THE FLORIDA STATE HORTICULTURAL SOCIETY AND
THE CITRUS PROCESSING INDUSTRY

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In writing this paper I reviewed the Proceedings for the full 100 years of the history of the Florida State Horticultural Society. The first paper I found on processing was in the 1920 Proceedings and the title was “Fruit Products in Florida”. In the same Proceedings there was a paper on “Citrus Fruit By-Products” by J. W. Sample and the fact that grapefruit juice had been preserved was noted in both publications. In the 1937 Proceedings Dr. Von Loesecke reported on, “Four years of Citrus Products Research in Florida” at the USDA Citrus Products Station, which began its research in January of 1932. In his paper he reported that “There is no known commercial method for either canning or bottling orange juice to yield the product which will have an aroma and taste exactly like fresh juice”. This is true today. Also, in the 1937 Proceedings there is a paper on “Producer and Processor Relationship” by C. E. Lindsey. Dr. Von Loesecke also reported in 1938, “The Chemist Looks at the Citrus Products Industry in Florida”. He reported that they had been investigating deaeration and flash pasteurization for processing both orange and grapefruit juice.

In 1942 Dr. Robert James reported on “By-Products of Citrus”. In this paper he reports that a number of people have been extracting the oil from the peel of oranges for some years but that they were now at the point of sales saturation of the oil due to the sugar shortage and the necessity for the reduction in soft drink and candy consumption. In 1943 Dr. L. G. MacDowell reported on “Citrus Research for the Florida Citrus Commission”. In this paper he states, “A sudden birth of the concentrating industry has presented us with a whole host of new problems. Among these are the optimum operating conditions for the best preservation of color and flavor and methods of packing and storing. The production of the ultimate concentrated product, that is, a citrus powder composed fully of citrus solids and with less than 1% moisture present, is not too far in the offing.”

In 1944 a paper by A. L. Stahl reported on the concentration of citrus juices by freezing. The last sentence of this paper reported, “A wide-spread adoption of citrus juice concentration by freezing is predicted”. In 1945, Dr. M. K. Veldhuis, Director of The U.S.D.A. Citrus Products Station, reported on their research. Also in this Proceedings R. T. Carlton reported the following on dehydrated orange juice, “recently a process for dehydrating and removing the water from orange juice has been developed and this process will be exploited by Florida Foods Incorporated”.

In the 1946 Proceedings, East, Cotton and Roy reported on “Problems in the Dehydration of Orange Juice”. In outlining the process the authors indicated that, “the orange juice is circulated at a temperature of 55°F through concentrators where water is evaporated under vacuum until the concentration reaches 50% to 60% solids. At this point some of the concentrate is further dried to powder, some is stored at 0°F and the remainder is blended with fresh juice to approximately 42% solids. This latter operation restores the volatiles lost by vacuum concentration.” In the 1947 Proceedings a paper on “Storage Studies on Frozen Citrus Concentrates”, by Cotton, Roy Brokaw, MacDuff, and Schroeder reported on concentrates stored at 40°F and also at 0°F. Quality changes were evaluated. In this paper the authors state “as pointed out previously, use of fresh juice to provide better flavor and aroma in frozen concentrates was developed by McDowell, Moore, and Atkins, of the Florida Citrus Commission working at the U.S. Citrus Products Station in Winter Haven, Florida”.

In the 1948 Proceedings the Constitution included the following: “a section of the annual program of the Society shall be devoted to the discussion of processing. This section shall be known as the Processing Section of the Florida State Horticultural Society.” In the first meeting of the processing section there were five papers that discussed the following topics: partial concentration of canned citrus juice, the composition of Florida citrus molasses, the physical and chemical characteristics of Floridian cold pressed oil of orange, citrus products waste disposal and canning and by-products research at the Citrus Experiment Station. This was the first report from the Lake Alfred Experiment Station following the installation of their citrus processing pilot plant in 1947. This first session of the Processing Section shows the diversity of research, although all papers were on citrus. Dr. M. K. Veldhuis was the first sectional vice-president.

In the 1949 Proceedings a paper by A. H. Rouse on gel formation in frozen citrus concentrates thawed and stored at 40°F discussed the problem of gelation in concentrates. This also had the first microbiology paper, “The role of Microorganisms and Storage Temperatures on the Quality of Orange Concentrate,” by Roger Patrick of the U.S. Citrus Products Station. In the 1950 Proceedings a paper on comparison of plating media used for the estimation of microorganisms in citrus juices by E. C. Hill and L. W. Faville continued the work on microorganisms. A paper by Kew and Veldhuis, “An Index of Pasteurization of Citrus Juices by a Rapid Method of Testing for Residual Enzyme Activity” was the first paper in FSHS to report on enzyme inactivation. In the 1951 Proceedings a “Statistical Review of Florida’s Canned Citrus,” by W. W. Giddings showed the rapid increase in the production of frozen orange concentrate and Atkins, Wenzel and Moore reported on “An Evaporator of Improved Design for the Concentration of Citrus Juices”. In 1954 Huggart and Wenzel reported on the measurement and control of color of orange concentrate.

