

ICASH-A089

## MICROENCAPSULATION OF KARAMUNTING LEAF EXTRACT (*Rhodomyrtus tomentosa*) AS AN INSTANT DRINK POWDER

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### ABSTRACT

**Backgrounds:** Karamunting (*Rhodomyrtus tomentosa*), a local wild plant from Central Kalimantan, Indonesia is believed by the Dayak tribe to treat diabetes mellitus. Based on the literature review, there have been no studies related to Karamunting focused on processed products in practical dosage forms in the form of instant powder, which has the longest shelf life. This study aims to explore the solubility and percentage of insoluble solids of Karamunting leaf powder that has been encapsulated with the addition of Maltodextrin. In addition, an assessment of the sensory attributes of Karamunting leaf drinks was also carried out.

**Methods:** This study was used an experimental with applied the Randomized Block Design (RBD) design with 2 factors, comparing the number of Karamunting leaf extracts and the concentration of Maltodextrin to produce a formula of 0.5L:5%, 0.5L:10%, 0.5L:15%, 1L:5%, 1L:10% and 1L:15%. This research conducted in the Laboratory of Agricultural Product Technology, Gadjah Mada University, Yogyakarta, Indonesia from November to December 2018.

**Results:** The application of spray dryer produced fine powder of Karamunting drink. It has a distinctive aroma and its color was ranged from bright cream to slightly brownish. Addition of Maltodextrin significantly accelerated powder's solubility and decreased its yield ( $p < 0.05$ ). Panelists tend to prefer products with 1 L of Karamunting leaf extract and 10% Maltodextrin.

**Conclusions:** Solubility rate of Karamunting leaf extract is strongly influenced by the concentration of Maltodextrin. The higher the concentration of Maltodextrin, the faster the product will be dissolved. Addition of Maltodextrin significantly reduced the total of insoluble solids. However, antidiuretic activity of Karamunting drink should be investigated to prove its health claim.

**Keywords:** Karamunting Leaves, Maltodextrin, Instant Drink Powder, Encapsulation

### INTRODUCTION

As a country with a tropical climate and fertile soil, Indonesia has many wild plants. One of them is Karamunting (*Rhodomyrtus tomentosa*), which usually grows in bushes and arid fields. Karamunting has different names in Indonesia regions. In Pekanbaru for example, this plant is known as Kalamunting. While in North Sumatra, this plant is known as Haramonting and in West Java, it is known as Harendong Sabrang. However, people in Central Kalimantan, named it Karamunting, which is often missinterchangeably used with *Masisin*, a berry typical fruit of the Dayak tribe. It is because both plants usually grow side by side.

Karamunting belongs to the group of shrubs. It has single leaves with hairy and rough surfaces, rounded base, flat edge and tapered tip. Karamunting's flowers are compound and purple in color. Karamunting produces edible fruits with tiny seeds and dark purple in color. This color may stain in teeth when people eat the fruits. Although it looks less attractive, Karamunting (*Rhodomyrtus tomentosa*) is believed by traditional society in Central Kalimantan, to treat diabetes mellitus (DM). DM is a condition when blood glucose concentration is chronically higher than the normal value due to insulin disfunction [1]. It is caused by hereditary factors, poor diet and less physical activity.

Some preliminary studies showed that Karamunting leaves contain phenol compounds, flavonoids, saponins, tannins, steroids and triterpenoids [2–4]. Furthermore, its flavonoid compounds have antioxidants, antimicrobial, antibacterial, antifungal, antiviral, hepatoprotective and anti-inflammatory activities. Therefore, scientist concluded that Karamunting may have antidiabetic activity through its function as antioxidants. Antioxidants in Karamunting leaves can bind free radicals leads to oxidative stress reduction. Consequently, it reduces insulin resistance and prevents the development of pancreatic  $\beta$ -cell dysfunction and damage [5]. So far, investigations of Karamunting were mainly conducted in raw material level, towards its fresh fruits and leaves. For this reason, it is necessary to conduct research at the application level, through the manufacturing of instant Karamunting drink powder. This type of product may have a longer shelf life compare to others due to its low moisture content as a result of drying process. In terms of practicality, instant drink powder sounds more attractive to busy people. This product may become a potential functional drink in the future.

