

# Sensory Characteristics of Restructured Fresh Fruit Composite Prepared from Jack Fruit (*Artocarpus heterophylla* L.) and Sapodilla (*Manilkara achras* Mill. Fosb.)

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## ABSTRACT

*Jack fruit and sapodilla are tropical fruits having sweet and distinctive flavor and attractive color. At present, consumers have limited choice for ready-to-eat fresh fruit products available in the market. The objective of this study was to determine the sensory characteristics of fresh fruit product composite prepared from combination of jackfruit and sapodilla and restructured using three different type of alginate. Three different type of alginates and two form of calcium lactate (encapsulated and non encapsulated) were used as binding ingredients. Ten panelists were employed to evaluate the freshly prepared fruit product composite for its taste, aroma, appearance, mouthfeel, and gel strength using a 5-point scoring. Type of alginate had no effect on the sensory properties of restructured fruit layers. However, the source of calcium in the form of encapsulated or not encapsulated powder showed significant effect on the appearance and gel strength. The fruit layers prepared using encapsulated Ca-lactate had less attractive appearance and weaker gel strength than the fruits restructured with free Ca-lactate. The two difference source of calcium had no significant effect on the products taste, aroma, and mouthfeel.*

*Key words : Alginate, calcium lactate, jack fruit, sapodilla, sensory characteristics*

## INTRODUCTION

Tropical fruit offers not only health benefit to consumers, but also exotic flavors and appealing color. The

market of fresh tropical fruits in Indonesia is mostly dominated by the whole fruits and only a small portion is commercialized in a form of minimally processed fresh fruit products. During harvesting, transportation, and distribution the whole fruits are easily damaged due to abusive conditions during handling. In addition, during harvesting we frequently find defective fruits such as irregular shape and size, infested by insects, and different state of ripeness. All of these conditions have led to a significant loss of the fruit economic values.

Restructurization techniques, which have been successfully applied in the muscle food business, has the potential for the fabrication of value added fruit products. It offers a better control in term of product portioning, desirable shape and size, and unlimited opportunity for product development. Various segment of consumers are also demanding more fruit product choices available in the markets. This demand is more obvious in the catering business serving mass transportation and various social events. A successful restructuring technique for the fresh fruit should meet requirements such as it should be able to form a strong binding without heat treatment, no effect on flavors and appearance, and effective low concentration. Among binding agents which have been used in restructured food products are cellulose derivatives, carragenan, modified starches, pectins, gelatin, and alginate (Luh et al., 1976; Luh et al., 1977; Truong and Walter, 1994; Truong et al., 1995).

Alginate is one of the binding agent that can form a strong gel with the presence of calcium ions without additional heating treatment. Therefore, this make it a suitable binding agent to be used in the fresh fruit product

(Kaletunc et al., 1990; Mancini and McHugh, 2000). Previous results has indicated that restructured fresh soursob, mango, and avocado have been successfully produced using the alginate-calcium binding system (Raharjo et al., 2002). The objective of the study was to determine the sensory characteristics of fresh fruit product composite prepared from combination of jackfruit and sapodilla and restructured using three different type of alginate.

## MATERIALS AND METHODS

### Materials

Fully ripe fresh sapodilla (*Manilkara achras* (Mill.) Fosb.) and jack fruit (*Artocarpus heterophylla* L.) were used in this study. These fruits were peeled, the seeds were removed, and the fruits flesh were collected. These fruits flesh were finely chopped to obtain puree using electric bowl chopper (Model Blixer 3, Robot Coupe S.N.C., France). Alginates used in this study, which include Manugel GHB (high guluronic), GMB (medium guluronic), and DMB (high mannuronic), were having the same particle size and obtained from ISP Alginates Inc., U.K. Calcium-lactate and encapsulated Ca-lactate were obtained from (Balchem corp., New York, USA). Sodium tripolyphosphate (Sigma Chemical Co., St. Louis, USA) was used to delay the gel setting.

