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The use of purple sweet potato (Ipomoea batatas) starch as binder in mangosteen peel extracts lozenges formulation

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ABSTRACT

This study was performed to find an alternative ingredient for use as a binder in mangosteen peel extracts lozenges dosage form. The purple sweet potato starch was produced by the decantation method, while mangosteen peel extract was extracted by maceration. The starch was used to formulate the lozenges at three levels of 5, 10, and 15%, and manufactured by wet granulation method. Alpha-mangostin was analyzed by Thin Layer Chromatography Densitometry method. Lozenges were evaluated in term of weight, hardness, brittleness, time dissolves and nutritious substance assay. Results showed that mangosteen peel extract could be formulated in a lozenges dosage forms using purple sweet potato starch as a binder. All of formulas were fullfill the requirements except taste test response. The hardness and time dissolves of Formula III using 15% purple sweet potato starch were 9,4±0,1721 kg/cm^2 and 7,092±1,352 minutes, respectively. Formula I II was stated as the best formulation.

Keywords: mangosteen, starch, purple sweet potato, lozenges, Thin Layer Chromatography, densitometry

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INTRODUCTION

Mangosteen, *Garcinia mangostana* L., family guttiferae is a fruit and the famous species of the genus Garcinia. Since of unique appearance and flavor, mangosteen fruit is often revered as “queen” of tropical fruits, especially in South East Asian country. As an exotic fruit because of its delicious taste, beautiful shape, and snow-white flesh, mangosteen, is a very popular both in country and even abroad [1].

Mangosteen peel is the main part of the mangosteen fruit waste. Mangosteen peel extract one of natural source of antioxidant compounds were reported have several health benefits. It contains xanthone, mangosteen, garsinone, flavonoids and tannins. Pharmacological activity of varied substances found in mangosteen peel extract had been studied and reported, such as antioxidants, anticarinogenic, anti-inflammatory, antihistamine, anti-heart disease, and antifungal therapy for HIV [2]. To improve the benefits, mangosteen peel extract could be prepared in lozenges dosage form as an antioxidant as well as anticarciogenic [3,4].

Lozenges are generally used for the treatment of local irritation, infection of the mouth or throat, but can also contains active ingredients intended for systemic absorption after ingestion [5]. Lozenges dosage form has several advantages i.e provide a sense of fun, easy to use and carry [4]. The main ingredients in lozenges formula are diluent, binders, flavor, dyes, lubricants, and drug substances. The differences between a conventional tablet and lozenges are organoleptic properties, non-disintegration, and extended dissolution time on the tongue. Lozenges should be eroded, not desintegrated in the mouth cavity [6]. Chewable tablet has hardness of 7-14 kg/cm^2, a higher hardness characteristic compare to conventional tablets. The suitable binder is required to obtain an adequate hardness characteristics [7].

Indonesia has an abundant of tubers that could be processed into starch. Starch could be obtained from corn (*Zea mays*), cassava (*Manihot uttilisima*), potato (*Solanum tuberosum*) and wheat (USP30-NF25). It is an important

ingredient in the tablet formulations as binder, and filler. Now a day it is widely used and imported to supply the needs of the pharmaceutical industry [8].

Currently, several efforts have been performed to reduce imported starch in order to develop the manufacture of starch from tubers of raw materials locally as an additive in tablet dosage formulations. It is processed from bananas, maize, cassava and sweet potatoes. Based on previous studies of starch obtained from banana, sweet potato, cassava and maize are all eligible for the tablet excipients [9].

In this study, the purple sweet potato starch was used as a substitue binder in lozenges formulation. Purple sweet potato, *Ipomoea batatas* L, is an important source of food, starch, and raw materials in alcohol manufacture [10]. The advantages of purple sweet potato starch is higher gelatination temperature compare to other varieties of sweet potato starch so as to provide good binding characteristic of tablet [11]. Research indicated that the increase in starch content of sweet potato purple lozenges lead to an increase in hardness and postpone the desintegration time of tablet [12].

MATERIALS AND METHODS

Samples Collection and Identification

The mangosteen fruit was cultivated in Limau Manis, Pauh subdistrict, Padang, while purple sweet potato obtained in Pasar Usang, Guguk, in the District of Gunung Talang, Solok, West Sumatra, Indonesia. The plant had been identified in the Herbarium ANDA, Department of Biology, Faculty of Mathematics and Natural Sciences, University of Andalas, Padang, West Sumatra, Indonesia.

