

DICED MANGO-ORANGE SALAD GELS WITH LOW SUGAR CONTENT¹

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diced mango-orange juice salad gel with low sugar content. The results of storage as a pasteurized and as an unpasteurized chilled product are presented and discussed.

Materials and Methods

Ripe 'Keitt' mango fruit were washed, peeled, diced by hand, and stored in glass jars at 32°F until used. Commercial 45° Brix frozen concentrated orange juice was thawed and reconstituted with distilled water to 12.8° Brix.

The gel blend was a mixture composed of locust bean gum and iota carrageenan (Sea Gel DG), and kappa carrageenan (Sea Gel GH). Both Sea Gels are approved by Food and Drug Administration and are commercially available from Marine Colloids, Inc., Springfield, New Jersey. The preferred ratio of the gel blend, Sea Gel DG to Sea Gel GH, was 60 to 40 parts by weight (4). Granulated cane sugar was used as the sweetening agent.

The gel blend and sugar were mixed together and dispersed in the 12.8° Brix orange juice at room temperature in a steam-jacketed kettle with vigorous agitation. The dispersed mixture was heated to 180°F by introducing steam into the jacket. The mechanical agitator was then turned off and the diced mangos added, which had been preheated to 100°F in a steam chest. The addition of mangos dropped the temperature in the kettle to 140°-145°F. Preheating the chilled diced mangos prevented the temperature of the mix in the kettle from dropping low enough to cause pregelation. The mixture was then stirred by hand with a stainless steel paddle while the temperature in the kettle was raised to 160°F at which time the mixture was poured into 300 X 407 cans and sealed. The ends of the cans were enamel-lined and the body of the cans tin plated. For pasteurizing, the sealed cans were placed on rotary rolls (120 rpm) in 185°F water bath for 15 min. For cooling, the cans were placed on rotating rolls (18 rpm) under water spray at 80°-85°F for 10 min. Spinning the cans too fast under the water spray resulted in the product coring. The products were placed at 32° and 80°F storage and examined periodically.

Another batch of salad gels was prepared in a similar manner, except the mixture was poured into 4.5-fl oz, clear, rigid plastic containers (XT

Abstract. A pilot plant pack of diced mango-orange juice salad gels was prepared and filled at 160°F into cans, hermetically sealed, further heated in hot water at 185°F, cooled and placed in storage at 32° and 80°F. Another pack of the salad gels was filled at 160°F into clear, rigid, plastic containers, covered with a plastic film, then heat-sealed, and placed in 32°F storage. Surprisingly, the pasteurized canned mango-orange salad gels developed only a slight flavor change after 26 weeks storage at 80°F and were essentially unchanged after 1 year at 32°F. This indicated that the potential marketing life of mango-orange combination is extended over other processed orange juice products at room temperature. The unpasteurized salad gels in plastic containers in 32°F storage developed a slight flavor change after 8 weeks and mold growth at 12 weeks.

The introduction of low sugar citrus gels in various forms has been made with the development of a gel blend for the production of multi-purpose gels (1). This gel blend was later modified and referred to as an all-purpose gel blend (4). Citrus gels can now be prepared with a smaller quantity of the gel blend, needing no tedious adjustment of the calcium ion for gelation, and having sufficient pH latitude for most fruits and their juices.

In the development of new food products at this Center, an exotic new jellied product consisting of diced mango and orange juice was prepared with the all-purpose gel blend. The work to be reported in this paper is on the preparation of a

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polymer) at 160°F, covered with a plastic film and heat-sealed without further heat treatment. The unpasteurized products were placed at 32°F and examined periodically.

Salad gels upon removal from the can and plastic container were examined for syneresis, gel structure, color, and flavor. Pectinesterase activity (PE) was measured on the pasteurized and unpasteurized products the day after packaging by the method of Rouse and Atkins (2). Samples were comminuted in an Osterizer for this determination. Units of PE are expressed in milliequivalents of ester hydrolyzed/min/g $\times 10^4$ on wet basis.