In 1958 Ralph W. Cook reported on, “Improvements in the Design of Citrus Concentrate Evaporators”. This paper discussed evaporator types which were the forerunner to the TASTE evaporators which are in primary use today in the Citrus Industry. In 1959, four papers were devoted to characteristics of commercial aqueous extracts of orange pulp, later known as WESOS. I stopped this
review with 1960, knowing that most of you are familiar with publications in the more recent years. The literature in the Proceedings for these early years was extremely interesting. Papers I have discussed in no way are the only important developments reported in the Proceedings during this period; they are only some of the important developments. I apologize to the many authors and papers which I did not have the time to cite. The Florida State Horticultural Society Processing Section in 1960 became the Florida State Horticultural Society Handling and Processing Section.


STABILITY OF PREPARED CARROT STICKS IN STORAGE

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Abstract. The market for prepared carrot sticks and other deli items would be greatly expanded if quality retention could be extended in storage. The limitation to extended shelf life for carrot sticks includes microbial deterioration and the consequences of slicing and exposure of the cut surface to air. Accelerated senescence is a major consequence of slicing which results in loss of flavor, discoloration, and loss of turgidity. Antimicrobials, antioxidants and cellular constituents were vacuum infused into carrot sticks, shrink packed in oxygen transmissible bags and stored at 2°C. Ascorbic and citric acids combined and calcium chloride singly, adversely affected flavor but not color or microbial population after 2 weeks storage. Glucose, pyruvate, and lecithin treated carrot sticks stored as well as untreated stored and freshly prepared carrots in terms of flavor, but glucose treated samples had higher microbial count and distinguishable color from freshly prepared control carrot sticks. All treatments increased resistance to sheer. The results suggest that vacuum infusion has promise as a technology for intimately contacting carrot tissue with agents to preserve quality in storage.

Fresh immature or partially mature carrots (Daucus carota L.) can be stored for 4 to 6 weeks at 0°C and retain fresh flavor and appearance (4). However, after processed into carrot sticks, storage in vacuum shrink bags is limited to 2 weeks for acceptable flavor and appearance (Kent Shoemaker, personal communication). The major markets for prepared carrot sticks are restaurants with salad bars, delicatessens; but if quality retention in carrot sticks can be extended in storage, supermarkets and other produce outlets will greatly increase the demand. The limitations to extended shelf life for carrot sticks include microbial deterioration and the consequences of slicing and exposure of the cut surface to air. Accelerated senescence is a major consequence of slicing to prepare carrot sticks, which results in loss of flavor, discoloration, and change in texture. Retarding microbial development and senescence would extend the shelf life of carrot sticks and open up new markets for the product.

Compounds were examined for their effectiveness in extending shelf life of carrot sticks. Citric and ascorbic acids are effective antimicrobial and antioxidant agents in foods (3) and calcium chloride slows down senescence in fruits and vegetables (9, 13). Lecithin is an important constituent of cell membranes (10) and glucose and pyruvate are normal metabolites in the carrot. The effect of these materials on taste, color, texture and microbial population of carrot sticks in storage was determined.

Materials and Methods

Carrots were commercial Emperato type obtained in 50-lb bags from Zellwin Farms, Zellwood, FL. They were stored at 2°C until processed, but not longer than 2 weeks. The carrots were placed in cold 1% solution of sodium hypochlorite for 30 minutes before they were peeled by hand. Carrot sticks (3/8" X 2") were prepared with a Hobart (Model PD 70) power unit with dicer attachment. Carrot sticks were infused with solutes in sterile solutions by evacuating air from the sticks submerged in the solutions in vacuum oven at 50 mm Hg. The vacuum was held for 5 minutes before being slowly released. Approximately 10% of the weight of the carrot sticks was infused with the solutions. About 300g of carrot sticks were packaged in each Cryovac E bag (20 x 40 cm, 2 mil thick; O2 transmission: 4000 cc per m2 at 20°C, 1 atm and 24 hrs). The bags were evacuated with a Model 750 B Piab vacuum pump and sealed with a Model 12A Sentinel heat sealer. The packaged carrots were stored at 2°C and 90% RH.

Taste preference. A panel of twenty tasters were submitted three samples of carrot juice to be ranked for preference, using scores of 1 for best liked, 2 for next best, and 3 for least liked. The juice was prepared from carrot sticks by blending with equal weight of deionized water which was served to the panel at room temperature. Ranked sums were used to determine significance of difference between samples (7). In the first experiment carrot sticks infused with three levels of solutes were evaluated by the panel. The following solutes in solution were infused: 0.05, 0.01 and 0.002% citric and ascorbic acids, 0.01, 0.002, and 0.0004% calcium chloride, 0.005, 0.001, and 0.0002% sodium pyruvate, 0.1, 0.02 and 0.004% lecithin and 2, 0.7 and 0.2% glucose. In the second experiment carrot sticks stored after infusion with one level of solute were taste tested with an untreated stored package of carrot sticks and freshly prepared carrot sticks.