INOVASIA (2) (2023) P-ISSN 2964-9420; E-ISSN 2963-2617

INOVASIA

https://jurnal.institutsunandoe.ac.id/index.php/inovasia

FORMULATION AND EVALUATION OF PHYSICAL PROPERTIES OF ANTIOXIDANT EFFERVESCENT GRANULES AND EXTRACT OF KARAMUNTING FLOWER (*MELASTOMA MALABATHRICUM* L.)

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Accepted: 01st June 2023. Approved: 12nd July 2023. Published: 23rd July 2023.

ABSTRACT

Karamunting (*Melastoma malabathricum* L.) contains several compounds with pharmacological activities including antioxidant, analgesic, anti-inflammatory, antipyretic and diuretic. *Karamunting* flowers contain flavonoid compounds, saponins and tannins. Tannin compounds can stabilize free radicals by complementing the electron deficiency of free radicals. To increase the utilization of *karamunting* flowers, it is formulated in the form of effervescent granules. This study aims to determine the ethanol extract of *karamunting* flower (*Melastoma malabathricum* L.) with concentrations of 1%, 2%, and 3% can be formulated in the form of effervescent granules. The physical properties of the granules were tested which included organoleptic test, flow rate test, granule compressibility test, dissolving time test and pH of effervescent granules. The results showed that formula 3 with a concentration ratio of 3% ethanol extract was a formula that met the requirements for the physical properties of the granules, namely with a sweet and sour taste, a characteristic odor of *karamunting*, and a dark purple-brown color. With an average flow rate of 2.853 g/sec, average compressibility of 21.12%, an average dissolving time of 7.52 seconds and a pH measurement of 5.

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Keywords: Antioxidants, Effervescent Granules, *Karamunting* Flower, Physical Properties.

INTRODUCTION

Natural plant materials are the most widely used source of active ingredients that can be used as medicinal components and play an important role in the treatment or prevention of human diseases. *Melastoma malabathricum* L. or also known as *Karamunting* is found in Indonesia, especially in abandoned forests. This plant has a beautiful purple flower crown so it is often used as an ornamental plant. The fruit is also often eaten, especially by people who live in rural areas (Pertama et al., 2021).

There are many benefits of *karamunting* for humans from the roots, fruit, stems, leaves to the flowers. *Karamunting* flowers contain flavonoids, saponins, and tannins. Tannin is one of the phenolic compounds found in plants, tannin compounds can stabilize free radicals by completing the lack of electrons possessed by free radicals. *Melastoma malabathricum* L. leaf and flower extracts have been widely reported as antioxidants. From the results of previous research, ethanol extract of *karamunting* flowers has an IC50 value of 14.083 ppm (µg/mL). Based on these results, it can be concluded that the ethanol extract of *karamunting* flowers has very strong antioxidant activity because it has an IC50 value of <50 µg/mL (Isnaini et al., 2019).

To facilitate its use, *karamunting* flower is formulated into a preparation in the form of effervescent granules (Daswi, 2021). Effervescent granules were chosen as a dosage form because they can provide a refreshing sensation, are easy to use, have an attractive color, smell, and taste (Vediya et al., 2022). Effervescent granules are granules that

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contain a mixture of acids and bases, which when added to water the acids and bases will produce carbon dioxide. The acid source commonly used is a combination of citric acid and tartric acid and the base source used is sodium bicarbonate (Grajang & Wahyuningsih, 2018). Sodium bicarbonate is a crystalline and water-soluble salt which when reacted with an acid source will produce foam in effervescent preparations, the addition of sodium bicarbonate in effervescent preparations can increase total soluble solids levels and can improve taste (Vediya et al., 2022).

Karamunting flower from Central Kalimantan peat forest has potential as a natural antioxidant (Isnaini et al., 2019) and has abundant availability but has not been widely developed into pharmaceutical dosage forms including effervescent granules (Arief et al., 2012; Niah & Baharsyah, 2018). Therefore, researchers are interested in making a formulation of *karamunting* flower extract into effervescent granules that are more attractive and easy to use as a health drink from natural ingredients from peat forests. Evaluation of physical properties using organoleptic test, flow rate test, compressibility test, dissolution time test and pH test.