## METHODS

Karamunting leaves were purchased from a local market in Palangka Raya, Central Kalimantan. The leaves were extracted and encapsulated with maltodextrin. This process was carried out at Laboratory of Agricultural Product Technology, Gadjah Mada University, Yogyakarta, Indonesia in November to December 2018. This study applied Randomized Block Design (RBD) with two factors: the amount of karamunting leaf extract (K) (0.5 L and 1.0 L) and maltodextrin concentration (M), varied from 5%, 10% and 15%. Therefore, the combinations were as follow:

Table 1 Formulation of Karamunting Instant Drink Powder

Formulation	Amount of Karamunting Leaf Extract (L)	Maltodextrin Concentration (%)
K1M1	0.5	5
K1M2	0.5	10
K1M3	0.5	15
K2M1	1.0	5
K2M2	1.0	10
K2M3	1.0	15

Each treatment was repeated in triplicate thus 18 experimental units were obtained. All formulas were sprayed using laboratory spray dryer and produced fine powders. Their colors were measured using a smartphone Colorimeter app version 3.5.3 (Research Lab Tools, Sao Carlos, SP).

### Solubility test

Solubility test was carried out by recording the time needed to dissolve 2 grams of Karamunting leaf powder in 50 mL of 50°C warm water [6]. Next, the solution was stirred with a magnetic stirrer at medium speed. Homogeneous solutions were separated using filter paper, which initially recorded as weight of filter paper (A). Filter paper that has been pasted with solution residue was then dried at 105°C

to its constant weight. The final weight was recorded (B). The percentage of dissolved solids was calculated using this formula:

$$\text{percentage of dissolved solids} = \frac{(B - A)}{A} \times 100\%$$

### ***Organoleptic Test***

As much as 1 gram of Karamunting leaf instant powder from each formula was dissolved in 40 mL of warm water [6]. Hedonic test of color, aroma, and appearance was conducted by a total of 16 moderately trained panelists. This type of panelist is anyone who has previously been trained or has performed organoleptic tests to determine certain sensory properties in food. This test was carried out at Organoleptic Laboratory, Health Polytechnic of Palangka Raya, Indonesia.

### ***Data Analysis***







Factorial ANOVA test (General Linear Model) was used to analyse data of solubility test while Friedman Test was used to analyse the organoleptic test result.

## **RESULTS**

### ***Characteristics of Karamunting Leaf Drinks***

Table 2 shows the color of Karamunting leaf drinks from Colorimeter App. They were varied from brownish green to light brown.

Table 2 Color of Karamunting Leaf Extract Powder

Formulation	Red	Green	Blue	Color
K1M1 (0,5 L : 5%)	87	75	51	
K1M2 (0,5 L : 10%)	137	131	95	
K1M3 (0,5 L : 15%)	129	123	89	
K2M1 (1 L : 5%)	119	105	66	
K2M2 (1 L : 10%)	131	118	83	
K2M3 (1 L : 15%)	134	129	100	

In general, the higher the concentration of maltodextrin added in the solution of Karamunting leaf extract, the brighter the color of powder produced.

### ***Solubility Rate***

The solubility rate of Karamunting instant drink powder was ranged from 38.25 seconds to 61.48 seconds (Figure 1).

