Antifungal Cream Preparation of Galangal rhizome Extract 
(Alpinia galanga L.)

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ABSTRACT
Cream is a semi-solid emulsion dosage form of both water-in-oil (W/O) or oil in water (O/W) type containing one or more dissolved or dispersed ingredients in the corresponding base material (containing no less than 60% water). Cream is usually used as emollient or containing active pharmaceutical ingredients on the skin (Ansel, 2008). The advantage of cream are the application practicality, water washability, and the easiness to spread evenly. In this research, we formulated cream containing rhizome Galangal rhizome. According to Darmono (2008), Galangal rhizome has various properties such as antifungal and antibacterial activities. Galangal rhizome contains 1-asetoksikhavikol asetat (ACA). ACA is an antifungal. ACA has good solubility in 70% ethanol. We maserated Galangal rhizome (Alpinia galanga L.) to extract ACA from the simplicia. As for the cream base, we use hidrophilic base containing emulgators stearic acid and triethanolamine, with glycerin as humectant. During the optimization, we chose three formulas, formula 1 (10% stearic acid , 2% triethanolamin, 5% glycerin, and 0.01% vitamin E), formula 2 (15% stearic acid , 3% triethanolamin, 10% glycerin, and 0.05% vitamin E), and formula 3 (20% stearic acid, 4% triethanolamin, 7.5% glycerin, and 0.09% vitamin E). We used the bases to contain 10% of the extract. The results show that formula 1, formula 2, and formula 3 had typical smell of Galangal rhizome, brown color, and thick consistency. All formulas are homogenous. Formula 1 the best stability. We conclude that Galangal rhizome (Alpinia galanga L.) can be formulated in cream form with our formula 1 had the best stability among others.

Keyword: cream formulation, antifungi, Galangal rhizome (Alpinia galanga L.)

INTRODUCTION
The climate in Indonesia supports the incidence of various tropical diseases, particularly skin infections caused by microbes, especially fungi. Skin infections caused by fungi is a difficult problem to overcome, because fungi survive more easily in the environment that is less favorable than other microscopic substances (Fatrotin, 2010). One of these diseases is dermatophytosis, caused by the infection of Trichophyton, Microsporum and Epidermophyton. This fungi infect the surface of human or animal bodies such as the skin, nails, hair, horns and feathers (Darmono, 2008).

The use of herbs as an alternative medicine tends to increase along with the expensive of several types of synthetic compounds. This is due to the growing awareness of the community to return to nature (Fitriati, 2007). One of medicinal plants used as a cure for skin diseases caused by fungi is Galangal Rhizome (Alpinia galanga L.). Galanga is a member of the Zingiberaceae family. Galangal rhizome is easy to obtain in Indonesia and works as a liniment for fungal skin disease (panu in bahasa) before modern medicine develops as it is now. Galangal rhizome has various properties including anti-fungal and antibacterial activities. Yuharmen et al., 2002 showed microbial growth inhibition activity by essential oils and methanol fraction of Galangal rhizomes in several species of bacteria and fungi. Suaib et al.,
2016 stated that the overall inhibitory effect of Galangal rhizome extract on the highest growth of *O. theobroma* fungi is at a concentration of 0.75% where the overall treatment showed a significant difference that had been tested at each concentration. The inhibitory effect of Galangal extract on the growth of fungus *O. theobroma* during observation at 0.25% was 20.47%, at 0.50% was 27.10%, and at 0.75% was 38.77%.

Cream is a semi-solid emulsion dosage form of both water-in-oil (W/O) or oil in water (O/W) type containing one or more dissolved or dispersed ingredients in the corresponding base material (containing no less than 60% water). Cream is usually used as emollient or containing active pharmaceutical ingredients on the skin (Ansel, 2008). The advantage of cream are the application practicality, water washeability, and the easiness to spread evenly. The concentration of Galangal rhizome extract in the cream was 10%. This concentration was chosen based on the concentration range of Galangal rhizome extract which effectively inhibited the growth of *M. Canis* and *T. Mentagrophytes*. Hezmela (2006) conducted a study to determine the optimal range of extract concentrations to inhibit the growth of the two test fungi. Based on the research conducted, it is known that the concentration range of extract to inhibit the growth of *M. Canis* is 0.3% - 5%, while for *T. Mentagrophytes* is 0.5% - 10%.

The cream contained stearic acid as a base of cream and emulsifier in the oil phase, triethanolamine as emulsifier in water phase, glycerine as humectant, α-tocopherol as antioxidant, methylparaben as preservative in oil phase, and propyl paraben as preservative in water phase. The formula design is formula 1 (10% stearic acid, 2% triethanolamin, 5% glycerin, and 0.01% vitamin E), formula 2 (15% stearic acid, 3% triethanolamin, 10% glycerin, and 0.05% vitamin E), and formula 3 (20% stearic acid, 4% triethanolamin, 7.5% glycerin, and 0.09% vitamin E). Galangal rhizome extract in the cream was 10%. The formulation cream can be seen in Table 1.