METHODS

Research type and method

This type of research used is an experimental type of laboratory approach method carried out by various experiments. The method in this study uses the wet granulation method because the granules produced are more homogeneous and easier to flow, thus better ensuring the uniformity of size and content of active substances. The wet granulation method refers to using the non-reactive liquid method, which is made two mixtures separately between the acid mixture and the base mixture. This separation is done to avoid premature effervescent reaction. By using three comparisons of ethanol extract of karamunting flower (*Melastoma malabathricum* L.), namely 1%, 2%, and 3%.

Research Tools and Materials

1. Research tools

The tools needed in this study The tools used in this study are analytical scales, *glass* tools, ovens, mesh no sieves. 20 and 40, pH indicator, filter paper, stirring rod, glass container, mortar, stemper, maceration set, and granule flow rate meter.

2. Research Materials

The materials used in the study were *karamunting* flowers, citric acid, tartaric acid, sodium bicarbonate, sodium cyclamate, mucilago amili, lactose, grape essence.

Procedure

3. Plant Determination

Karamunting plants taken in Rawung, Tangkiling, Bukit Batu District, Central Kalimantan. This plant has been determined on complete plant parts at the Plant Systematics Laboratory, Faculty of Biology UGM No. 01940/S.Tb./I/2021 which shows that it is true that the plant taken is *Karamunting* with another name, *Senggani*.

4. Simplicia Preparation

The *karamunting* plants selected in this study are *karamunting* plants located in Rawung, Tangkiling, Bukit Batu District, Central Kalimantan. The karamunting plant that will be sampled in this study is the flower part. How to take *karamunting* flowers picked and taken blooming flowers. The process of making *karamunting* flower Simplicia is first cleaned from the tube-shaped petal tube in wet sorting, washing is carried out after that drying with sunlight to dry, after drying the Simplicia is sorted dry. The dried flowers are then *blended* and sieved until smooth so that when extracted the compounds in the *karamunting* fruit will be attracted all by the solvent.

5. Sample extraction

Simplicia that has been collected from *karamunting* flower plants is dissolved with 96% ethanol solvent in a ratio of 1:3 (L). Simplicia karamunting flowers that have been dissolved will be macerated every 24 hours filtered to take the filtrate and replaced using new ethanol, repeated for 3 days. After maceration, the filtrate of the *karamunting* flower is then evaporated using a *rotary evaporator to* produce an extract which is then placed on a *waterbath* to become a thick extract.

Table 1 Effervescent Granule Formula

Material	Formula I (%)	Formula II (%)	Formula III(%)
karamunting flower extract	1	2	3
Mucilage amili	1.5	1.5	1.5
Cyclamate sodium	2	2	2
Citric acid	10	10	10
Tartric acid	20	20	20
Sodium bicarbonate	30	30	30
Wine Essen	Qs	Qs	Qs
Lactose		Ad 150 gram	

6. *Effervescent Granule* Preparation

Manufacture of *effervescent* granules using the wet granulation method. This method uses a separate granulation process between acidic and basic components. The formula made using the composition of the *effervescent* drink formula is listed in Table 1. Granulation of the base component was carried out by drying Sodium Bicarbonate at 500 C for 1 hour, then adding mucilage amyli and essence as a binder, added distilled water solution, stirred until smooth, then granulated with a 20 mesh sieve. Granulation of acid components is done by drying citric acid, tartaric acid, fruit extract and lactose at 500 C for 2 hours, then adding mucilage amyli and essence as a binder, adding distilled water stir until smooth, then granulated with a 20 mesh sieve. After granulation, each acid and base component is dried at 500 C until the moisture content is 2-5%. After the granule is dry, the two components are mixed and then sieved again with a 40 mesh sieve.

7. Evaluation of *effervescent* granules

a. Organoleptics

Observations were made directly on the shape, color and odor of the granules produced. The shape and color of the granule as much as possible can be regular (Gupta et al., 2013).

b. Flow rate test

The test was conducted using the funnel method. The method is as follows, namely weighing 25 grams of granules placed in the funnel of the flow time test equipment in a closed state. Open the lid let the granule flow, record the time the measurement is replicated (Daswi, 2021).

c. Compressibility test

Put 25 g of granules into a 100 mL measuring cup, record the initial volume (Vo), do tapping and see the volume on the 100th tap (Vediya et al., 2022).

d. *Effervescent* Granule dissolution time

Put the granule with the granule weight according to the formula into a glass containing 200 mL of water. Record the time required for the granule to dissolve in water with a stopwatch (Daswi, 2021).

e. pH measurement

The solubility of *effervescent* was done by dissolving 10 grams of *effervescent* granule in 200 mL of distilled water, then measured with universal pH paper (Jayasuriya et al., 2022).

