging

Several studies have reported the use of antimicrobial compounds either incorporated into or coated onto packaging films. Antimicrobial films are proposed as a means to provide an antimicrobial compound in direct food contact to extend shelf life through microbial spoilage and/or pathogen reduction. Another proposed use involves self sanitizing films that would reduce packaging as a source of microbial contamination. The ideal antimicrobial would be one that has broad spectrum antimicrobial activity, activity at low concentrations, thermostable for extrusion, controlled migration, no organoleptic effects, not inactivated by the food, and is inexpensive. Unfortunately, only a limited number of antimicrobial compounds have regulatory approval for use in foods, and these compounds are often more effective when added directly to the food product than through a film application.

Irradiation

Irradiation involves subjecting the food product to ionizing radiation either as gamma rays, E-beam, or X-rays. It can be effective against all microorganisms and could be used to post-pasteurize food products. There are considerable economic, logistic, sensory, packaging, and regulatory hurdles to overcome before irradiation will be widely used. Economic and logistic hurdles involve either the expense of building a radiation unit or transporting all food products to an existing unit. There are only a limited number of packaging materials that can be irradiated. Irradiation is currently only approved for use with raw meat and poultry. Use on processed meats is not approved and would require a food additive petition for approval.

Non-Thermal Processing - Pulsed Electric Field

Pulsed electric field (PEF) involves subjecting the food product to a high electric field (35 to 75 kV/cm) pulse between two electrodes for a short period of time (pulse equals 1 to 4 microseconds). PEF can be performed in a continuous flow and is most suitable for low viscosity, homogeneous liquid products (i.e., juices). Generally intended as a pasteurization

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effect at product temperatures < 50°C and with a total treatment time of 30 to 400 microseconds. PEF is most effective against vegetative cells and less effective against spores.

Non-Thermal Processing - Oscillating Magnetic Fields

Oscillating Magnetic Fields (OMF) is an emerging technology that can inactivate microorganisms and denature some enzymes in either fresh or prepared foods. The technology involves subjecting the food to high energy OMF while generating minimal heat within the food. Potential applications involve solid and liquid foods in a flexible packaging. Currently, there are no commercial applications in use.

Non-Thermal Processing - High Pressure Processing

High Pressure Processing (HPP) involves subjecting food products to a non-thermal extremely high hydrostatic pressure treatment (typically 70,000 to 130,000 psi or 500 to 900 Mpa). It is currently available as a batch or semi-continuous process. HPP is used to provide a pasteurization process because it is effective against vegetative microorganisms, but less effective against spores. Extreme pressures and slightly elevated temperatures have been shown to reduce *Clostridium botulinum* type E spores. HPP provides uniform pressure throughout the food product and retains food flavor/nutrients while providing a shelf life extension. Commercial applications involve jams, jellies, juices, guacamole, and sliced processed meats in Europe.

Thermal Processing - Steam or Hot Water

Post-packaging heat treatments (typically referred to as post-pasteurization) have long been used for whole muscle products that are unavoidably handled after the initial thermal processing (Beckwith, 1995). Cryovac investigated the effectiveness of post-packaging heat treatments on shelf life extension and pathogen reduction in 1986, and was issued a post-pasteurization Statutory Invention Registration (DeMasi and Deily, 1990). Post-packaging heat treatments generally involve heat treatments of 160° to 205°F for time periods varying from 30 seconds to 10 minutes. Initial tests were performed to examine various time and temperature treatments efficacy on spoilage organisms that directly influence product shelf life. Use of CN530 and certain post-pasteurization treatments proved beneficial in controlling the microbial counts and extending the product shelf life by destroying surface organisms and/or extending the lag phase through microbial injury (Figures 1 and 2). This generated interest in determining the effectiveness of these treatments on pathogen reduction and a second phase of testing was initiated. *L. monocytogenes* was surface inoculated on a cured ham product and subjected to various post-packaging heat treatments. Results showed that exposing the surface of a cured ham product to 205°F for either one or two minutes resulted in a 1 to 2 log reduction of *L. monocytogenes* (Figure 3). However, in no instance did the post-packaging heat treatments completely destroy all viable *L. monocytogenes*. Therefore we can not recommend that the treatments investigated in this study be used to ensure the safety of the food product, only as a means to extend shelf life. In addition, several other reports have shown the effectiveness of post-packaging heat treatments on reducing microbial populations (Cooksey, et al., 1993; Hardin, et al., 1993).

Typical post-packaging heat treatments will not inactivate all organisms. Therefore, they should be used as a tool to increase the quality and shelf life of products that are unavoidably handled after the initial heat processing. Post-pasteurization heat treatments should not be viewed as a method to correct for unsanitary practices and good manufacturing practices must be maintained throughout processing.

References

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