

A Second Year Of Citrus Research On Byproducts

And Problems Of The Citrus Canning And Concentrating Industry In Florida¹

June 1944 marks the end of the second year of cooperative research on citrus byproducts by the Florida Citrus Commission and the Bureau of Agricultural and Industrial Chemistry, Agricultural Research Administration at the U. S. Citrus Products Station, Winter Haven, Florida. Three Florida Citrus Commission research fellows, in cooperation with Federal chemists, have dealt with research on citrus byproducts and the problems of the canning and concentrating industries.

Wartime emergencies have increased the demand for immediate and reliable information on such problems as the suitability of glass containers as a substitute for tin containers in packing citrus juices, the storage life of these canned goods, and the prevention of losses from spoilage of canned citrus products. Special projects planned to meet these needs, along with the ever-important work on utilization of citrus byproducts, have made up the research program.

Concentrates and Powdered Juices

Before the war Florida was producing 3 percent of the U. S. total of concentrated citrus juices; in 1943 its four commercial plants turned out over 35 percent of the total purchased by the Government for Lend-Lease shipment to our Allies.* Such concentrated products will likely have greater popularity after the war when increased quantities may be made available to hospitals, institutions, hotels, and restaurants throughout the country; and citrus concentrates from Florida will probably help in post-war feeding problems in Europe.

With a view to improvement of the flavor and keeping qualities of

orange juice concentrate, three Florida packers during the past season have furnished samples of concentrate for bacteriological, color and flavor examinations, and chemical analyses. Tests are being made

mixing dry products have been made from orange juice by the addition of stabilizing materials. Experiments are being continued with the aim of producing a good quality, pure dry orange powder at a moderate



High Vacuum Double-Drum Dryer for Producing Powdered Citrus Juices—
Florida Citrus Commission Research Fellows, E. L. Moore,
E. Wiederhold, C. D. Atkins

regularly on the concentrates kept at various storage temperatures.

Work is in progress on comparisons of orange juice concentrates made at the temperatures and pressures used in commercial plants, with those made at lower temperatures and pressures. Some of the latter concentrates have been diluted with various amounts of fresh orange juice before canning, and a public service patent is being applied for in order to protect this process for public use. Some of these products have been quick-frozen for 8° F. storage, and some are being held in cold storage at 40° F. The reconstituted juices are being compared at intervals for color, flavor, and vitamin C content.

A double-drum dryer with facilities for producing a high vacuum has been installed for the purpose of studying its suitability for drying citrus juices, and several pro-

cost. It is also planned to attempt the preparation of other powdered citrus juices by this method.

Glass and Tin-Packed Products

Investigations were made of the changes occurring in unsweetened orange juice and grapefruit juice during commercial processing and subsequent storage for 6 months of products packed in glass and tin containers. Processing studies made at the canning plant indicated high vitamin C retentions in the juices (98 - 99 per cent). Samples were stored at room temperature (average 80° F.) and in cold storage (40° F.). It was found that bottled juices lost slightly more vitamin C during 6 months of storage than did juices in tin containers, but at the end of the 6 months' storage period all juices, regardless of type of container, could still be considered excellent sources of vitamin C. During the storage period all bottled

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* Figures taken from Western Canner and Packer, Vol. 35, No. 13 P. 25.

and canned juices retained their color well with the exception of the bottled grapefruit juice held at room temperature, which at the end of 5 months showed definite browning. In general, all cold-room samples of juice showed little change in flavor

citrus juices after removal from cold storage, a pack of grapefruit juice in glass containers was put up by the research fellows at the U. S. Citrus Products Station, Winter Haven, Fla. This experimental pack is being stored in the cold room (40° F.) and samples removed to room temperature at intervals, to be held at room temperature for varying periods of time before testing. Control samples are being stored at 40° F. and at room temperature. Periodic examinations are being made for retention of vitamin C, color, and flavor.

Citrus Juices

In cooperation with the Florida Canners' Association, a survey was made of the vitamin C retention in Florida grapefruit juices during commercial canning. Twelve central Florida canning plants which packed over half of the unsweetened grapefruit juice canned in the state, cooperated in this survey. Equipment for sampling and testing of the juices was taken to the plants and analyses were made at the plants on unsweetened grapefruit juices. Samples were taken at various points in the canning operation so that the

grapefruit juice. Results of this study on storage will be published in the near future.

In order to answer requests for information on how rapidly vitamin C is lost from freshly extracted orange juice and grapefruit juice, a controlled experiment was carried out, using hand-reaming and machine-reaming for extraction of the juices, which were then stored in covered and uncovered glass jars at room temperature and in a cold room (40° F.). This investigation indicated that fresh grapefruit juice and orange juice retained over 97 percent of their vitamin C content even after 3 days at room temperature, at the end of which time many of the samples had started to ferment. A complete report on these findings is being submitted for publication.

