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Maltodextrin Encapsulation of Garcinia atroviridis Griff by Spray Drying Technique

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Abstract— ***The purposes of this study were to produce Garcinia powder and to evaluate the physicochemical changes of the spray dried powder using maltodextrin as encapsulating agent. Three different concentrations of maltodextrin (3%, 5% and 8%) were added to Garcinia juice with the concentration 50% w/v at three different inlet temperatures (165 ^{o}C, 175 ^{o}C, 185 ^{o}C) respectively. Results demonstrated that as inlet temperature increased, the moisture content and water activities decreased and the L*, a*, b*, hue and chroma values changed as the inlet temperatures were increased. The results also showed that there was no significant differences in hydroxycitric acid content of the spray dried powders for all the inlet temperatures investigated.***

Keywords—**Spray drying, *Garcinia atroviridis* Griff, maltodextrin, encapsulation**

I. Introduction

Garcinia atroviridis (G.atroviridis) Griff. is a medium-sized fruit plant that belongs to the Gutiferae family. It is endemic in Peninsular Malaysia and is known as "asam gelugor" or "asam keping". The fruit is distinctly have sour sweet taste, and have been used for centuries in South East Asia to make meals more filling, which give acidity to the cooked dishes. The plant contains fruit acids, such as citric acid, tartaric acid and ascorbic acid that contain antioxidant properties (Amran *et.al*, 2009). However, the fully ripe ones which are bright orange-yellow in colour, is too acidic to be eaten fresh. This plant is used frequently in Thai medicine as an acidic fruit for reducing weight and excess fat by stopping the glycogen process (thereby converting fat to energy). Drying is the process of removing the moisture from a food product which is accomplished by heating. In this process, two transport phenomena occur simultaneously: moisture movement and heat transfer. Spray drying of most fruit and vegetable juices require drying aids to accomplish the drying process. Maltodextrin has been used as a drying carrier to produce food powders and it has become a popular method nowadays (Sablani *et al*., 2008; Tonon *et al*., 2008). Previous studies have reported that the crude extract of this fruit can be used as antimicrobial, antitumour-promoting agent and it is high antioxidant (Ali *et al*, 2000) and the presence of Hydroxycitric acid, which has been primarily obtained from the *Garcinia* genus, is an effective inhibitor of lipogenesis with commercial and clinical applications (McCarty, 1995; Moffett *et al*., 1996). The objectives of this work were to produce spray dried *Garcinia atroviridis*. The physicochemical changes on moisture content, dissolubility, water activity, hydroxycitric acid content, and colour values of the powders were also determined.

II. Material and Methodology

Fresh *Garcinia* fruits, green in colour and overripe, were taken from Tropical Fruit Farm, Sungai Udang, Melaka. The average weight of each was from 400 g to 500 g. The juice extract was prepared from fresh and green *Garcinia* extracting it using fruit extractor. The approximate weight of *Garcinia* fruits to distilled water was in 1:1 ratio. The extracted juice was then filtered by using muslin cloth. The juice was then added with 3%, 5% and 8% of maltodextrin respectively before undergo spray drying process.

Spray drying
The spray drying experiments were performed using a lab scale spray dryer Lab Plant SD 06. Three different concentrations of maltodextrin (3%, 5% and 8%) as the drying aid were added to Garcinia juice with the concentration 50% w/v at four different inlet temperatures (165 °C, 175 °C, 185 °C) respectively. The drying aids and their proportion with Garcinia juice were chosen based on previous investigations.

Moisture content
Moisture content was determined by the AOAC method. Mass loss after 5 g of each powder was placed in an oven dryer at 105 °C (U30, Memmert) for 3 h was determined.

Water activity (aw)
Garcinia powders of 1 g were determined using a water activity meter (Novasina) at 25 °C.

Colour
The colour of Garcinia juice and powder were measured using (Lovibond Tintometer PFX 880/L) and expressed as L*, a*, and b* values.

