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## Lempuyang rhizome extract microcapsule formulation (*Zingiber Zerumbet*) for enhancer appetite in children

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### Abstract

Stunting is a public health problem that must be treated seriously. Findings Riskesdas showed that stunting cases were relatively stagnant at around 36.8% (2007) and reached 37.2% (2013). The problem of stunting (short children) has become one of the problems of malnutrition become the focus of the Government of Indonesia. Malnutrition is often caused by a child's reduced appetite. This is very important to pay attention to when making supplement products could increase appetite. These supplements must be safe and effective to use. One of the safe products used comes from nature, such as many rhizomes grows in Indonesian soil such as: turmeric, ginger, ginger, ginger and lempuyang. Lempuyang rhizomes (*Zingiber zerumbet*) contain alkaloids, saponins, flavonoids, polyphenols and essential oils. This rhizome has many properties such as: tonic, anti-seizure and appetite enhancer. Supplements made from lempuyang extract are packaged in microcapsule form. Based on this, the researchers aimed to make lempuyang extract microcapsules.

The supplement has been in microcapsule form used by a spray drying technique. The obtained microcapsules were evaluated using a Scanning Electron microscope, particle size analyzer which obtained 10 - 500 mm microcapsules and HPLC to determine the percentage of lempuyang extract trapped in the microcapsules (% Entrapment efficiency) of 72%.

**Keywords:** microcapsule, lempuyang extract, spray drying technique

### INTRODUCTION

Background This research begins with the problem of stunting (short children). nutritional problems which are the focus of the Government of Indonesia. Stunting is a growth disorder that is not balanced by catch-up growth (1, 2). Stunting cases were a problem found in society which has been associated with an increased risk of disease, death and impaired motoric or mental growth or both. This can result in a reduction in the number of superior future generations of the nation. The prevalence of stunting toddlers in Indonesia in 2015 was 36.4%. That means, around 8.8 million toddlers in Indonesia that year had problems

providing nutrition, resulting in their height being below age standards. Those cases are above the WHO threshold of 20%. This percentage will continue to increase if not quickly resolved (2,3,4).

One effort to overcome this problem is to create a product that can be consumed by toddlers so that it can improve the nutritional status of toddlers or can stimulate it toddlers to increase their nutritional intake. These stimulation products, also known as supplements, can be sourced from synthetic compounds or from nature. Safe and effective supplement products that are used from generation to generation are derived from nature. Especially rhizomes

the zingiberaceae family has often been used for generations as an appetite enhancer such as turmeric, ginger, temulawak and lempuyang. Lempuyang rhizome (*Zingiber zerumbet*) contains alkaloids, saponins, flavonoids, polyphenols and essential oils (5,6,7). This rhizome has many properties such as: tonic, anti-seizure and appetite enhancer (6,7,8).

This lempuyang is extracted and made in the form of microcapsules which are packaged in capsules. The problem with producing supplements to increase appetite for toddlers is How is this thick extract of Lempuyang Rhizome (*Zingiber zerumbet*) converted into powder microcapsules with slightly reduced active components and do not affect the taste of food that will be mixed with the supplement. The approach used is using spray drying technique (9,10,11).

Where this technique does not use temperature heat which allows the components of the thick extract not to decrease. Taste of This supplement is made neutral by using additional compounds that can mask the taste extract. This research is novel because no microcapsule product has been used yet the active ingredient is a thick lempuyang extract which is converted into powder. And can be mixed into food or drink that will be consumed but does not affect the taste of the food and the drink.

## **METHODS**

### **Equipments**

Disperser Ultra-turax, Rotary Atomizer Spray Dryer, BECKMANN COULTER, Dissolution tester, HPLC

### **Materials**

Dried lempuyang rhizome, 96% Ethanol, Maltodextrin, Zerumbot (pure compound)

### **Lempuyang Rhizome Extraction (5)**

Ethanol extract of lempuyang (*Zingiber zerumbet*) rhizome using maceration method

96% ethanol solvent. As much as 200 grams of lempuyang rhizomes were chopped and macerated with 96% ethanol as much as 1000ml. This mixture is stirred for six hours to mix evenly and allowed to stand for 18 hours, filtered with a flannel cloth, the filtrate was evaporated Vacuum until a thick extract is obtained.

### **Preparation of lempuyang extract microencapsulation (9,10)**

The thick extract was dissolved in ethanol and homogenized using a disperser until completely dissolved. While maltodextrin is made a solution with distilled water using a disperser with a ratio of active ingredient extract to maltodextrin is 1:4.