### Sample preparation

In this experiment, 1500 g batches of finished product formulation were prepared. Freshly chopped jack fruit and sapodilla puree were separately mixed with alginate (1% w/w) for 5 minutes in a mixer (Philips, model HR 2292/B, Holland) at a speed of approximately 400 rpm. Sodium tripolyphosphate (0.1%) was mixed in the mixer for another 5 minutes, except in treatment containing encapsulated Ca-lactate no sodium tripolyphosphate was added. The Ca-lactate (1.0%) was then added and mixed at a speed of 600 rpm for 15 seconds, while treatment with added encapsulated Ca-lactate (1.0%) was mixed for another 5 minutes. The mixtures were then molded in plastic cups of approximately 1 cm thickness, followed by another layer of other fruit mixture. The cups were closed with the lids and stored overnight in the refrigerator. The finished products were consisted of either two or three alternating layers of jackfruit-sapodilla-jackfruit, see (Figure 1) for example : jackfruit-sapodilla-jackfruit, sapodilla-jackfruit-sapodilla, and jackfruit-sapodilla. These restructured products were evaluated in the following day for its sensory attributes.

### Sensory evaluation

Sensory evaluation was conducted by 10 trained panelists in an individual booth in a room lighted with white lamp. Samples were removed from the refrigerator or

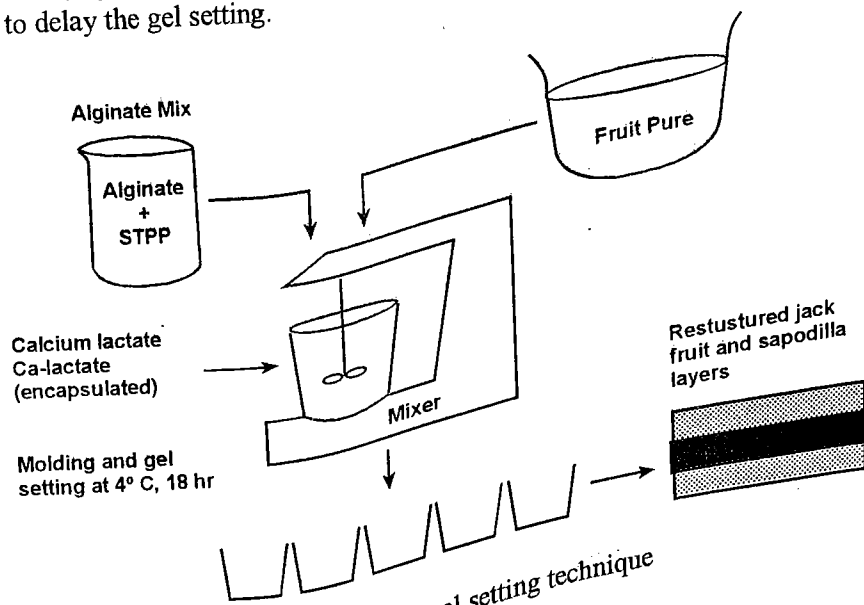
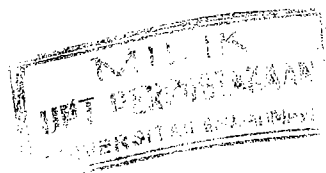


Figure 1. Internal setting technique



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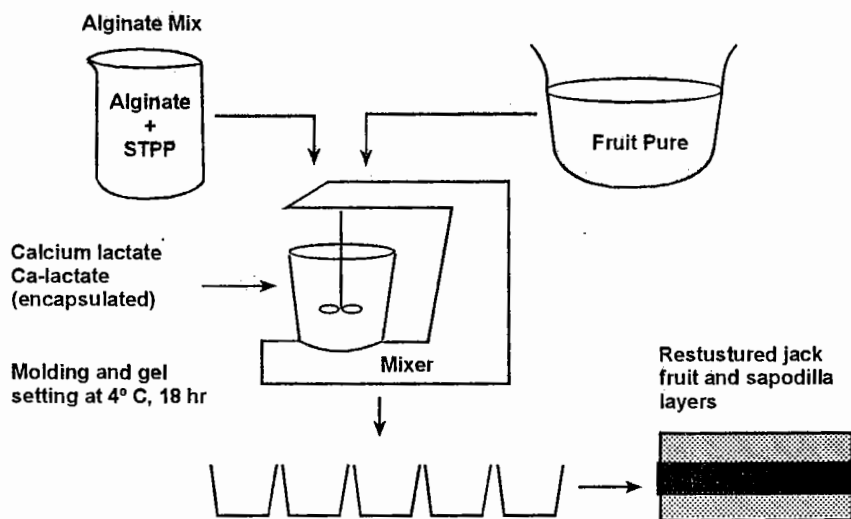


