Control of *Salmonella* and *Listeria monocytogenes* on peaches through spray-bar brush bed sanitizer intervention

Contact

Meijun Zhu, PhD
Washington State University
School of Food Science
509-335-4016
meijun.zhu@wsu.edu

Authors

Xiaoye Shen, Yuan Su, Mengqian Hang, Jeanene Deavila & Meijun Zhu

Project funding dates

January 1, 2023 – December 31, 2024

Acknowledgements

We would like to extend our sincere gratitude to Mr. George Nikolich and the California stone fruit industry for their invaluable input, support, and provision of peaches. We also acknowledge the dedicated team of graduates and staff from WSU for their contributions.

Summary

Recent outbreaks of *Salmonella* and *Listeria monocytogenes* linked to the consumption of peaches and other stone fruits posed serious health risks to consumers and caused huge economic loss for the industry. These outbreaks highlight the potential for foodborne pathogens to survive and persist on stone fruits during production, processing, and handling. This is particularly concerning for fresh stone fruits like peaches, which do not undergo a kill step before consumption. While sanitizing agents are commonly added to peach spray wash water, there is limited knowledge about the practical efficacy of current antimicrobial interventions for reducing pathogens on fruits. The main objective of this study is to assess and validate critical operating parameters for commercially used sanitizers against *Salmonella* and *L. monocytogenes* on peaches.

Objectives

1. Validate the efficacies of selected sanitizers against *Salmonella* and *Listeria monocytogenes* on peaches.
2. Verify the selected sanitizer interventions in representative commercial peach packing lines in California.

Methods

The selected variety of peaches will be inoculated with a 3-strain of either *Salmonella* or *L. monocytogenes* cocktail. After 24 hours, the inoculated peaches will undergo treatment with commonly used brush-bed sanitizers, including chlorine, chlorine dioxide, and peroxyacetic acid, at the industry-standard concentration ranges and contact time. The fidelity of *E. faecium* NRRL B-2354 as a surrogate of *L. monocytogenes* and *Salmonella* on peaches during brush bed spray wash will be verified through bench-scale and a pilot-scale spray-bar brush-bed system. It will then be used as a non-pathogenic surrogate for in-plant validation of spray bar sanitizer intervention on peaches in three enrolled peach packing operations in California to verify the lab-based effectiveness of selected sanitizers in controlling the pathogens.

Results to Date

Figure 1 shows that total plate counts and yeast/mold counts of received batches of peaches were comparable. The research team developed a standardized protocol for inoculation, establishment, and enumeration of the bacteria on peaches to ensure a comparable initial inoculation level of ~5.7 log10 CFU/peach (**Figure 2**). A contact time of 30 sec with chlorine at 50 ppm and 100 ppm reduced *L. monocytogenes* populations on peaches by 0.92 and 1.79 log10 CFU/peach, respectively (**Figure 3**). Chlorine at 50 ppm had similar efficacy against *Salmonella*, *E. faecium*, and *L. monocytogenes*. Chlorine at 150 ppm was slightly but significantly less effective against *Salmonella* and *E. faecium* than against *L. monocytogenes*, resulting in reductions of 1.73 and 1.71 log10 CFU/peach, respectively (**Figure 3**).

Benefits to the Industry

This study will provide the industry with science-based recommendation on the best process parameters and standard operating procedures. The outcomes will also establish a framework for validated process controls and verification of standard operating procedures that can be implemented by the stone fruit industry to ensure compliance with FSMA Preventive Controls requirements.

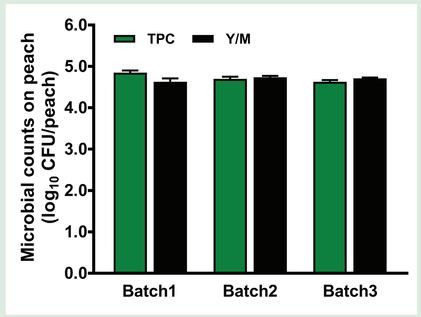

Figure 1. Resident microbiota of receiving peaches. TPC: total plate counts; Y/M: yeast/mold counts. Mean ± SEM, n =10.

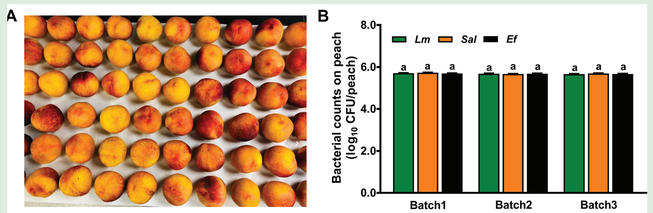

Figure 2. Initial bacterial inoculation level on peaches. A) Representative images of inoculated peaches; B) bacterial counts of inoculated peaches. *Lm: L. monocytogenes*; *Sal: Salmonella*; *Ef: E. faecium*. Mean ± SEM, n =10. a Means among bars without common letters differ significantly ($P < 0.05$).

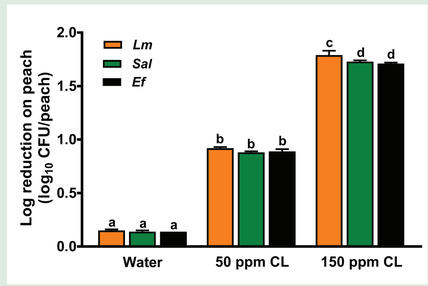

Figure 3. Antimicrobial efficacy of chlorine against *L. monocytogenes*, *Salmonella*, *E. faecium* on peaches at a 30-sec contact time. CL: Chlorine; *Lm: L. monocytogenes*; *Sal: Salmonella*; *Ef: E. faecium*. Mean ± SEM, averaged from three independent experiments, 10 peaches per treatment within an independent study. a-d Means among bars without common letters differ significantly ($P < 0.05$).