

Multistate Research Project S-294
Postharvest Quality and Safety in Fresh-cut Vegetables and Fruits

2007-2008 Activities Report

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Introduction: Synopsis:

Research was focused on developing methods to measure and maintain the quality of fresh-cut fruits and vegetables. Our ongoing studies of the wound signal were hampered by the lack of graduate student researchers. Components of the signal pathway were isolated but not identified. Studies on the short- and long-term respiratory response of various commodities to wounding were initiated. A method was developed to rapidly measure the acid content of fruits and vegetables without the need for titration of expressed liquid samples with volumes of a base of known concentration.

Activities

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

The organoleptic quality (i.e., taste) of many fruits and vegetables is significantly influenced by the ratio of sugars to acids. While the sugar concentration can be easily measured with a hand-held refractometer, the acid concentration is much more difficult to measure. The pH of juice extracted from the commodity is not indicative of the content of acid in the sample. The acidity of the sample is measured by titrating a known volume of sample with a known concentration of base to a set endpoint pH value. While simple in concept, this titration requires a setup that is impractical for routine field use.

A method was developed to easily measure the acid content of commodities in the field. The method uses a strip of absorbent material (e.g., filter paper) loaded with a known concentration of base (e.g., NaOH) and a pH indicator (e.g., phenolphthalein). The strip is sandwiched between two layers of material, one of which is transparent. Isolating the strip from the atmosphere prevents moisture and carbon dioxide in the air from degrading the reagents. Before use, one end of the strip is cut and immersed in a liquid sample. Solution is wicked up the strip. As it progresses up the strip, acid in the liquid neutralizes some of the base and causes the indicator to change color. The moving liquid front is followed by a colored band where the acid has been neutralized and the color is unchanged. Behind that is an area where the color has been changed. The amount of acid in the liquid sample will be proportional to the length of the colored band, or the ratio of the length of the wetted area to the length of the colored area.

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

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

A model was devised to segregate the efflux of CO₂ from segmented tomato fruit into the four components previously described to measure the contribution of each component to the efflux measured. A substantial, but transient increase in CO₂ efflux occurred immediately after segmentation. The rate of efflux did not return to the initial rate but stabilizes at a slightly

elevated rate presumably caused by increased respiration resulting from enhanced diffusion of oxygen into the tissue. This was confirmed by measuring increased respiration from whole fruit when the internal O₂ concentration was increased by increasing the external O₂ concentration. This method should allow isolating wound-enhanced respiration from other respiratory changes brought on by altering the diffusion of gases into and out of the segmented tissue.

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

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

Major project underway in 2008-2009

- Identification of the wound signal in fresh-cut lettuce.
- Studies of physical and physiological effects of wounding on the rate of carbon dioxide efflux.