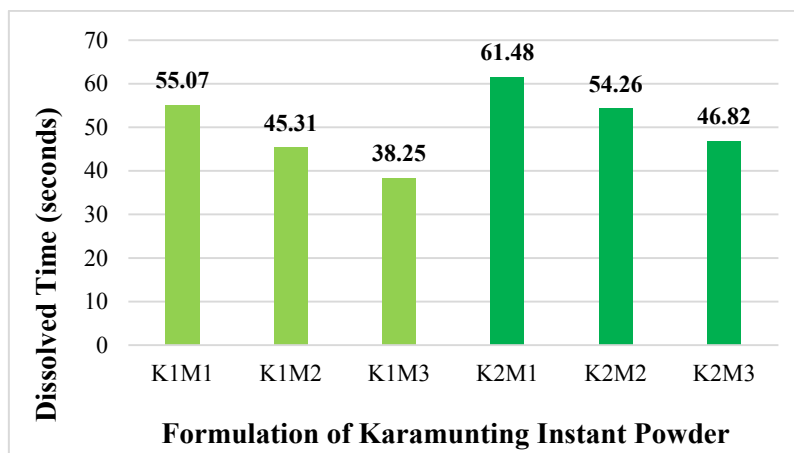


Figure 1. Solubility Rate of Karamunting Instant Powder

The solubility chart above shows the time needed to dissolve instant powder, which become longer along with the addition of karamuting leaf extract. On the other hand, the higher the concentration of maltodextrin, the faster the powder will be dissolved. This is confirmed by the statistical result in Table 3, which shows that the concentration of maltodextrin significantly affected the solubility rate of Karamunting powder ( $p < 0.05$ ).

Table 3 Statistical Test of Solubility Rate of Karamunting Instant Powder

Formulation	Karamunting Leaves Extract (L)	Maltodextrin Concentration (%)	Dissolved Time (seconds)	Sig.
K1M1	0.5	5	55.07 ± 0.834 <sup>c</sup>	0.00001
K1M2		10	45.31 ± 2.283 <sup>b</sup>	
K1M3		15	38.25 ± 1.456 <sup>a</sup>	
K2M1	1	5	61.48 ± 2.232 <sup>d</sup>	
K2M2		10	54.26 ± 1.404 <sup>c</sup>	
K2M3		15	46.82 ± 1.301 <sup>b</sup>	

Different notations show significantly different at the 0.05 level

### ***Insoluble Solids Percentage***

Insoluble solids percentage of Karamunting leaves instant powder ranged from 2.21% to 6.32. Its total rendemen tend to decrease along with addition of maltodextrin (Figure 2).

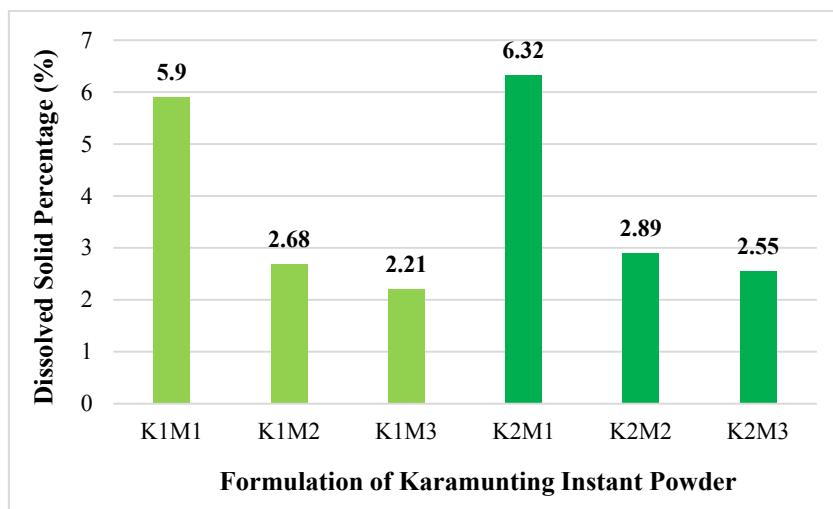


Figure 2 Insoluble Solid Percentage of Karamunting Instant Powder

Table 4 clearly confirms that insoluble solids percentage is significantly influenced by the amount of Karamunting leaf extract and the concentration of maltodextrin ( $p < 0.05$ ).

Table 4 Statistical Test of Insoluble Solid Percentage of Karamunting Instant Powder

Formulation	Karamunting Leaves Extract (L)	Maltodextrin Concentration (%)	Dissolved Time (seconds)	Sig.
K1M1	0.5	5	$5.89 \pm 0.531^b$	0.00001
K1M2		10	$2.68 \pm 0.321^a$	
K1M3		15	$2.21 \pm 0.293^a$	
K2M1	1	5	$6.32 \pm 0.368^b$	
K2M2		10	$2.89 \pm 0.225^a$	
K2M3		15	$2.55 \pm 0.410^a$	

Different notations show significantly different at the 0.05 level

#### ***Organoleptic Test of Karamunting Instant Drinks***

Before organoleptic testing was conducted, Karamunting leaf instant powder were first dissolved in the same amount of warm water. Sensory parameters observed in the instant powder were color, aroma and appearance. No assessment of taste attribute was carried out because the instant powder drink was processed without any added sweeteners. Therefore, the basic flavor produced was tasteless and panelists may dislike this tastelessness.