### **Microencapsulation of lempuyang extract (9,10)**

Microencapsulation is carried out by dissolving the active ingredient extract with 20% of the solution maltodextrin and homogenized for approximately 30 minutes. Then the rest of the solution maltodextrin was added little by little to the solution and homogenized for 15 minutes. Microcapsule preparations are made in a ratio with maltodextrin: 1:1, 1:2, 1:3, 1:4 and 1:5. The encapsulation solution is then processed using spray drying to obtain the active ingredients encapsulated in form microcapsules. The microcapsule forming tool uses a Rotary spray dryer Atomizer Spray Dryer with speed 9000 rpm to 12000 rpm, input capacity 2 liters per hour to 5 liters per hour.

### **Characterization of microcapsule products (9,10,11)**

This test uses Scanning Electron Microscopy (JSM-5600LV SEM Instrument, JEOL-Ltd) and particle size analysis with Particle Size Analyzer (BECKMANN COULTER. And to find out the safety of using microcapsules in handling then microbiological tests were

carried out. To determine the amount of extract trapped using the HPLC measurement method. Where are the microcapsules obtained in each comparison, the core material was isolated and measured using HPLC as a comparison active ingredient powder from lempuyang (*Zingiber zerumbet*). So you get a percentage of trapped lempuyang.

% Entrapment efficiency

$$= \frac{\text{extract weight (g)}}{\text{microcapsule weight (g)}}$$

### Lempuyang Rhizome Extraction (5)

Ethanol extract of lempuyang rhizome (*Zingiber zerumbet*) using the maceration method with 96% ethanol solvent. A total of 200 grams of lempuyang rhizomes were chopped and macerated with 1000 ml of 96% ethanol. This mixture was stirred for six hours so that it could be mixed evenly and allowed to stand for 18 hours, filtered with a flannel cloth, the filtrate was evaporated by vacuum until a thick extract was obtained. The thick extract obtained had the following yield:

% Rendemen

$$= \frac{\text{berat ekstrak yang diperoleh (g)}}{\text{berat simplisia (g)}}$$

$$= \frac{90}{2000} = 4,5 \%$$

### Preparation of lempuyang extract microencapsulation (9,10)

The condensed extract with maltodextrin was dissolved in water and homogenized using a disperser until completely dissolved with the ratio of the active ingredient extract to maltodextrin being 1:3 and 1:4. Then this solution is put in the spray drying tool.

### Microencapsulation of lempuyang extract (9,10)

The encapsulated solution is then processed using a spray dryer to obtain the encapsulated active ingredients in the form of microcapsules at a speed of 9000 rpm to 12000 rpm, an

input capacity of 500 ml liters per hour. Spray drying is an encapsulation method that has been widely used in both the pharmaceutical and food industries. The spray drying process has many advantages such as being more economical, flexible with easy-to-use tools and producing micro-sized capsules of good quality. This technique includes three main stages, firstly dispersing the material to be coated/active substance/core material (usually in liquid form) into the matrix or coating solution, the wrapping which is generally a hydrocolloid. Second, the homogenization process produces an oil-in-water emulsion, and finally the atomization process is carried out in hot air in a spray dryer so that the solvent in the form of water will be evaporated and drying quickly occurs so that microcapsules are formed. The mechanism for retaining the extract in the capsule using the spray drying technique has been described by previous researchers [12].

During the drying process, a film layer will form on the droplet surface. This layer is more permeable to water molecules which function as solvents when the solids formed are dried and the pore size is smaller than the molecules of the active substance. This is because the active substance molecules have lower solubility and are larger in size compared to water molecules, so the active substance molecules in the form of extracts cannot diffuse out through the surface of the film and will be trapped in the dry droplets. The results obtained were then characterized.

### Characterization of microcapsule products (9,10,11)

This test uses Scanning Electron Microscopy (JSM-5600LV SEM Instrument, JEOL-Ltd) and particle size analysis with a Particle Size Analyzer (BECKMANN COULTER).

### Morphological Structure of Microcapsules

The morphological structure of the microcapsules of the active substance zerumbone in the ethanol extract of lempuyang rhizome (*Zingiber zerumbet*) can be seen from the Scanning Electron Microscopy (SEM) photo in the figure below. The results of the SEM analysis show that the morphological structure of the microcapsules produced both using the spray drying technique and without using spray drying has a structure that tends to be round/spherical (microsphere).