Figure 1. Internal setting technique

freezer 2-3 hour prior to serving to the panelists. Each panelist was provided with 15-20 grams of restructured fruit samples from each treatment and served with a cup of drinking water, plastic plate, fork, and knife. Panelists were asked to give a score ranged from 1 to 5 on each sensory attributes such as aroma, taste, appearance, mouth feel, and gel strength of the samples by marking on scoring sheet provided. Every set of restructured fruit samples were evaluated with the presence of its corresponding original fresh fruit as a reference for aroma, taste, and appearance. Aroma, taste, and appearance score of 5 indicates very similar with its original fruits, while score of 1 indicates very different properties compared with its original fruits. Mouth feel score of 5 indicates no gel fragments present in the mouth cavity during chewing and after swallowing the samples, while score of 1 indicates the noticeable presence of gel fragments. To measure gel strength the panelists were asked to cut the sample of restructured fruits into pieces using a plastic knife. Score of 5 indicates a strong gel in which the restructured fruit pieces were remain intact and no sign of falling parts, while score 1 indicates a very weak gel or the samples were easily falling a part during cutting.

## RESULTS AND DISCUSSION

The panelists scored the taste and aroma of jack fruit in jackfruit-sapodilla-jackfruit composite relatively lower than its original fruit (Figure 2). However, fruit composite restructured with Ca-lactate had lower taste score compared with the fruit restructured with encapsulated Ca-lactate. This is in part due to the Ca-lactate powder at 1% level of addition could elicit noticeable unpleasant after taste by some of the panelists. Fruit restructured with Ca-lactate had a lower gel strength than that of restructured with encapsulated Ca-lactate. Fruit composite restructured with encapsulated Ca-lactate had significantly lower score on appearance due to the visible presence of white spot of encapsulant. The same trend was also found in the sapodilla layer of jackfruit-sapodilla-jackfruit composite (Figure 3). The presence of white spot of encapsulated Ca-lactate even more obvious due to the dark background color. The taste of the sapodilla was remain moderately acceptable compared with its original fruit. Aroma of the sapodilla layer in the fruit

composite, however, was becoming significantly lower. This was due to the predominant effect of aroma from two layers of jackfruit, while there was only one layer of sapodilla.

For the fruit product composite having two alternating layer of sapodilla and one layer of jack fruit in the middle, the taste and aroma of either jack fruit or sapodilla were remain moderately acceptable (Figures 4 and 5). The aroma and taste of one layer of jack fruit was strong enough to be combined with the two alternating layers of sapodilla. The presence of higher proportion of sapodilla in the product could contribute to the moderate score of its taste and aroma. Composite fruit products restructured with encapsulated Ca-lactate resulted in lower score of appearance. This was due to the fact that the encapsulating materials were only partially dissolved during mixing and gel setting. It showed many white spot on the surface of the products which made it less attractive. The gel strength of fruit composite restructured with encapsulated Ca-lactate was lower than the product restructured with Ca-lactate (non encapsulated). The use of encapsulating materials inhibited the release of Ca to form a gel in with alginate. There was no noticeable mouthfeel in both sapodilla and jack fruit layers.

The use of three different types of alginate (high guluronic, medium guluronic, and high mannuronic) had no significant effect on the taste, aroma, appearance, mouthfeel, and gel strength of fruit composite made of jack fruit and sapodilla fruit layers (Figures 6 and 7). The taste, aroma, and mouthfeel of jack fruit layer were not significantly different for fruit composites restructured with encapsulated Ca-lactate or non encapsulated Ca-lactate. However, fruit composite restructured with non encapsulated Ca-lactate showed better gel strength and appearance than those of encapsulated Ca-lactate. The differences in gel strength and appearance were more obvious when the sapodilla fruit layer was evaluated.