Figure 3 shows the result of organoleptic tests on color of Karamunting leaf drinks. Most of panelists like the formula of 0.5 L Karamunting leaf extract and 15% maltodextrin (K1M3).

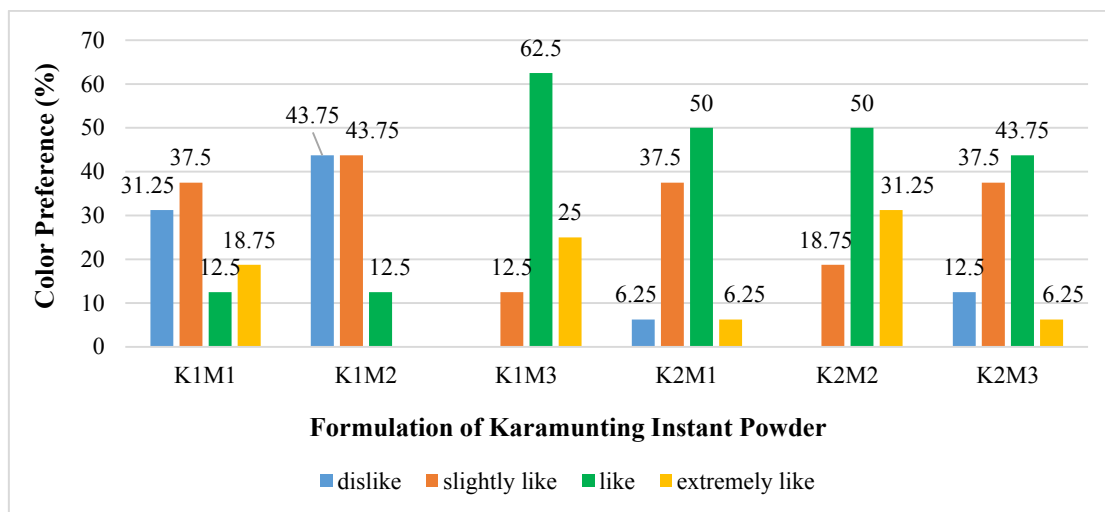


Figure 3 Color Preference of Karamunting Leaf Drinks

The aroma of Karamunting instant drink is described as a distinctive aroma of Karamunting leaves. However, the scent is not very intense.

