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INTRODUCTION

Commercial production of mangoes in Hawaii is centered on the island of Maui, although a considerable tonnage is produced from small plantings throughout the state. Mangoes are marketed chiefly as fresh fruit. Processing has not developed on a large scale, but occasionally small packs of frozen slices or of chutney have been marketed.

The mango grows throughout the tropics and is considered one of the more delicious tropical fruits. Some mango products such as pickles, chutney, and canned slices have been available for some years from Jamaica, India, Mexico, and South Africa (3), as well as from Puerto Rico and the Philippines (6). Some varieties grown in Hawaii are Haden, Pirie (12), Pope (2), Joe Welch, Zill, and several others (4). Procedures for canning (6) (7) (8) (9), freezing (4), and dehydration (1) have been described, and a mango cereal flake has been reported (5) to be a stable, acceptable product. Recently the Hawaii Fruit Laboratory has developed information on processes for producing high-quality, stable puree from which excellent beverage and dairy products can be manufactured.

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MANGO PROCESSING

Preparation of Puree

Haden mangoes were sorted, washed in a rotary spray washer, and the seeds removed with knives by hand. A mechanical scraping device (10) was used to remove the peel for some of the experimental lots. The peel was separated from some lots of fruit to determine if its presence in the puree gave rise to undesirable flavors. The fruit was put through a cutting mill and a paddle pulper fitted with a screen with .033-inch perforations to remove coarse fibers and particles. The puree was then either frozen or pumped through a plate heat exchanger for rapid heating and cooling to inactivate the enzyme catalase. In the heat exchanger the temperature of the puree was raised to 195–200°F., held at that temperature for 1 minute, then cooled to 90–100°F. It was then filled into 30-pound tins with polyethylene liners and frozen at -10°F.

Preparation of Nectar

Puree was thawed overnight at room temperature and transferred to a large stainless steel container in which the ingredients could be mixed with a power stirrer. The basic formula used for the nectar was as follows:

100 lb. mango puree
30 lb. sugar
170 lb. water
10 oz. citric acid

After thorough mixing, the nectar was filled into No. 2 cans (580 grams per can) and vacuum sealed. The cans were processed 3 minutes at 212°F. in a spin cooker (11) in which the cans were rotated at 125 rpm on their long axis; they were spin cooled 4 minutes with water at 72°F., which was sufficient to reduce the temperature to about 100°F.

MANGO NECTAR EVALUATIONS

Heated Vs. Unheated Purees

During the 1966 season, heated and unheated mango purees were frozen, held at 0°F. for 8 months, thawed, and made into nectars. A nine-member panel evaluated the nectars for quality of mango aroma

and flavor. The nectars were scored on a 7-point scale where 1 signified lowest quality and 7, highest quality. A preliminary training session was conducted to acquaint the judges with the product and its characteristics. The judges evaluated the nectars on 4 consecutive days. The samples were served at 55°F. in coded 50-ml beakers under red illumination in individual taste booths. The judges evaluated aroma on one set of samples and then were given a second set for evaluation of flavor. Within each set, serving order of the samples was random.

Analysis of variance was applied to aroma and flavor scores. Average scores are shown below in Table 1. Nectar made from heated puree scored significantly higher than that made from unheated puree in both aroma and flavor quality ($p = 0.01$).

Table 1. Comparison of nectars from heated and unheated purees (stored 8 months at 0°F., 1966)

	Aroma Score[a]	Flavor Score[a]
Heated	5.50**	5.80**
Unheated	2.70	3.13

[a]Average of 30 judgments.
**Significantly higher quality ($p = 0.01$).

To further examine the effect of heating for enzyme inactivation on the flavor and aroma of the product, another lot was processed during the 1967 season. Procedures for puree and nectar preparation and for evaluation were identical with those given above. After 1 week storage at 0°F., puree was thawed and processed into nectars. Results of the evaluation of these nectars are given in Table 2.

When purees were processed into nectars after only 1 week of freezer storage, the heated lot scored higher in aroma and flavor quality than the unheated lot. Apparently, heating the puree for enzyme inactivation is necessary for fresh quality retention during freezer storage.

Some of the puree prepared in 1967 was held in freezer storage for periods up to 4 months with no apparent change in flavor or aroma quality of nectars made from the puree. However, at all of the storage intervals, the heated sample scored significantly higher than the unheated sample.

Table 2. **Comparison of nectars from heated and unheated purees (stored 1 week at 0°F., 1967)**

	Aroma Score[a]	Flavor Score[a]
Heated	5.0*	5.7**
Unheated	4.2	4.7

*Significantly higher quality (p = 0.05).
**Significantly higher quality (p = 0.01).
[a]Average of 29 judgments.

Peeled Vs. Unpeeled Fruit for Puree

Mango purees made from both peeled and unpeeled fruits were prepared for freezing by heat-inactivation of enzymes as described above. After freezer storage for 2½ months, the purees were thawed and made into nectars. Taste tests were conducted on these nectars after 1 week of storage at room temperature, in the same manner as above.

Analysis of variance was applied to aroma and flavor scores. Average scores are shown below in Table 3. Nectar made from unpeeled mangoes scored significantly higher than that made from peeled fruit in both aroma and flavor quality (p = 0.01).

Table 3. **Effect of peel separation on the quality of nectars prepared from the puree**

	Aroma Score[a]	Flavor Score[a]
Peeled	5.3	5.3
Unpeeled	6.1**	6.2**

**Significantly higher quality (p = 0.01).
[a]Average of 41 judgments.

CONCLUSIONS

High-quality frozen mango puree can be produced, from which beverages, dairy, and other products may be formulated.

Heat treatment of the puree for 1 minute at 195–200°F. inactivates the enzyme catalase and helps preserve flavor and aroma quality.

Separation of the peel is not necessary or desirable for making mango puree for freezer storage.

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