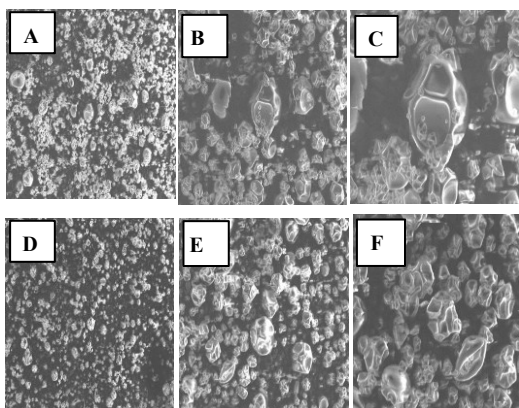


Figure 1. a microcapsule scanning electron microscope magnification (1:3) 500x (A), (1:3) 1500x (B), (1:3) 3000x (C), (1:4) 500x (D), (1:4) 1500x (E), (1:4) 3000X(F)

### Particle Size Distribution

The distribution and particle size of microcapsules can be seen in the figure below:

Table 3. Total plate count analysis, Yeast Mold, E. coli, Salmonella

Sample	Specified	Material	Parameter	Unit	Result
Lempuyang and maltodekstrin extract	Sediaan oral (powder)	<i>E. coli</i> <i>Salmonella</i> total plate figures Kapang Khamir	cfu/ml	Negative	SNI 01-2897-2008
			cfu/ml	Negative	SNI 01-2897-2008
			cfu/ml	5,1 x 10 <sup>4</sup>	SNI 01-2897-2008
			cfu/ml	9,5 x 10 <sup>1*</sup>	SNI 01-2897-2008

In the microbiological test, the contents for E.coli and Salmonella showed

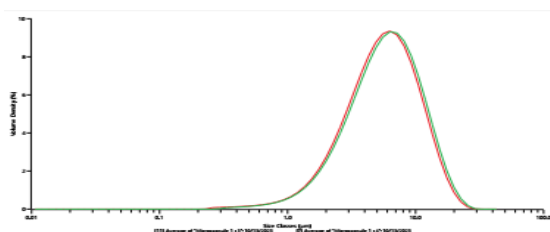


Figure 2. Particle Size Distribution

The details are as follows:

Table Particle Size Distribution

Mikrokapsul	Volume Density (%)			
	< 10 µm	< 50 µm	< 90 µm	100 µm
1 : 3	2,184	5,612	11,985	27,180
1 : 4	2,273	5,891	12,553	27,305

The results of particle size analysis using the Particle Size Analyzer (PSA) showed that the particle size with the Spray Drying tool had an average particle size of 12.02. The distribution of particle sizes in microcapsules using the spray drying technique is evenly distributed and tends to be uniform. This is due to the presence of agglomerated capsule particles. The unevenness of the drying process greatly affects the distribution of particle sizes.

### Microbiology Test

To determine the safety of using zerumbone microcapsules from lempuyang extract to increase appetite in children for oral use, a microbiological test was carried out which included analysis of total plate count, yeast, E.coli and Salmonella.

negative results, for analysis of total plate count it contained 5.1 x 10<sup>4</sup>

cfu/mL, while for yeast analysis it contained  $9.5 \times 10^1$  cfu/mL. These values are very safe because the maximum limit for total plate count and yeast mold is  $1 \times 10^{10}$  cfu/mL.

#### Determination of Entrapment Efficiency Percentage

To determine the amount of trapped extract using the HPLC measurement method. Where the microcapsules obtained in each comparison were isolated from the core material and measured using HPLC as a comparison with Zerumbon which is an active compound from lempuyang (*Zingiber zerumbet*). So that the percentage of lempuyang trapped is obtained:

Table 4. Entrapment Efficiency Percentage of Zerumbone in Microcapsules

Ratio	% EE
1 : 3	75,14%±2,90%
1 : 4	64,45%±3,04%

#### CONCLUSIONS

Microencapsulation of active substances containing asiaticoside and ginger extract with material packing of gum arabic and maltodextrin was done using the spray drying technique. Spherical particles produced by spray drying. From particle size analysis shows the particle size with the dryer spray with an average particle size of each is  $12.0 \mu\text{m}$ . More particle size distribution homogeneous in the capsules produced by the technique spray drying. From microbiological tests, microcapsules active substances containing asiaticoside and extracts ginger is safe to use for oral preparations where to content of *E.coli* and *Salmonella* showed negative results, for total plate number analysis containing  $5.1 \times 10^4$  cfu/mL, while for analysis Yeast mold contains  $9.5 \times 10^1$ cfu/mL

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