New engineering solutions for pathogen control in low moisture foods

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The outbreaks associated with milk powder, crackers, peanut butters, spices, and chocolates over the past decade have created emerging concern over safety of low moisture foods. But the food industry experienced difficulty in developing effective pasteurization for those products. Experimental evidents have shown when dehyrated bacterial bathogens, such as Salmonella, are extremely tolurant to thermal treatments, the thermal processing conditions designed for high and intermediate moisture foods are not more effective for low moisture foods. These bacterial bathogens can also survive for months or even years in most low moisture foods. There is a need for foundmanal understanding about the influence of key factors on thermal resistance of bacterial pathogens in order to design and validate thermal treatements for low moisture foods.

This presentation provides a summary of recent results from our research on thermal inactivation of Salmonella and a surrogate, E. faecium, in low moisture foods. Our research consisted of three major components: 1) determining water activity (aw) of different food matrices over a range of temperatures to establish relationships between product moisture content, aw, and temperature; 2) determining thermal resistance (D values) of Salmonella and E. faecium in low moisture foods as functions of temperature and aw; 3) using the above knowledge to develop and validate thermal processing based on radio frequency heating and controlled high relative humidity.

Our studies show that aw of food generally increases with temperature. But aw of oil decreases sharply with temperature. aw of food matrices at treatment temperatures (not measured at room temperature) is a determinant factor on thermal resistance (D values) of bacterial pathogens. At a fixed temperature, D value for Salmonella and E. faecium in difference matrices increased exponentially, by up to 100 fold, with reduction of aw measured at treatment temperature from 0.7 to 0.2. The above results explain the difficulty in thermal activation of bacteria pathogens in foods having low aw at elevated temperatures and in oil-rich products. Our studies demonstrated that relative humidity at high temperatures can be used as a control parameter in designing thermal treatment operations for pathogen control in low moisture foods.