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Studies on papaya puree processing at the Hawaii Fruit Laboratory have led to the development of a procedure for producing a superior papaya puree. This puree can be used immediately or frozen for later reprocessing into nectar or as an ingredient with other juices.

The papayas used in these experiments were the Solo variety grown at the Kauai Branch Station and flown to Honolulu weekly in 500 to 1000-pound lots. The papayas were field run and of varying maturity.

Enzyme Inactivation

Since it was envisioned that the frozen puree would be stored for various periods of time, the first phase of the study involved a brief survey of the papaya enzymes which could cause gelling or the development of off-odors and off-flavors during storage. Seagrave-Smith and Sherman (2) reported

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gelation could be prevented by heating the puree to 200°–210°F. for 60 seconds and cooling rapidly. Yamamoto and Inouye (*3*) described the effect of sucrose as a gelation inhibitor of frozen papaya puree. In the work reported here, inactivation of the enzymes was accomplished with a plate-type heat exchanger.

Papaya puree was pumped through the heat exchanger to give product temperatures ranging from 180° to 234°F.; it was held at the high temperature 1 minute, then cooled to 85°F. The heating-cooling cycle required 2½ to 3 minutes. Heating the papaya puree to 210°F. immediately after seed removal consistently prevented gel formation and inactivated catalase, peroxidase, and papain with minimum heat effect on flavor and color. No polyphenol oxidase or polygalacturonase were detected in papaya.

Separation of Skins

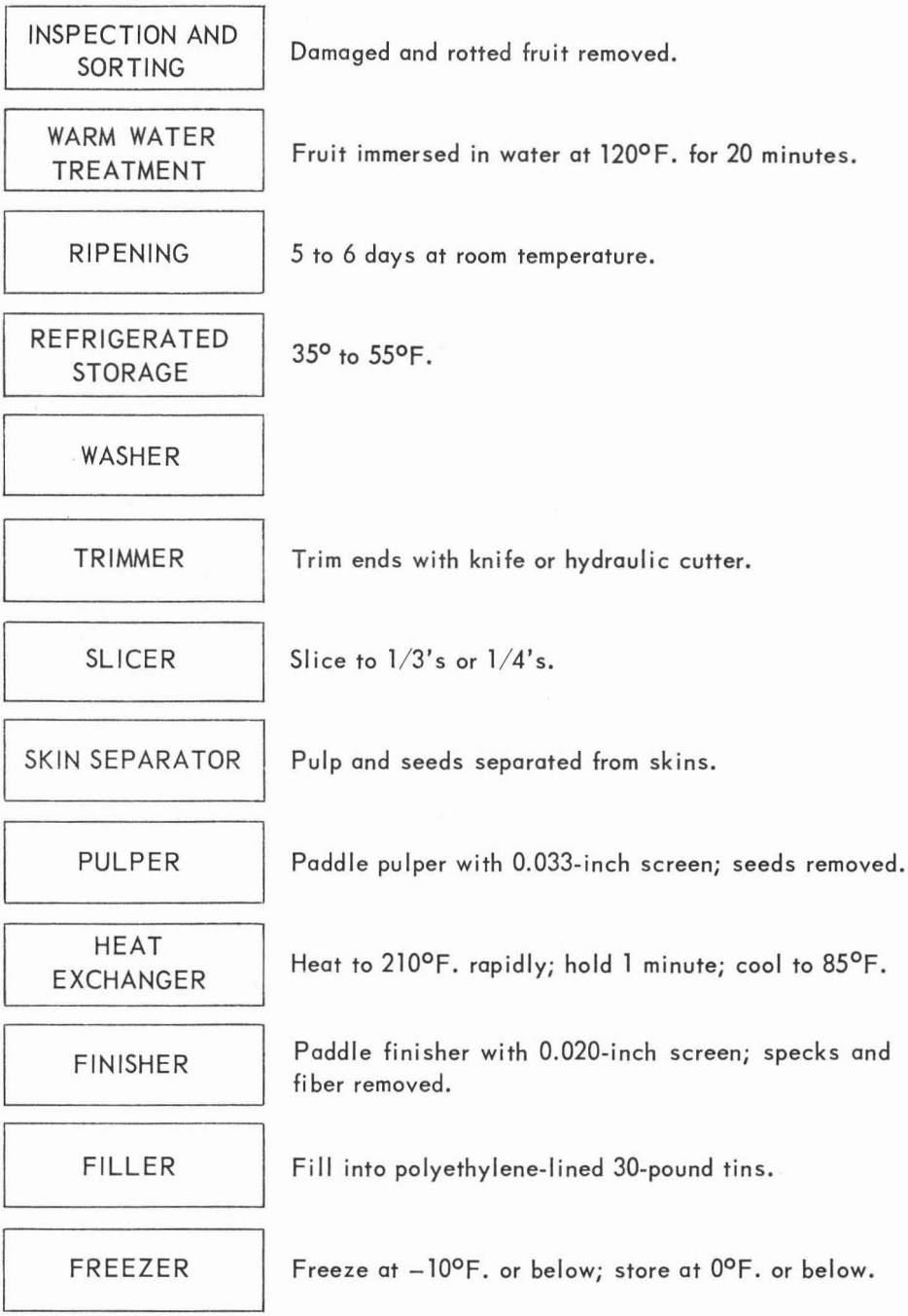
The second part of the study involved elimination of the bitter flavor that can occur in papaya puree produced by chopping up whole fruits in a cutting or hammer mill as a first step in puree production. A pilot model machine for separating papaya skins from the seeds and flesh was used to determine if this would lessen or eliminate the bitter flavor. Papaya puree made with this machine showed no sign of bitter off-flavor. The machine was developed in the late 1930's but has been unused since. Work on an improved model is now being carried out by the Agricultural Engineering Department of the University of Hawaii.

