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CHEMICAL AND BIOLOGICAL ENGINEERING DEPARTMENT SEMINAR SERIES

Decontamination of Milk by Pulsed UV Light and Infrared Heating

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Time: Wednesday, October 29; 3:15 – 4:30 pm

Location: Perlstein Hall Auditorium

Abstract

Food-borne diseases are estimated to cause approximately 76 million illnesses, 325,000 hospitalizations, and 5,200 deaths annually in the United States leading to several billion dollar loss. Conventionally, heat treatment is used for inactivation of pathogenic and spoilage microorganisms in food. Increased consumer demand for fresh-like foods and industries' thirst to minimize the total cost of food processing, propel researchers to investigate the efficacy of various novel food processing technologies for enhancing food safety. Currently, the efficacy of high pressure processing, pulsed UV light, pulsed electric field processing, infrared heating, microwave radiation, pulsed electric field, magnetic field, and ohmic heating are being investigated by researchers around the world. This presentation will be focusing on the efficacy of pulsed UV light and infrared heating for inactivation of Staphylococcus aureus (a pathogenic microorganism) in milk.

Pulsed UV light refers to the broad-band spectrum in the wavelength range of 100 to 1,100 nm. It is proved to inactivate microorganisms up to six times faster than continuous UV light. In this study, pulsed UV light completely inactivated Staphylococcus aureus in milk. Pulsed UV light is also proved to reduce milk allergens and increase vitamin D content. Therefore, pulsed UV light can serve as a potential milk pasteurization technique which can: i) inactivate milk allergens, ii) inactivate pathogenic microorganisms, and iii) enhance vitamin D content.

The inactivation mechanism of pulsed UV light was also investigated using transmission electron microscopy and Fourier transform infrared spectroscopy in order to better understand the process. The results indicated that pulsed UV light treatment can effectively inactivate Staphylococcus aureus. Even a 5-sec exposure to pulsed UV light resulted in structural damages (damage to the cell wall, cytoplamic membrane damage, leakage of cellular contents) to the bacterial cell.

Far-infrared radiation (3 to 1,000 μm) can be successfully used for inactivation of pathogens, as the absorption of energy by microorganisms and food components is high in this region. Infrared heating of milk resulted in up to 8.41 log10 CFU/ml reduction in the population of Staphylococcus aureus. Therefore, infrared heating can also be potentially used for milk pasteurization. Infrared heating is proved to be cost effective as it can reduce the energy consumption up to 44% for various food products compared with conventional heating.

In conclusion, the results showed that pulsed UV light and infrared heating can be potentially used for milk pasteurization with further optimization. These technologies are also expected to be effective against various pathogenic microorganisms present in other food products.