Research Project: Non-Thermal and Advanced Thermal Food Processing Intervention Technologies

Location: Food Safety Intervention Technologies Research

Title: *Inactivation of avirulent Yersinia pestis in Butterfield's Phosphate Buffer and Frankfurters by UVC (254 nm) and Gamma Irradiation*

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Technical Abstract: Yersinia pestis is the causative agent of plague. While rare, pharyngeal plague in humans has been associated with consumption or handling of meat prepared from infected animals. The risks of contracting plague from consumption of deliberately contaminated meat are currently unknown. Gamma radiation is a penetrating form of electromagnetic radiation while Ultraviolet C (UVC) Radiation is used for decontamination of liquids or food surfaces. Gamma radiation D-10 values, the radiation dose needed to inactivate 1 log of pathogen, were 0.23(0.01) and 0.31(0.03) kGy for avirulent Y. pestis inoculated into Butterfield's Phosphate Buffer or onto frankfurter surfaces, respectively, at a temperature of 4C. A UVC radiation dose of 0.25 J/cm2 completely inactivated avirulent Y. pestis suspended in Butterfield's Phosphate Buffer. UVC radiation doses of 0.5 - 4.0 J/cm2 inactivated 0.97 - 1.20 log of the Y. pestis surface-inoculated onto frankfurters. Y. pestis can easily be inactivated in aqueous solution by both gamma and UVC irradiation. A low gamma radiation dose of 1.6 kGy could provide a 5 log reduction, while a UVC radiation dose of 1-4 J/cm2 would provide a 1 log reduction, of Y. pestis surface-inoculated onto frankfurters.

Interpretive Summary: Yersinia pestis is the bacterium that causes plague, and the risk of contracting plague through the consumption of food that has been deliberately contaminated is currently unknown. In this work we investigated the ability of gamma and ultraviolet radiation to inactivate avirulent Y. pestis in a buffer solution and on the surface of frankfurters. A relatively low gamma radiation dose of 1.0 kGy, and a low ultraviolet radiation dose of 0.25 J/cm2 completely inactivated Y. pestis in a buffer solution. A relatively low radiation dose of 1.6 kGy could inactivate 99.999 percent of Y. pestis on frankfurters, while a modest ultraviolet radiation dose of 4 J/cm2 can inactivate greater than 90 percent of the bacterium on frankfurter surfaces. This work will help food processors and federal action agencies protect the nation's food supply.

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