Investigation of Secondary Metabolites Content of Mangosteen Peel

Investigation of the content of secondary metabolites were performed on the fresh samples of mangosteen peel includes examination of alkaloids, flavonoids, terpenoids, steroids, saponins, and phenolic [13].

Preparation of Mangosteen Peel Extract

The the skin of mangosteen fruit wass peeled, peel is sliced crosswise and dried. The dried peel was grinded. Mangosteen peel extracts was prepared by the maceration method using ethanol (96%) for 5 days with occasional stirring. The maceration process was repeated following the same treatment (n=3).

Preparation of Purple Sweet Potato Starch (PSPS)

Weighed peeled potatoes was washed, grated and squeezed. The mixture was then filtered into the container. Suspension or filtrate was then decanted for 24-48 hours. Supernatant liquid was discarded and the sediment was washed repeatedly with water until the clearer starch precipitate obtained. Precipitated starch was dried using an oven at a temperature of ±50°C for 24 hours. Dried starch powder was then crushed and sieved using 80 mesh screen.

Evaluation of Starch

Purple sweet potato starch was examinated following the similar method on evaluation of cassava starch based on Indonesian Pharmacopoeia [14].

Lozenges Formulations of Mangosteen Peel Extract

Mangosteen peel extract lozenges was manufactured based on the following formulas shown in Tabel 1 bellow.

Table 1. Lozenges Formulas of Mangosteen Peel Extract

Ingredient	Function	Formulas		
		I PSPS 5%	**II PSPS 10%**	**III PSPS 15%**
Mangosteen peel extract (mg)	Substance	**100**	**100**	**100**
Mannitol (mg)	Diluent, Sweetener	**370**	**365**	**360**
PSPS Mucilagines (mg)	Binder	**5**	**10**	**15**
Talcum (%)	Glidant	**25**	**25**	**25**
Total weight tablet (mg)		**500**	**500**	**500**

Preparation of granules

Lozenges were manufactured by wet granulation method using PSPS paste as a binder. Mangosteen peel extract and mannitol were blended, and kneaded with PSPS paste step by step until appropriate mass obtained. Mass obtained

was sieved using 14 mesh screen and then dried in an oven. The dried granules were sieved through a 16 mesh screen and evaluated [15].

Tableting

Weighed dry granules was added with talc and mixed by mixing apparatus. The mixture were compressed into appropriate tablet. Tablets produced were evaluated [6, 12].

RESULTS AND DISCUSSION

Mangosteen plant has been identified in the Herbarium ANDA University of Andalas Padang, West Sumatra, Indonesia. The chemical contents of the fresh mangosteen fruit peel were found as follows flavonoids, steroids, saponins and terpenoids [16]

In extraction process, from 3 kg of dried mangosteen peel gained 1.25 kg of simplesia and rendemen of extracts obtained was 14.07%. Rf value of α-mangostin from mangosteen peel extract and lozenges were of 0.5 corresponding to the Rf value of the standard. The Rf value of α-mangostin could be seen on Figure 1. While the amount of α-mangostin in mangosteen peel extract found was 23.8%.

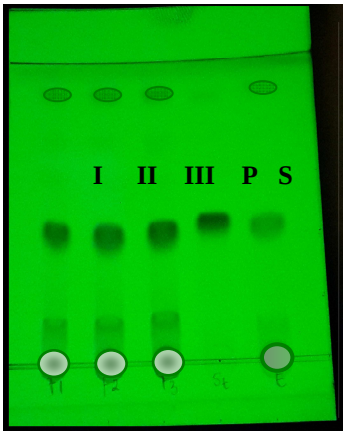

Figure 1. TLC Patterns of lozenges obtained and peel mangosteen extract under 254 nm UV lamp

The amount of cleaned purple sweet potato peel and starch obtained were 736.4, and 78.02 g or 10.60%, respectively. The examination results of purple sweet potato starch full filled the Indonesian Pharmacopoeia standard [14].

(a) **(b)**

Figure 2. a. Purple sweet potato starch, b. Microscopic of starch 400x magnification

The excipients used in the manufacture of lozenges were mannitol (PT Kimia Farma) and talc (PT Brataco). The evaluation of mannitol and talc were fulfilled the specifications of the certificate of analysis. The flow ability, lost on drying, water content, particle size distribution and bulk density were in accordance with the criteria in the literature. Evaluation of tablets were met the requirements of the literature, except the tablet taste. No one from all of 10 volunteers stated as a very good and even good taste for all of formulas. Data can be see on Table II.