Results and Discussion

Formulation of the ingredients used in the pilot plant in preparing the diced mango-orange juice salad gel for packing in 300 X 407 cans is presented in Table 1. The formulation for gels packed in 4.5-fl oz plastic containers differs slightly in that only 0.6% gel blend is required. Sugar content of 10.3% in the formulation is optional and may be varied according to manufacturer's desire.

Table 1. Formulation for diced mango-orange juice salad gels.

	g.	%
Gel blend (Sea Gels DG and GH)	64.0	0.8
Sugar	824.0	10.3
Orange juice (12.8° Brix)	3112.0	38.9
Diced mango	4000.0	50.0
Total	8000.0	100.0

Table 2. Effect of storage at 80°F on pasteurized canned diced mango-orange juice salad gels.

Storage period	Gel structure	Color	Flavor	Syneresis	
				on opening can	after 1 hr
24 hr	firm	good	good	none	none
4 wk	firm	good	good	none	none
12 wk	firm	good	good	none	none
20 wk	firm	good	good	none	very slight
26 wk	firm	good	good- ^z	none	very slight

^zAppearance of slight storage flavor.

The PE activity found in the unpasteurized salad gels was 0.3×10^{-4} and there was complete inactivation of the enzyme in the pasteurized products. The finished salad gels had a pH 4.2 which is ideal for gelation without syneresis. All processing should be carried out without delay to minimize hydrolysis of carrageenans in the gel blend.

Storage of pasteurized salad gels. Results presented in Table 2 show the effect of storage at 80°F on pasteurized canned diced mango-orange juice gels containing 50% mango by weight. These products were examined after 24 hr and periodically for 26 weeks. At the 26th week examination, the products remained firm, showed no color change, and no syneresis when removed from the can. After standing 1 hr, the amount of syneresis had increased from none to only very slight. Furthermore, only slight storage flavor could be detected by the authors after this period of storage. Usually pasteurized, canned orange juice at 80°F storage for 12 wk has a pronounced storage flavor. The stability of the gel's flavor, even though the gel contained 38.9% orange juice, indicated that mango contains a pro-flavor compound which either partially inhibits or delays the development of storage taste in heated orange juice kept at room temperature.

A pasteurized pack of diced mango-orange juice salad gels was also stored for 1 yr at 32°F. After 1 yr (data not shown in tabular form) the gels were judged to have no syneresis and no change in firmness, color or flavor. The diced mango retained the fresh flavor of the fruit at this storage temperature.

Storage of unpasteurized salad gels. Results are presented in Table 3 on the effect of storage at 32°F for a product that is only partially heat-

Table 3. Effect of storage at 32°F on unpasteurized (160°F) diced mango-orange juice salad gels in 4.5-fl oz plastic containers².

Storage period	Gel structure	Color	Flavor	Syneresis	
				on opening can	after 1 hr
24 hr	firm	good	good	none	none
4 wk	firm	good	good	none	none
8 wk	firm	good	fair+	none	none
12 wk ^Y	firm	good	fair+	none	none
16 wk ^X	firm	darkened	fair-	very slight	very slight

²Clear, rigid, plastic containers made of XT polymer (American Cyanamid Co.).

^YFirst appearance of mold.

^XMold in most containers, storage study discontinued.

treated. This would be considered a chilled product. No preservatives were added to the salad gels in this experiment. Complete pasteurization in these containers was not attempted because observations in the past have shown XT polymer plastic containers would discolor and become distorted at temperatures of 180°F or above (3). Examination of the gels after 8 wk showed a slight but not a serious flavor change. Mold growth appeared on the surface of several samples at the end of 12 wk storage, although the other physical characteristics were virtually unaffected. After 16 wk the product no longer retained its delicate flavor and was considered mediocre. Further examinations were discontinued because there was a general breakdown in all characteristics except for gel structure which remained firm.

Conclusions

Pasteurized mango-orange juice gel containing

50% mango and 38.9% orange juice has a marketing life of 26 wk at 80°F and a marketing life in excess of 1 yr at 32°F.

Unpasteurized mango-orange juice gel containing 50% mango and 38.9% orange juice packed in plastic containers has a marketing life of not more than 12 wk at 32°F. This product is prepared without added preservative.

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