Results of this study indicated that the non thermal restructuring technique using gel Ca/alginate as binding system was very effective in maintaining fresh fruit product sensory properties. Further effort, however, is still needed to reduce the presence of undesirable aftertaste due to the use of non encapsulated Ca-lactate and less attractive appearance due to the use of encapsulated Ca-lactate.

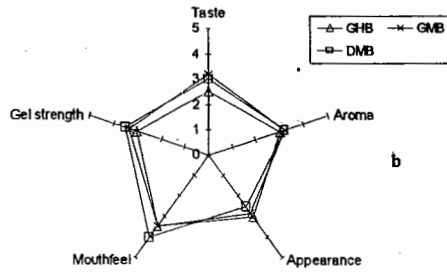
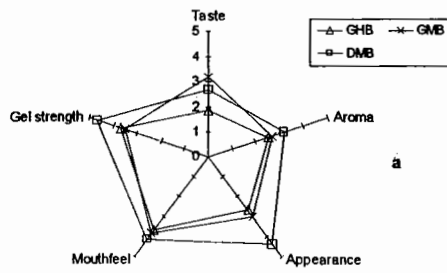


Figure 2. Sensory evaluation of restructured fruit layers consisted of jackfruit-sapodilla-jackfruit puree (emphasis on jack fruit sensory properties) after storage at 4°C for 20 hours, (a) Ca-lactate, (b) encapsulated Ca-lactate. Type of alginate : GHB (high guluronic), GMB (medium guluronic), and DMB (high mannuronic).

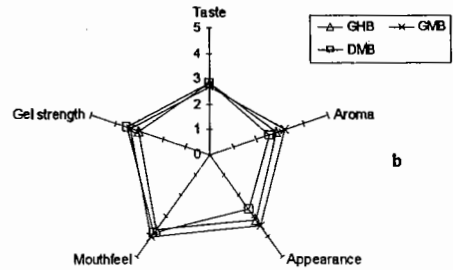
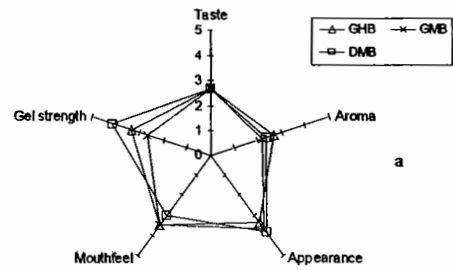


Figure 4. Sensory evaluation of restructured sapodilla-jackfruit-sapodilla puree (emphasis on jack fruit sensory properties) after storage at 4°C for 20 hours; (a) Ca-lactate, (b) encapsulated Ca-lactate. Type of alginate : GHB (high guluronic), GMB (medium guluronic), and DMB (high mannuronic).

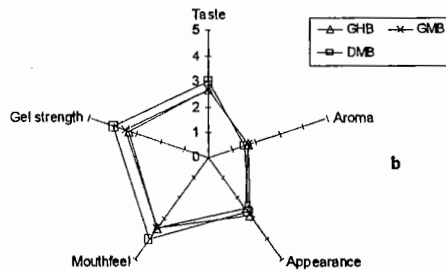
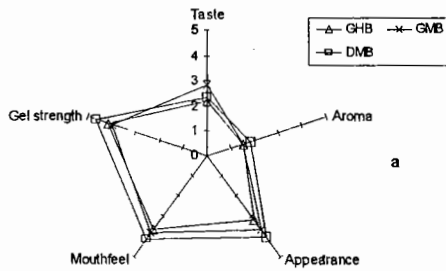


Figure 3. Sensory evaluation of restructured jackfruit-sapodilla-jackfruit puree (emphasis on sapodilla sensory properties) after storage at 4°C for 20 hours; a: Ca-lactate, b: encapsulated Ca-lactate. Type of alginate : GHB (high guluronic), GMB (medium guluronic), and DMB (high mannuronic).