RESULTS AND DISCUSSION

In this study, the method used was wet granulation because the granules produced were more homogeneous and easy to flow, thus ensuring uniformity of size and active substance content. The wet granulation method uses a non-reactive liquid method, namely two separate mixtures are made between the acid mixture and the base mixture. This separation is done to avoid premature effervescent reactions (Adi-Dako et al., 2021).

Organoleptics

As for the test results regarding the Organoleptic of effervescent granule can be seen in

Table 2.

Table 2 Organoleptic of Effervescent Granule

Formula	Color	Aroma	Taste	Shape
F1	Light purple	Grapes	Acid	Fine granule
F2	Dark purple-brown	Typical caramunting flower	Slightly sweet and sour	Fine granule
F3	Dark purple-brown	Typical caramunting flower	Sweet and sour	Fine granule

The quality of *effervescent* taste and odor plays an important role because it is directly related to *acceptability* to consumers. The results obtained from the organoleptic test on the base, formula 1, formula 2 and formula 3 are that they have a smooth round granule shape, the aroma that is smelled in the base and formula 1 smells of grapes, formulas 2 and 3 smell typical of *karamunting*. There is a change in aroma because each formulation has a different concentration of extracts in formulations 2 and 3 which have a large enough concentration of 2% and 3% *karamunting* flowers have a distinctive aroma that covers the smell of the grape essent used.

The taste of the base and formulation 1 has a sour taste, formulation 2 has a slightly sweet-sour taste, and formulation 3 has a sweet and sour taste.

The sweetness is obtained from *karamunting* flower extract and also sweetener additives, namely sodium cyclamate and the sour taste is obtained from the use of ingredients such as tartaric acid (Grajang & Wahyuningsih, 2018). Then the color formed is on a light purple base, formula one is light purple-brown, formula two is dark purple-brown, and formula 3 is also dark purple-brown. Because the *karamunting* flower extract has anthocyanin compounds, which are a class of hydrophilic organic chemical compounds that can dissolve in polar solvents that can produce orange, red, purple, blue, and black colors (Joffry et al., 2012).

Flow rate test

The test results regarding the Flow Rate of Effervescent Granule can be seen in **Table 3**.

Table 3 Flow Rate of Effervescent Granule

Formula	Flow rate (grams/second)			Mean ± SD
	Replication 1	Replication 2	Replication 3	
F1	2.351	2.628	2.287	2.422 ± 0.18
F2	3.024	2.876	3.188	3.029 ± 0.15
F3	2.903	2.787	2.870	2.853 ± 0.05

In this study, replication was carried out 3 times which aims to increase accuracy and reduce the error rate of researchers. The average results obtained from the flow test, namely the base of 2.098 g/s, formula 1 of 2.422 g/s, formula 2 of 3.029 g/s, and formula 3 of 2.853 % have a standard deviation of ± 0.059-0.248. Factors that can affect flow properties are granule shape, specific gravity and granule surface conditions. Flow time is one of the important factors in making granules because a good flow time will ensure weight uniformity. A good granule is a granule that can flow freely so that it can then be forged into a tablet preparation. The smaller the concentration of binders, the smaller the size, viscosity and density, thereby increasing the cohesion force between granule or powder particles. A good flow rate value is <10 grams/second (Gustaman et al., 2021). All formulas show good flow speed and meet the requirements.

Compressibility Test

The Compressibility Test results can be seen in

Table 4.

Table 4 Compressibility of Effervescent Granule

Formula	Carr's Index (%)			Mean ± SD
	Replication 1	Replication 2	Replication 3	
F1	20.89	19.40	21.74	20.67 ± 1.180
F2	24.80	23.20	23.20	23.73 ± 0.923
F3	20.31	21.53	21.53	21.12 ± 0.704

Compressibility is the ability of granules to remain compact under pressure. Factors that affect compressibility are shape, density, and particle size. There are two types of density, namely bulk density and tapped density. Bulk density is the weight of the sample divided by the volume of the sample without interparticle space and intraparticle space. The higher the bulk density value, the more intraparticle void space the granule has. While tapped density is the weight of the sample divided by the volume of the sample after being pressurized (Vediya et al., 2022).