Citrus Byproducts

A process was developed (Atkins, Moore, and Heid,³) which it is believed will benefit growers greatly in the profitable disposal of surplus tangerines, thus helping to stabilize tangerine production and marketing. Besides recovery of cold-pressed peel oil, the method provides for either



Titration of Vitamin C in Citrus Juices — E. L. Moore

during storage. At the end of the 6 months' storage period at room temperature, however, the orange juices in glass and tin containers were somewhat off-flavor; the bottled grapefruit juice was considered unpalatable, but the grapefruit juice in tin containers was still satisfactory. These results (Moore, Wiederhold, and Atkins, 1) indicated that plain tin was preferable to glass for packing grapefruit juice when the juice was to be stored at room temperature. Glass-packed citrus juices should be kept in cold storage for maximum retention of vitamin C and to retard the development of off-flavors and colors. These orange and grapefruit juices packed in cans or bottles, even after a year's storage at 40° F. were good in flavor, had an attractive color, and remained excellent sources of vitamin C. This work is being continued and a further report giving these results for a year's storage period will be published at a later date.

In an effort to obtain information on the shelf life of glass-packed



Bacteriological Control of Citrus Products — E. Wiederhold

part of the plant procedure causing the loss, if any, could be ascertained. The results obtained (Moore, Wiederhold, Atkins, and MacDowell, 2) indicated that with the present methods in use in Florida, over 97 per cent of the vitamin C was retained during the canning operations. Samples of these canned juices were brought back to the laboratory and stored at room temperature to furnish information on retention of vitamin C. After 6 months of storage there still remained, on the average, 83 percent of the vitamin C that was in the freshly canned

the production of a concentrated beverage base or a bland table sirup. These products, because of their value as byproduct outlets have already attracted the attention of several local citrus processing plants, that have available equipment necessary for their manufacture. The high food value and pleasing flavor of these sirups and beverage bases, together with current shortages, should insure a receptive market.

A part of each year's crop of Persian limes is not shipped because of market conditions and because of size and grade restrictions. There

is increased interest in the quantity of oil from this fruit which may be recovered by various methods. Lime oil is extensively used by manufacturers of confections and flavoring extracts and has demanded higher prices than most other volatile citrus fruit oils. Preliminary tests (At-

kins, Wiederhold, and Heid, 4) indicated that by the use of a tapered-screw press about one-third of the oil present in the whole fruit could be recovered as cold-pressed lime oil in a laboratory model centrifuge. Work on this project will be continued this season, and also some experimental work will be done on the preparation of powdered lime juice.



Determination of Gas Content in Canned Citrus Juices — C. D. Atkins

kins, Wiederhold, and Heid, 4) indicated that by the use of a tapered-screw press about one-third of the oil present in the whole fruit could be recovered as cold-pressed lime oil in a laboratory model centrifuge. Work on this project will be continued this season, and also some experimental work will be done on the preparation of powdered lime juice.

A process was developed (Pulley, Moore, and Atkins, 5) for the preparation of crude dried citrus pectin from waste grapefruit peel. The crude pectin, or refined pomace, is produced by leaching properly treated grapefruit peel with water and then drying and grinding the leached peel. The grapefruit cannery residue, about half of which was formerly hauled and dumped on pastures, groves, and wasteland, is the source of the raw material that can now be used for making either crude or pure pectin. Two plants in the state have taken advantage of this experimental work and a high-grade product is being manufactured commercially.

An analysis of the vitamin C content of citrus fruit used in commercial canning indicated that the juice of the oranges and grapefruit examined contained only about one-fourth of the vitamin C present in the fruit. It was found that the

peel and pulp remaining after juice extraction represented a good source of vitamin C which might be extracted by various methods. Further experiments are in progress on the extraction and concentration of water-soluble constituents of the peel and their inclusion in beverage

Publications

(1) Changes Occurring in Oranges and Grapefruit Juices During Commercial Processing and Subsequent Storage of the Glass- and Tin-Packed Products. Edwin L. Moore, Eunice Wiederhold, and C. Donald Atkins. *Fruit Products J.* 23, (9), 270-275, 285 (May 1944).

(2) Ascorbic Acid Retention in Florida Grapefruit Juices — I. During Commercial Canning. Edwin L. Moore, Eunice Wiederhold, C. Donald Atkins, and Louis G. MacDowell. *The Canner* 98, (9), 24-26 (January 29, 1944).

(3) Tangerine Juice Products. C. D. Atkins, E. L. Moore, and J. L. Heid. *Fruit Products J.* 23, (5), 132-134, 152, 153, 157, (January 1944).

(4) The Recovery of Flavoring Oil from Persian Limes—Preliminary Experiments. C. D. Atkins, Eunice Wiederhold, and J. L. Heid. *Fruit Products J.* 23, 306-308 (June 1944).

(5) Grapefruit Cannery Waste Yields Crude Citrus Pectin. C. N. Pulley, E. L. Moore, and C. D. Atkins. *Food Industries* 16, (4), 94-96, 136, 137 (April 1944).

Price Fixed for Fruit In Bushel Containers

Maximum prices for oranges and grapefruit produced in Florida and Texas and packed in bushel containers shall be five-eighths of the prices of the same fruit packed in standard containers, the Office of Price Administration has announced. The bushel baskets will hold five-eighths as much as the standard boxes.

This bushel ceiling was established because Florida and Texas citrus producers have been using more and more bushel baskets. They found it increasingly difficult to obtain enough standard containers. The use of the baskets, however, made it necessary for each to be weighed and marked. The new prices on a bushel basket basis eliminate the need for this extra work.

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