

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

2005-2006 Activities Report

Institution: University of California at Davis

Participant: Adel A. Kader, Department of Plant Sciences, University of California, One Shields avenue, Davis, CA 95616; telephone: 530-752-0909; fax: 530-752-8502; email: aakader@ucdavis.edu

Introduction: The primary focus of our research is on factors affecting flavor and nutritional quality of fresh-cut fruit products and the reasons why their flavor-life is shorter than appearance-life.

Activities:

Objective 1: Assess the presence and physiological significance of nutrients and other functional components of fresh-cut vegetables and fruits as affected by storage and handling.

1.1. Nutrient Retention in Fresh-cut vs. Whole Fruits (Maria I. Gil, Encarna Aguayo, and Adel A. Kader):

The influences of processing and storage on the quality indices and nutritional content of fresh-cut fruits were evaluated in comparison to whole fruits stored for the same duration, but prepared on the day of sampling. Fresh-cut pineapples, mangoes, cantaloupes, watermelons, strawberries and kiwifruits and whole fruits were stored for up to 9 days in air at 5 °C. The postcutting life based on visual appearance was shorter than 6 days for fresh-cut kiwifruit and shorter than 9 days for fresh-cut pineapple, cantaloupe and strawberry. On the other hand, fresh-cut watermelon and mango pieces were still marketable after 9 days at 5°C. Losses in vitamin C after 6 days at 5 °C were 5% or less in mango, strawberry, and watermelon pieces, 10% in pineapple pieces, 12% in kiwifruit slices, and 25% in cantaloupe cubes. No losses in carotenoids were found in kiwifruit slices and watermelon cubes, while losses in pineapples were the highest at 25% followed by 10 to 15% in cantaloupe, mango, and strawberry pieces after 6 days at 5 °C. No significant losses in total phenolics were found in any of the fresh-cut fruit products tested after 6 days at 5 °C. Light exposure promoted browning in pineapple pieces and decreased vitamin C content in kiwifruit slices. Total carotenoids contents decreased in cantaloupe cubes and kiwifruit slices, but increased in mango and watermelon cubes in response to light exposure during storage at 5 °C for up to 9 days. There was no effect of exposure to light on the content of phenolics. In general, fresh-cut fruits visually spoil before any significant nutrient loss occurs. **(accepted for publication in J. Agric. Food Chem., 2006)**

1.2. Quality retention and potential shelf life of fresh-cut lemons as affected by cut type and temperature (Francisco Artés-Hernández , Fernando Rivera-Cabrera and Adel A. Kader) :

The effects of four cut types of 'Lisbon' lemons (wedges, slices, ½ and ¼ slices) and storage at four temperatures (0, 2, 5 and 10 °C) on post-cutting life were studied. Respiration rates of all cut types that were stored at 0, 2 and 5 °C up to 8 days were 2 to 5 times higher than those of the whole lemons, while the increase was up to 12-fold at 10 °C. Small differences among treatments were observed in the post-cutting changes of color parameters and chemical composition. Based on the sensory analysis, the four cut types remained marketable for up to 7 days at all tested temperatures, but only the wedges, slices, and ½ slices stored at 0, 2 and 5 °C preserved their sensory attributes for up to 10 days.. Good retention of vitamin C (about 85% ascorbic acid and 15% dehydroascorbic acid) and antioxidant capacity were found after 10 days at 0, 2, and 5 °C. Ethanol was the main fermentative metabolite found (88% of the total) and its concentration increased by up to 3-fold in slices, ½ and ¼ slices after 10 days at 10 °C. Acetaldehyde concentrations did not exhibit any significant changes. Total phenolics concentrations decreased gradually throughout the storage period in all cases. **(submitted for publication in Postharv. Biol. Technol., 2006)**

Objective 3: Develop a better understanding of the physiology of fresh-cut vegetables and fruits in response to processing and during storage and handling.

3.1. Combined Effects of 1-Methylcyclopropene, Calcium Chloride Dip, and/or Atmospheric modification on quality Changes in fresh-cut Strawberries (Encarna Aguayo, rattanawan Jansasithorn, and Adel A. Kader)

The aim of this study was to determine the effects of 1-methylcyclopropene, 1-MCP ($1 \mu\text{L L}^{-1}$ for 24 h at 5 °C) on quality attributes and shelf life of fresh-cut strawberries. The 1-MCP was applied before (whole product) and/or after cutting (wedges), followed by storage in a continuous flow of air or air + $1 \mu\text{L L}^{-1}$ C_2H_4 . The combined effects of 1-MCP and CaCl_2 dips (1% for 2 min) and/or CA (3 kPa O_2 + 10 kPa CO_2) were also examined. The application of only 1-MCP before and/or after cutting did not have a significant effect on firmness and appearance quality during storage for up to 12 days at 5 °C. The exposure to a continuous flow of $1 \mu\text{L L}^{-1}$ C_2H_4 in air during storage did not increase softening rate. 1-MCP applied before cutting or both before and after cutting of the strawberries increased respiration rate but reduced C_2H_4 production rate. Exposure to 1-MCP had a synergistic effect when combined with CaCl_2 plus CA. The combined treatment of 1-MCP + CaCl_2 + CA slowed down softening, deterioration rate, TA and microbial growth. Compared to control, which had a 6-day shelf -life, the shelf life of fresh-cut strawberries subjected to the combination treatment was extended to 9 days at 5 °C. **(accepted for publication in Postharv. Biol. Technol., 2006)**

Publications:

Vilas-Boas, E. V. and A. A. Kader. 2006. Effect of atmospheric modification, 1-MCP and chemicals on quality of fresh-cut banana. *Postharv. Biol. Technol.* 39:155-162.

Marrero, A. and A.A. Kader. 2006. 2006. Optimal temperature and modified atmosphere for keeping quality of fresh-cut pineapples. *Postharv. Biol. Technol.* 39:163-168.