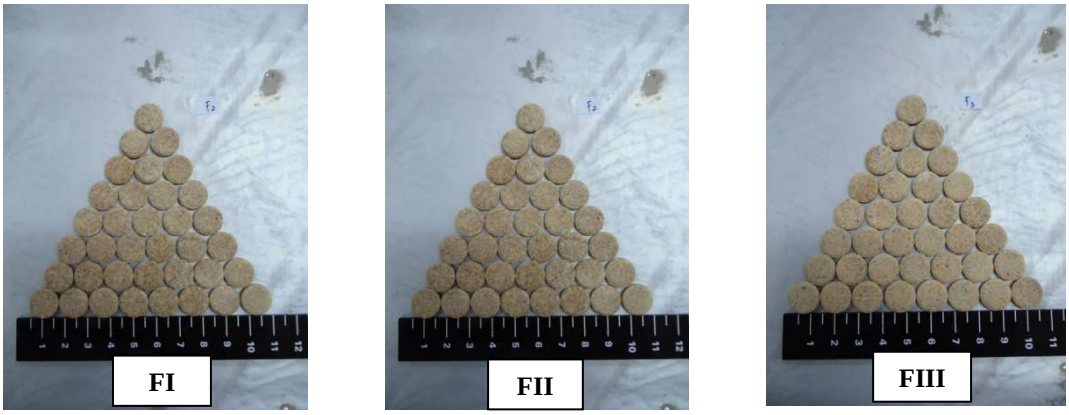

Figure 3. All Formula of Lozenges produced in this research

Table 2. Lozenges evaluation

No.	Evaluation	Average ± SD		
		Formula I	Formula II	Formula III
1.	Hardness (kg/cm^2)	7,9 ± 0,61	9,1 ± 0,053	9,4 ± 0,1721
2.	Time Dissolves (min)	5,6 ± 1,06	6,4 ± 1,46	7,1 ± 1,35
3.	Brittleness (%)	0,16 ± 0,075	0,12 ± 0,08	0,09 ± 0,07
4.	Weight (mg)	499,8 ± 2,26	499,4 ± 1,28	499,4 ± 1,06

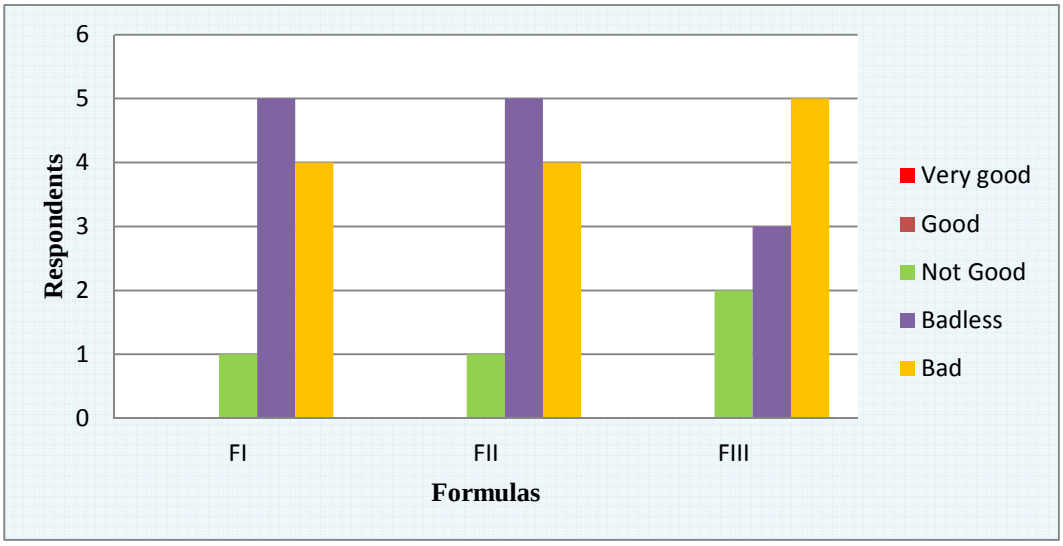

Figure 4. Renpondents Taste Diagram for All Formula of Lozenges produced in this research

CONCLUSION

Based on data obtained from studies conducted, its could be concluded that mangosteen peel extract (*Garcinia mangostana* L.) could be made in a lozenge dosage forms using purple sweet potato starch (*Ipomoea batatas* L. Lam) as a binder. Results of the evaluation of the extract, starch, granules and tablets were met the criteria of dosage lozenges according to the literatures. Formula III prepared using the PSPS at concentration of 15% gave the hardness and the time dissolves were 9.4±0.17 kg/cm^2, and 7.1±1.35 min, respectively. The hardness and time dissolves were better than the Formula I and II.

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