The calculation results (Table 4) Bulk density in F1 is 0.53; 0.54; 0.53 g/ml, in F2 the value is 0.47; 0.48; 0.48 g/ml, and in F3 the value is 0.51; 0.51; 0.51 grams/ml. Tapped density in F1 is 0.67; 0.67; 0.69 g/ml, in F2 it is 0.625; 0.625; 0.625 and in F3 it is 0.64; 0.65; 0.65 g/ml. The smaller compressibility value will produce better flow properties (Siregar, 2010). From the three formulas, the compressibility values are F1 = 20.67% ± 1.180, F2 = 23.73% ± 0.923, and F3 = 21.12% ± 0.704. It can be seen that the smallest compressibility value is obtained in F1 and F3, which indicates that the granules have good flow properties (passable) (Utama et al., 2021).

Dissolution Time Test

The results of the Dissolution time test can be seen in **Table 5**.

Table 5 Dissolution Time of Effervescent Granule

Formula	Dissolution time (seconds)			Mean ± SD
	Replication 1	Replication 2	Replication 3	
F1	09.07	08.38	07.71	08.38 ± 0.68
F2	09.78	08.77	07.81	08.78 ± 0.98
F3	07.67	07.89	08.60	07.52 ± 0.96

The dissolution time (**Table 5**) indicates the amount of time required by a granule in a serving size to dissolve completely in a certain volume of water. *Effervescent* granules that have dissolved completely are characterized by the dissolution of the entire mass of granules into solution and no gas bubbles appear in the solution (Syamsul, 2014).

The faster the time used to dissolve the granule, meaning that the granule has high solubility. Measurement of *effervescent* granule dissolving time using a *stopwatch*. The dissolving time of *effervescent granules* ranges from 1-2 minutes. If the granule is well dispersed in water with a time of ≤ 5 minutes, then the preparation meets the requirements of dissolving time (Mahdiyyah et al., 2020).

The results of the *effervescent* granule dissolving time test show no more than 10 seconds so it can be concluded that all formulations have significant values so that there are differences in the dissolving time of each formula. It can be concluded that all formulas have the best dissolving time. In the control granule test using *effervescent* granule preparations that are sold freely in the market and which already have a notification number from BPOM, the average is 16.90 seconds and a standard deviation of 0.87.

Result pH test

The results of the pH test can be seen in

Table 6.

Table 6 pH Test Results

Formula	pH		Average	Temperature (°C)
	Replication 1	Replication 2		
	5.38	5.39		
F1	5.39	5.39	5.39	28.95
	5.39	5.39		
	4.25	4.25		
F2	4.25	4.25	4.25	28.40
	4.25	4.25		
	6.37	6.39		
F3	6.36	6.41	6.39	28.95
	6.38	6.41		

The pH values (

Table 6) of the effervescent granule solutions were 5.39 (F1), 4.25 (F2), and 6.39 (F3). The variation in pH values may be due to the different concentrations of effervescent mixtures. Solutions with a pH range of 4-6 are not too acidic. This is the optimal acidic range that can facilitate or interfere with the requested flavor and provide better palatability without causing GI irritation. Therefore, effervescent preparations are declared safe for consumption. In addition, its slightly acidic nature can provide a fresh taste when consumed (Mahdiyyah et al., 2020).

CONCLUSION

Based on the results of research conducted on the formulation of *effervescent* granule preparations of karamunting flowers (*Melastoma malabathricum* L.) it can be concluded that, ethanol extract of karamunting flowers (*Melastoma malabathricum* L.) can be formulated in the form of *effervescent* granule preparations with a ratio of extract concentrations of 1%, 2% and 3%. The results showed that formulation 3 (3%) met the quality of the evaluation of the physical properties of *effervescent granules* (organoleptic, flow speed, compressibility, *effervescent* granule dissolving time and pH measurement).

Author's declaration

Authors' contributions and responsibilities

The authors made substantial contributions to the conception and design of the study. The authors took responsibility for data analysis, interpretation and discussion of results. The authors read and approved the final manuscript.

Funding

Write down the research funding, if any.

Availability of data and materials

All data are available from the authors.

Competing interests

The authors declare no competing interest.

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