

S-294 Annual Report (for 2007)
Summary of Research Activities at ISU
May, 2008

Institution

Iowa State University

Names of S-294 Researchers

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Introduction and Research Objectives

Our research focus is on developing and evaluating novel approaches for enhancing the microbial safety and quality of fresh and fresh-cut vegetables and rapidly detecting pathogens on these products.

Objective 2: Evaluate and control unintentional or intentional microbial contamination of fresh and fresh-cut produce

Research is being conducted on applying foodgrade chemical sanitizers, and low dose irradiation for killing pathogens on the skin surface of cantaloupes to reducing contamination of the fresh-cut fruit. Hydrogen peroxide, selected surfactants or organic acids alone or in combination are being tested for destroying human enteric pathogens on cantaloupe, apples, lettuce, seed sprouts and almonds. Sequential applications of various chemical sanitizers and electron beam irradiation are also being evaluated to destroy pathogens on the outer rind surface of cantaloupe. In addition, a combination of flow cytometry and fluorescent molecular probes is being used for rapid detection of human enteric pathogens including *Salmonella* in seed sprouts.

We have recently developed a method combining a simple adhesive tape-based method of surface sampling with fluorescence *in situ* hybridization (FISH) for the rapid detection of *Salmonella* spp. on tomato surfaces. *Salmonella* spp. were easily detected on tomato surfaces in less than 2 h, with a sensitivity of 10^3 - 10^4 *Salmonella* cells per cm^2 . Additional enhancement in sensitivity was obtained after short (8 hr) solid-phase enrichment on selective (XLT-4) agar.

This proof of concept work highlights the potential for tape-FISH to provide rapid, cost-effective and specific detection of *Salmonella* spp. on fresh produce surfaces, even in the presence of non-target organisms such as saprophytic yeasts. This approach also has potential for allowing cultivation-independent characterization of microbial community interactions occurring on produce surfaces.

Publications and Presentations

Wilford, J., **A. Mendonca**, and L. Goodridge. 2008. Water pressure effectively reduces *Salmonella* Enteritidis, on the surface of raw almonds. *J. Food Protection* 71(4):825-829.

Lantz, A.W., **Brehm-Stecher**, B.F. and D.W. Armstrong. 2008. Combined Capillary Electrophoresis and DNA-FISH for Rapid Molecular Identification of *Salmonella* Typhimurium in Mixed Culture. *Electrophoresis* (in press)

Bisha, B., **Brehm-Stecher**, B.F. "Tape-FISH for *Salmonella*: Simple Adhesive Tape-Based Sampling of Tomato Surfaces Coupled with a Rapid Culture-Independent Detection Step", S-294 Annual Science Symposium and United FreshTech Meeting, Las Vegas, NV, May 4-8, 2008.

Woods, F., and **A. Mendonca**. 2008. Influence of electron beam irradiation on microbial safety and quality of fresh-cut cantaloupe stored at 5 °C. S-294 Annual Science Symposium and United FreshTech Meeting, Las Vegas, NV, May 4-8, 2008.

Lineberry, K., Brehm-Stecher, B.F., Pate, M. "The Impact of Household Refrigerator Storage Conditions on the Shelf Life of Fruits and Vegetables" (project update), ASHRAE Winter Meeting, New York, NY, January 19-23, 2008.

Weinkauf, H. and Brehm-Stecher, B.F. "Polyionic Cell Permeabilizers Enhance the Antimicrobial Activities of Plant Essential Oils Against Foodborne Pathogens", International Association for Food Protection Annual Meeting, Columbus OH, August 3-6, 2008 (accepted)

Mendonca, A. F. 2007. Irradiation: Potential for Improving Microbial Safety of Fresh and Fresh-cut Produce. Science Symposium at the United Fresh Tech Conference, Palm Springs, CA, April 26-28, 2007.

Mendonca, A. F., and A. Orozalieva. 2007. Sequential application of chemical and irradiation treatments to destroy *Salmonella* spp and *Escherichia coli* O157:H7 on the outer rind surface of cantaloupe. In Abstracts of the S-294 Regional Project and United Fresh Tech Meeting, Palm Springs, CA, April 27-29, 2007.

Mendonca, A. F. 2007. Actions for Improving the Microbial Safety of Fresh and Fresh-cut Vegetables and Fruits. NATO-sponsored Conference on Food Safety and Security: Global Holistic Approaches for the Future and Environmental Impacts, Galati, Romania, September 4-6, 2007.

Proposals Funded: none

Work in Progress

The extent of pathogen destruction on fresh produce by surface application of chemical sanitizers followed by low dose irradiation is being investigated. The effects of antimicrobial interventions on shelf-life and selected quality attributes (including color, texture, etc) of the fresh produce are being evaluated. Further research is being conducted on the combined application of flow cytometry and fluorescent molecular probes for rapid detection of pathogens in fresh and fresh-cut produce.

Future efforts will extend this work to other fresh fruit and vegetable surfaces, such as spinach or lettuce leaves and will incorporate semi-automated image processing techniques for enumeration of *Salmonella* spp. in mixed populations from microscopic images of hybridized capture tape.