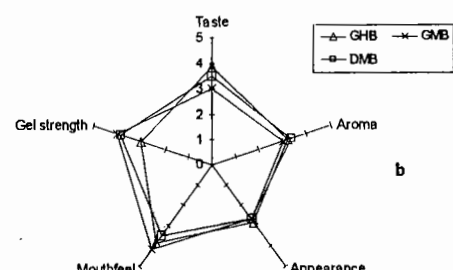
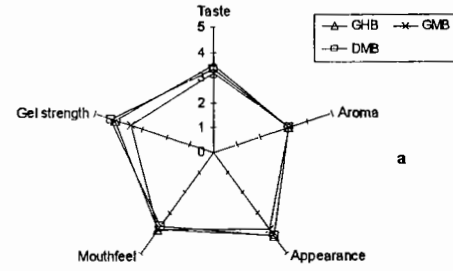


Figure 5. Sensory evaluation of restructured sapodilla-jackfruit-sapodilla puree (emphasis on sapodilla sensory properties) after storage at 4°C for 20 hours, (a) Ca-lactate, (b) encapsulated Ca-lactate. Type of alginate : GHB (high guluronic), GMB (medium guluronic), and DMB (high mannuronic).

## CONCLUSION

Type of alginate had no effect on the sensory properties of restructured fruit layers. However, the source of calcium in the form of encapsulated or not encapsulated powder showed significant effect on the appearance and gel strength. The fruit layers prepared using encapsulated Ca-lactate had less attractive appearance and weaker gel strength than the fruits restructured with free Ca-lactate. The two difference source of calcium had no significant effect on the products taste, aroma, and mouthfeel.

## ACKNOWLEDGEMENT

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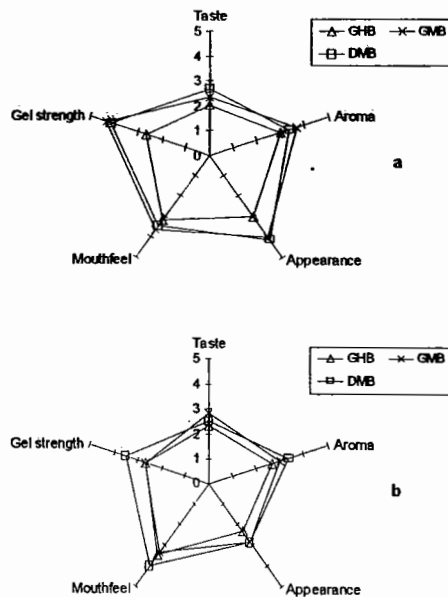


Figure 6. Sensory evaluation of restructured jackfruit-sapodilla puree (emphasis on jack fruit sensory properties) after storage at 4°C for 20 hours, (a) Ca-lactate, (b) encapsulated Ca-lactate. Type of alginate : GHB (high guluronic), GMB (medium guluronic), and DMB (high mannuronic).

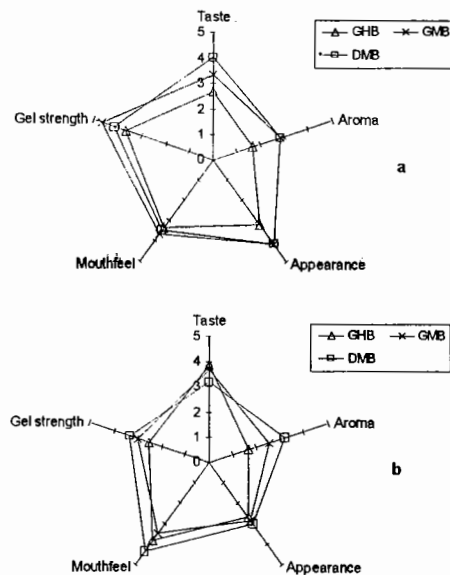


Figure 7. Sensory evaluation of restructured jackfruit-sapodilla puree (emphasis on sapodilla sensory properties) after storage at 4°C for 20 hours, (a) Ca-lactate, (b) encapsulated Ca-lactate. Type of alginate : GHB (high guluronic), GMB (medium guluronic), and DMB (high mannuronic).