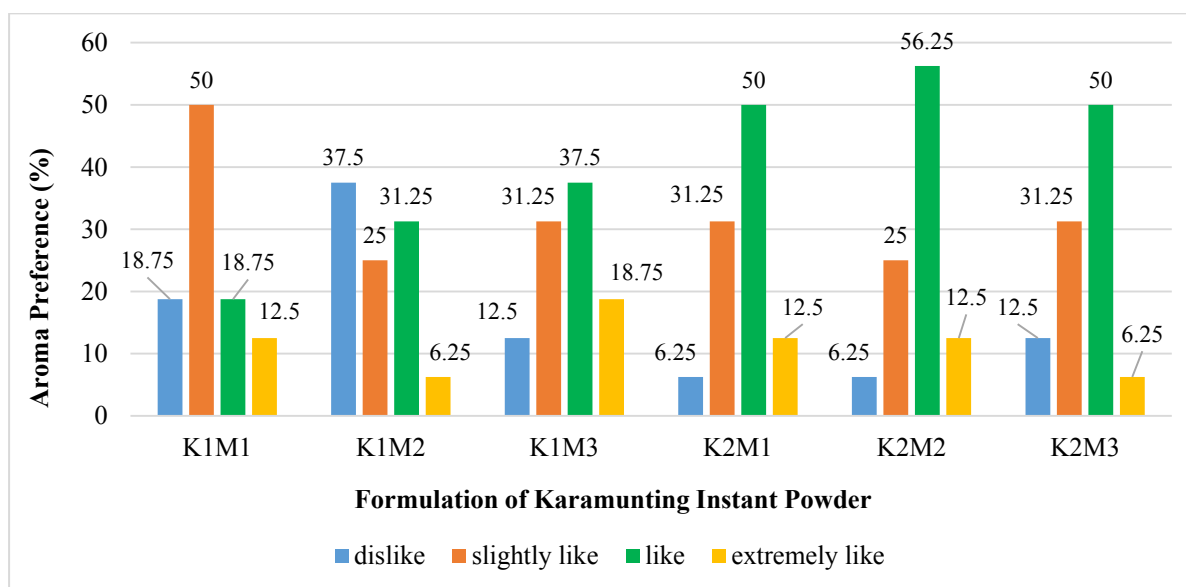


Figure 4 Aroma Preference of Karamunting Leaf Drinks

Figure 4 shows fluctuations in aroma preferences of Karamunting instant drink. It is likely that this attribute was difficult to measure. When compared to 0.5 L Karamunting extract (K1), 1 L Karamunting extract (K2) tends to be preferred by panelists, especially the formula of K2M2 (1 L Karamunting extract and 10% maltodextrin). Likewise, figure 5 shows K2M2 as the most preferred by panellist in terms of products' appearance.

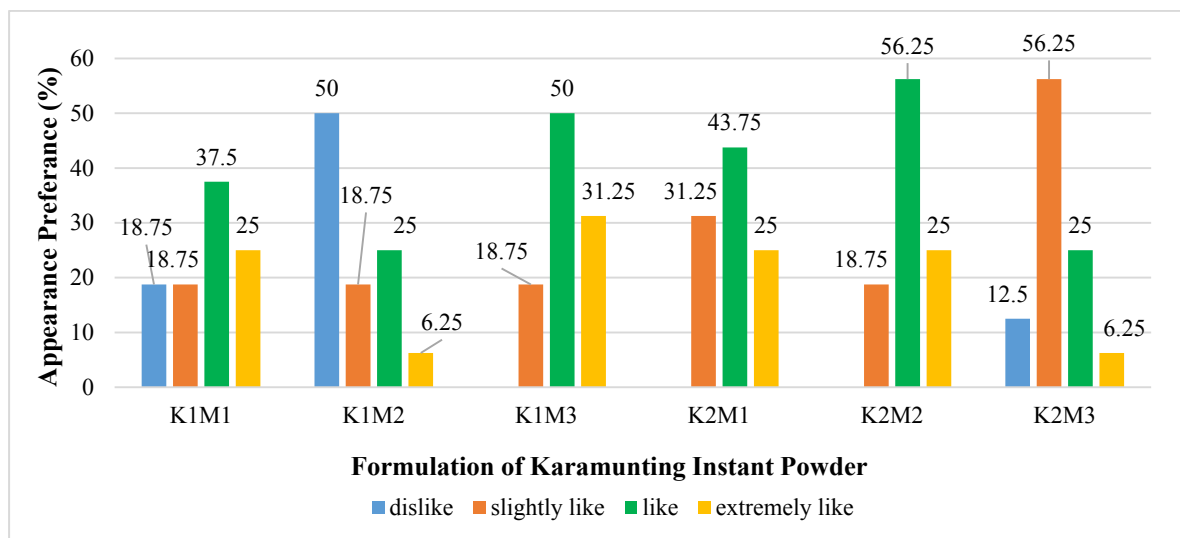


Figure 5 Apperance Preferences of Karamunting Instant Drinks

## DISCUSSION

### *Characteristics of Karamunting Leaf Extract Powder*

The color of Karamunting leaf extract powder were varied from brownish green to light brown. It is likely that chlorophyll, pigment responsible for the green color of fresh Karamunting leaves were oxidized after they were crushed to produce the leaves extract [7]. This causes the color of Karamunting leaves juice to turn brownish. Moreover, during the extraction process, the chlorophyll level dropped down, vanished its green color. On the other hand, addition of maltodextrin contributes to the color of end product. The higher the concentration of maltodextrin, the brighter the color of Karamunting instant powder.

The powder was smooth and fine in texture as the result of micro-sized nozzles found in the head of spray dryer. Its smaller particle size will accelerate the dissolution process when the powder is mixed with water. Moreover, maltodextrin enlarged the outer surface of Karamunting powder particles.