Particle size distribution
The sieve analysis was done by a typical sieve analysis method using a nested column of sieves (ranging from 250 - 2000 μm). The sample was poured onto the top sieve (which had the widest openings) and the column was typically placed in a mechanical shaker. The shaker shook the column for about five minutes after which the material on each sieve was weighed and divided by the total weight to give a percentage retained on each sieve.

III. Results

Moisture content , water activity and Hydroxycitric acid content
The moisture content and water activities were clearly influenced by the inlet air temperatures and drying aids added. High inlet drying air temperature often resulted in decreasing moisture

content and water activities. Other than that, there was no significant different in hydraxycitric acid content in Garcinia powder as it remained before and after the spray drying process was done. Drying aids should reduce hygroscopic and thermoplastic properties with variation of the Garcinia juice properties and should not alter the quality of the Garcinia powders. Generally, the greater the temperature differences between the particles, the greater the evaporation rate (Grabowski *et al*, 2006). Similar results have been reported for spray dried tomato paste (Goula *et al*, 2004) and for pineapple juice (Abadio *et al*, 2004). Moisture content also decreased with increasing maltodextrin concentration as a drying aid. This was due to the hygroscopic property of maltodextrin and hence it reduced moisture content and aw of powdered Garcinia.

Particle size distribution

The variation in particle size distribution which could be caused by the caking and sticking of the powder on each chamber side could be overcome by scrapping method. Nevertheless, Garcinia powder was produced successfully. Sieve analysis for particle size distribution of the powder should be treated with some cautions especially for particles deviating radically from spherical shape, and it needs to be supplemented with microscopic examination of the powders. This is due to the facts that the size distribution of powders can be useful in estimating parameters for example the surface area available for a reaction, the ease of dispersion in water, or the performance characteristics of a spray dryer or a separating cyclone.

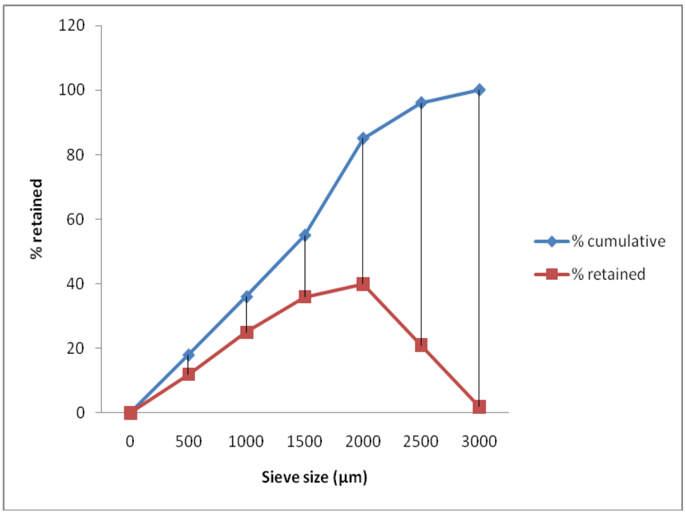

Fig 1: Particle size distribution

Colour values

Colour was represented by L* and a*/b* where L* values range from black (0) to white (100). The a*/b* ratio described yellowness of Garcinia powder. As the inlet air temperatures were increased, the L* value and yellowness of powders decreased. In general, higher drying air temperature affects colour of dried product due to a non-enzymatic browning reaction. The best colour value of Garcinia powder products were achieved at 175 °C inlet temperature and 5% of encapsulating agent.

IV. Conclusion

Moisture content and water activity of Garcinia powders decreased with increasing inlet air temperature. There was no significant difference in hydroxycitric acid content of the spray-dried powders for all the inlet temperatures investigated. The colour values changed as the inlet temperatures increased. At 175 °C inlet temperature and 5% maltodextrin concentration, the best quality of Garcinia powder was obtained.

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