2019 Reciprocal Meat Conference– Meat and Poultry Safety

Meat and Muscle Biology™

Efficieny of Phage Intervention Against *Salmonella* in Meat and Poultry Processing

B. De Vegt[1]*, S. Sirdesai[1], R. Peterson[1], M. Pinheiro[1], W. Nuboer[1], A. Kan[1], and J. Van Mierlo[1]

[1]Micreos Food Safety, Micreos, Wageningen, the Netherlands
*Corresponding author. Email: b.devegt@micreos.com (B. De Vegt)

Keywords: bacteriophage, ground turkey, parts, poultry processing, *Salmonella*
Meat and Muscle Biology 3(2):142

Objectives

Pathogen Reduction, Hazard Analysis, and Critical Control Point systems final rule mandates establishments to seek and adopt antimicrobial interventions that can help in reducing the prevalence and most probable number of *Salmonella* in their meat and poultry products. Bacteriophages can aid in this challenge, as they can invade and kill specific target pathogenic bacteria on food products. Effective kill by phages relies on the appropriate phage application technique. Correct dose, good distribution on the food surface area, and adequate dwell time are key factors which influence phage-bacteria contact and thereby phage efficacy. This study determined the efficacy of a commercially available phage product, PhageGuard S consisting of 2 phages, FO1a, and S16. Different pick up levels, blend and hold times (chosen based on regulatory restriction and process limitations), as well as spray versus dip treatment methods were tested.

Materials and Methods

Overnight culture streptomycin resistant *Salmonella enterica enterica* Enteritidis C (Se13) was diluted and inoculated at a concentration of 2×10^4 CFU/cm^2 or CFU/g on parts of chicken fillet and held for 10 min for bacterial attachment (duplicate samples per time point). Subsequently, contaminated parts were spray treated with one phage concentration (108 Plaque Forming Units/g) at 0.5%, 1% or 3% pick up (v/w) or water (control) and blended for 5, 10, and 20 min before immediate grinding and retrieval of bacteria (latter blend time sample was held for 24 h before grind). Another set of contaminated fillet parts were treated by dipping in 5% phage solution (at 1% pick up, 10^8 PFU/g) and held for 1, 5, 10, and 20 min, and 1 and 24 h at 40°F (4°C) before retrieval of bacteria. Enumeration of bacteria was done on selective agar plates and reductions were calculated relative to water treated control.

Results

The application of phages 10^8 PFU/g via spray on chicken parts at 3% pick up and 20 min blend time resulted in 0.9 $\log_{10}$ CFU/g log reduction of *Salmonella*. Additional hold time of 24 h before grind resulted in 1.1- 1.2 $\log_{10}$ CFU/g kill at lower and higher pick up of 0.5% and 3%. Dip treatment resulted higher *Salmonella* reduction of 1.2 $\log_{10}$ CFU/cm^2 within 5 min of 10^8 PFU/cm^2 phage application and up to 2.3 $\log_{10}$ CFU/cm^2 $\log_{10}$ reduction when held for 24 h. Overall, the spray technique, showed a dose response effect where increasing pick up and blend time resulted in an increasing *Salmonella* kill in ground product. However, the dip technique resulted in more effective *Salmonella* kill in shorter dwell time. All values are mean value of two individual experiments.

Conclusion

The above results indicate that the commercially available phage solution, PhageGuard S, either via spray or dip method reduces *Salmonella* contamination on meat and poultry parts by 1.2 to 2.3 $\log_{10}$, respectively. Thereby is an effective intervention in reducing risks and allowing for increase in consumer safety. Dip technique works better than spray due to better distribution on meat surface. Longer hold and/or blend time after phage treatment results in more kill.