Karamunting instant powder had a distinctive aroma, similar to the aroma of fresh Karamunting leaves. The greater the concentration of maltodextrin added, the fainter the distinctive aroma of the powder. It is likely that the function of maltodextrin as an encapsulator media/coating material has proven to be efficient to produce Karamunting instant powder.

### *Solubility Rate and Insoluble Solid Percentage*

According to the solubility test, concentration of maltodextrin significantly affected the solubility rate of Karamunting powder which means the higher the concentration of maltodextrin, the faster the powder will be dissolved. Chemically, maltodextrin has a helical spiral-shaped molecular structure that allows active components and nutrients in Karamunting leaf extract to be caught inside during mixing and drying processes [8]. The nature of maltodextrin which is very hygroscopic (easily soluble in water) allows the product to form a uniformly dispersed system [9]. As a result, maltodextrin will increase the surface area of the powder and then escalates its solubility rate [10]. In addition, maltodextrin is rapidly soluble in cold water [11]. Thus, even if the product is dissolved in cold water, the powder is expected to disperse easily. On the other hand, the total yield will increase along with the addition of Karamunting



leaf extract solution. The yield is originated from insoluble fiber [11]. Theoretically, the addition of fillers in the form of maltodextrin is intended to prevent damage of heat treatment, accelerate the drying process, coat unwanted components of flavor and aroma (odor and unpleasant taste) [12].

### ***Organoleptic Test of Karamunting Instant Drinks***

The assessment of organoleptic quality is very important because it reflects consumer's acceptance towards food products. Accordingly, panelists tend to prefer product with 1 L of Karamunting leaf extract and 10% maltodextrin (K2M2) which is slightly brown in color and has a distinctive Karamunting aroma. Its color is strongly influenced by chlorophyll pigment of the Karamunting leaves which has been oxidized during the extraction process. Like any herbal products, its brownish green color is often psychologically associated with the health benefits of a product [13]. According to Creusen (2015), color aspect contributes to 80% of consumer behavior in choosing products [14]. Unfortunately, no further color survey was carried out to examine the colors that meet consumer's expectation. Therefore, to be further processed into a commercialized Karamunting leaf beverage, it is necessary to conduct a color survey.

On the other hand, there were fluctuations in aroma preferences of Karamunting instant drink. It seems this attribute is difficult to measure. Differences of opinion in the assessment of aroma quality are likely caused by differences in olfactory sensitivity [15]. In general, products from herbal plants have a distinctive aroma due to flavonoid compounds dissolved in extraction process. These bioactive components often have health benefits, for example to treat diabetes mellitus and its complications [16,17].

In liquid products, visual appearance is closely related to the consistency and presence of flocculants when mixed with water. Consistency in K2 formulation tends to be thicker compared to all K1 formulations, so it may look more attractive. Its viscosity actually represents the total of dissolved solids [18]. On the other hand, the consistency of Karamunting drink may greatly affect the attributes of taste and texture. In which case, drinks with higher viscosity will leave a certain impression in the mouth [19]. Therefore, when this beverage formula will further be developed, the assessment of the rheological aspects and tribology of the product are required.

### **CONCLUSIONS**

1. Solubility rate of Karamunting leaf extract is strongly influenced by the concentration of maltodextrin. The higher the concentration of maltodextrin, the faster the product will be dissolved. Addition of maltodextrin significantly reduced the total of insoluble solids. Panelists tend to prefer product with 1 L of Karamunting leaf extract and 10% maltodextrin.
2. Formulation of instant Karamunting drinks can be developed by adding sugar or natural sweeteners such as stevia leaves. Furthermore, other stabilizers such as arab gum, carrageenan and whey may be added to examine the effectiveness of powder solubility when combined with maltodextrin. On the other hand, the assessment of the rheological aspects and tribology of the product are required to examine consumer preference towards this functional drink. At last, its antidiabetic activity should be investigated to prove the health claim.

### **ACKNOWLEDGMENTS**

The authors acknowledge financial support from Health Ministry of Indonesia, under the Lecturer Research Grant for Health Polytechnic of Palangka Raya.



## CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

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