The present machine consists essentially of two reels rotating at different speeds with the papaya slices fed between them. The upper reel is made of wood covered with a thin sheet of corrugated rubber. The larger lower reel which separates the flesh from the skin is constructed of stainless steel rods which are approximately 5/16 inch apart. The machine is referred to as a skin separator.

Processing Steps

The optimum processing sequence worked out in pilot plant studies is shown in Figure 1. The warm water treatment in step two was used to prevent undue spoilage losses during ripening as prescribed by Akamine (*1*). To avoid gel formation, it is necessary to heat inactivate the pectin esterase enzyme in the puree immediately after seed removal in step nine. It was also found that precooling the fruit prior to processing, and finishing the puree after inactivation of pectin esterase, lessened the possibility of gel formation.

FIGURE 1. Papaya puree processing.



Pilot plant runs were made to compare the yield of puree from a processing line utilizing the papaya skin separator with a line utilizing a cutting mill. The yield obtained from the line utilizing the skin separator was 1 to 2% lower, depending on the spacing between the reels. When the spacing is too close the quality of the puree will be lowered. The use of a hydraulic trimming device lowered the yield by 5 to 10%; however, various types of knives and adjustments can be used on this device to minimize the loss. The balance between yield and quality must be resolved by the processor.

Evaluation of Nectars

Nectars prepared from various purees processed as indicated above were vacuum-sealed in No. 2 enameled cans, spin-cooked for 3 minutes, and cooled 4 minutes to about 100 F. The nectar was made with approximately 10 parts of puree, 16.4 parts of water, 2.1 parts of sugar, and citric acid sufficient to adjust the pH to 4.0. These nectars were evaluated by a trained taste panel using a 7-point quality scale. Results indicated that nectars made from heat-treated purees (210°F.) were superior in flavor to nectars made from purees which had not been heated to inactivate enzymes. Milling the whole fruit resulted in a nectar inferior in flavor and mouthfeel quality to the nectar prepared from skin-separated puree. Removal of seeds by hand prior to mechanical pulping was shown to be unnecessary. Warm water treatment of the fruit before ripening caused no adverse effects on the final nectar quality.

SUMMARY

Studies at the pilot plant level show that a superior papaya puree can be produced by using the papaya skin separator instead of milling the whole fruit; rapid heat inactivation of enzymes with a heat exchanger further enhances quality. Taste panel evaluations of nectars confirm that improved quality in the puree is reflected as higher quality in the nectar product.

REFERENCES

1. Akamine, E. K.
   1960. Temperature effects in fresh papayas processed for shipment. Hawaii Agr. Exp. Sta. Bulletin 122.

2. Seagrave-Smith, H., and G. D. Sherman.
   1954. How to avoid a "gel" in commercially frozen papaya puree. Hawaii Agr. Exp. Sta. Progress Notes No. 100.

3. Yamamoto, H. Y., and W. Inouye.
   1963. Sucrose as a gelation inhibitor of commercially frozen papaya puree. Hawaii Agr. Exp. Sta. Technical Progress Report No. 137.

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