

**Institution:** USDA/ARS Citrus & Subtropical Products Laboratory

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## **Introduction**

The ARS Citrus & Subtropical Products Laboratory group has expertise in food science, postharvest physiology, postharvest pathology, edible coatings, sensory and flavor chemistry that can be applied to fresh-cut fruit and vegetable research. Cooperative relationship exists with the Horticultural Sciences Department at the University of Florida. For this reporting period, work on pretreatment of whole mango for fresh-cut benefit and post-cutting treatment of mango slices was completed and resulted in two publications, while another manuscript is in preparation. Work on strawberries both pre- and post harvest has been conducted for two seasons and a manuscript is in preparation. Treatment of mangoes with 1-MCP was beneficial for fresh-cut shelf life, but the levels of 1-MCP needed are above what is allowed. Treatment of mangoes with ethanol vapor reduced spoilage and maintained appearance, but resulted in off-flavor at the higher treatment levels. Treatment of intact mangoes with peroxyacetic acid reduced microbial counts in the subsequent cut slices compared to treatment with chlorine, which has been published. Pre- and post-harvest treatment of strawberries with peroxyacetic acid reduced decay and extended postharvest shelf life. Postharvest treatment of strawberries, whole or topped, with chitosan coatings or pectin in acetate buffers also reduced decay. Treatments were developed for enzyme-peeled oranges to improve appearance, texture and microbial stability, some of which has been published.

## **Activities**

**Objective 1:** Develop, evaluate, and standardize subjective and objective quality evaluation methods in intact and fresh-cut fruits and vegetables.

- Pre-cutting treatments to optimize post-cutting shelf life and reduce microbial contamination from the fruit surface were explored on mango and topped strawberries. Flavor, decay and shelf-life analysis of 1-MCP treated tomatoes was also done.
- Flavor was evaluated on fruit homogenate by headspace GC using standard curves where authentic standards were injected into deodorized fruit homogenate at 5-7 levels with any volatiles left in the deodorized background subtracted. Some samples were run on GC-MS equipped with the same column(s) for peak retention time identification. Both polar and non-polar columns were used (Stabilwax and DB-5).
- Sensory ranking of samples for overall preference, firmness, tartness, (mango) flavor and off-flavor was performed using experienced consumer panels of 15+ members, repeated were

compared to the instrumental results.

- Methods for testing and comparing sensory and analytical measurements for flavor research are ongoing for tomato flavor and orange juice aroma thresholds in the juice matrix. Perception of  $\beta$ -ionone was found to be bi-modal in that roughly half the panelists were super perceivers while the other half were not. This was not based on age or sex, but appeared to be a genetically-based.
- Trained panel rating of generated flavor descriptors for aroma and flavor of fresh tomato was also performed. Panelists (8-10) were trained using the Meilgaard method
- Texture was measured using a texture analyzer TX2i equipped with a 1-cm diameter probe inserted 5 mm for two measurements on each fruit (mango) slice, or 2 mm on radial arms of a tomato cross-section with a probe (method developed previously by Judy Abbott).
- Cut fruit color was measured with a Minolta CR-300 Chroma Meter calibrated to a white plate using the CIE L\*, a\*, b\* system. Usually Hue angle was used.

**Objective 2:** Develop new strategies to maintain fresh-cut product quality.

- Methods to extend shelf life of fresh cut produce were and will continue to be tested, and sensory and chemical analysis of flavor descriptors, acceptability, and concentration of chemical components will be evaluated. Relationships between treatments, chemical flavor components and flavor descriptors will be explored.
- Color, firmness and physiological parameters such as ethylene production and respiration rate will also be monitored for effect of pre- and post-cutting treatments and storage conditions.
- Mango fruit were cut and treated with edible polysaccharide coatings with or without additives at applied to cut mango pieces. Weight loss, respiration, ethylene, color, firmness, sugar, acids and aroma measurements were taken.
- Strawberries were treated pre- and/or postharvest with antimicrobial compounds including peroxyacetic acid and plant extracts, then evaluated for postharvest decay. Some compounds were also evaluated in vitro by placing compounds on paper disks in agar inoculated with fruit pathogens and measuring zones of inhibition. Promising compounds were also evaluated on fruit peel pieces in vitro, and ultimately on whole or cut fruit.
- Treatments were developed for enzyme-peeled oranges to improve appearance, texture and microbial stability of the peeled slices.

**Objective 3:** Improve understanding of biochemical, physiological and molecular mechanisms that affect fresh-cut product quality.

- Strawberries were treated with pectin and chitin/chitosan fragments and pectin and chitosan coatings. Fruit were evaluated for ethylene production and incidence of decay. Frozen samples will be analyzed for induced plant defense proteins.

**Objective 4:** Standardize methods for recovering pathogenic and spoilage microorganisms from intact and fresh-cut produce including tree nuts.

- Routinely recover non-pathogenic microorganisms from fruit surfaces to screen for antagonist activity and pathogenic organisms for culture collection.

**Objective 5:** Evaluate and control unintentional and intentional microbial contamination of intact and fresh-cut produce.

- Microbial assays were conducted on the cut fruit where 3-4 representative fruit pieces were taken and placed in sterile sampling bags with sterile phosphate buffer, agitated for 2 min and aliquots taken in triplicates and analyzed on a Whitley Automatic Spiral Plater. Isolations of microorganisms from fruit pieces were made using plate count agar and potato dextrose agar for bacteria, yeasts and molds.
- Pre-treatment of whole mango fruit with peroxyacetic acid was found to be more effective than chlorine in reducing microbial counts of the cut slices in combination with post-cutting sanitizing treatments with no adverse effects on quality.

## **Publications**

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