O/W cream was formulated by combining stearic acid and triethanolamine (TEA). TEA was chosen as an emollient because TEA will form an oil emulsion in water which is very stable when combined with free fatty acids. The most suitable fatty acids to be combined with TEA are stearic acid because stearic acid does not experience discoloration like oleic acid (Cosmetic Ingredient Review Expert Panel, 1995). Stearic acid reacts with TEA in situ to produce a salt, triethanolamine stearate which functions as an emollient for oil-in-water type emulsions (Aulton, 2002). The salt formed is the result of a stoichiometric reaction. Each component reacts with an appropriate comparison. 2-4% of TEA and 5-15% stearic acid generally used depends on the amount of oil to be emulsified (Jenkins et al., 1957). Stearic acid in Allen (2009) was used at concentrations of 1-20%. Stearic acid is neutralized using a flavoring agent or triethanolamin to avoid skin irritation because of the compounds. This research used 10-20% stearic acid and 2-4% TEA.

Glycerin as humectants with the consideration that glycerin will resist evaporation of water in the cream preparation and in the skin serves as a moisturizer (Hendradi et al., 2013). The use of glycerin is common between 10-20% (Tranggono and Latifah, 2007). This research use 5-10% glycerine as humectant.

Vitamin E is a fat-soluble antioxidant that protects the skin from oxidative stress, one of which is photaging. Photaging is premature aging due to the continuous production of oxygen radicals in the skin from UV light. Many studies documented that vitamin E has major antioxidant and photoprotection activities efficient enough to reduce the frequency and severity of pathological events in the skin (Nachbar & Korting, 1995). The use of 0.5% vitamin E in cream preparations only enough to penetrate 4.3% of the skin, so it is
recommended to use at least 1% of vitamin 
E in order to penetrate into the skin and 
produce the expected therapeutic effect. 
According to a survey conducted by the 
Personal Care Products Council in 2013, the 
maximum concentration of vitamin E used 
in products with dermal / skin contact is 
5.4%. Most of the α-tocopherols used in 
topical cosmetic products had 5% or less 
(Hasibuan et al, 2014). This research use 
vitamin E in the range of 0.01-0.09%, 
expected to be enough to penetrate the skin.

METHODS
Galangal Rhizome (Alpinia galanga L.) 
Extraction
Cutting tool (knife), grinder, 
maseration container, rotary evaporator, 
extract container, and oven. Cream 
production, analytical balance, porcelain 
cup, glass watch, paper parchment, spoon 
horn, glass beaker 250 ml, glass beaker 
1000 ml, small glass beaker, 100 ml 
measuring cup, 10 ml measuring cup, drops, 
waterbath, stirrer, spindle, and mortar.

Materials
100 g of simplicia Galangal rhizome, 
70% of ethanol, aluminum foil, and filter 
paper. While the ingredients used in the 
preparation of the cream are the ethanol 
extract of Galangal rhizome, stearic acid, 
triethanolamine (TEA), glycerine, α- 
tocopherol, methyl paraben, propyl 
paraben and aquadest.

Samples of Galangal rhizome (Alpinia 
galanga L) were freshly taken in Pepadan 
village, Karangmoncol district, Purbalingga 
regency. Samples were washed thoroughly 
in running water. Clean samples were 
sorted wet and aerated to reduce moisture 
content. Samples were chopped and dried 
by aerated in a place that is not exposed to 
direct sunlight. After drying, it was dry-
sorted and milled. Simplicia of Galangal 
rhizome was weighed 100 g and put into a 
container. Two liters of 70% ethanol (until 
the simplicia is submerged) were added to 
the jar containing the sample. The container 
was then closed tightly. The maceration 
process was for 3 days at room 
temperature, protected from light, and 
occasionally stirred. Filtrate was collected 
and evaporated using waterbath to obtain 
thick extract. Evaporation was stopped at 
10% yield (MOH, 2010).

Cream Production
Before used a raw material for cream, no 
characterization of Galangal rhizome 
was carried out. Reference to the anti fungi 
possessed by Galangal rhizome is taken 
from the research of (Yuharmen et al, 
2002) and (Suaib et al, 2016). Suaib et al, 
2016 states that the overall inhibitory effect 
of Galangal rhizome extract on the highest 
growth of O. theobrema fungi is at a 
concentration of 0.75% where the overall 
treatment showed a significant difference. 
The inhibitory effect of Galangal extract on 
the growth of fungus O. theobremae during 
observation at a 0.25% was 20.47%, 0.50% 
was 27.10%, and 0.75% was 38.77%. It is 
expected that the levels of 10% Galangal 
rhizome extract can stop fungal activity 
better than those obtained in Suaib’s (2016) 
study. In addition, the concentration of 
Galangal rhizome of 10% was chosen based 
on the concentration range of galangal 
extract which effectively inhibit the growth 
of M. Canis and T. Mentagrophytes. Hezmela 
(2006) conducted a study to determine the 
optimal range of extract concentrations to 
inhibit the growth of the two test fungi. 
Based on the research conducted, it is 
known that the concentration range of 
extract to inhibit the growth of M. Canis was 
0.3% - 5%, while for T. Mentagrophytes 
was 0.5% - 10%. Formula 1, 2 and 3 (Table I). 
The choice of formula was based on the 
function of each ingredient used and the 
expected cream product. The amount 
ingredients were used was decided by 
considering the combination.

All materials were weighed according 
to the results of the calculations contained
in (Table I). Separate the materials to be dissolved in the oil phase and water phase. Oil phase was made by combining between stearic acid, α-tocopherol, and methyl paraben successively above the waterbath while stirring until homogeneous. Temperature was maintained at 50°C. For the water phase, triethanolamine, glycerin, and propylparaben were dissolved above the waterbath while continuously stirring. The temperature was maintained at 70°C. The water phase was put into the heated mortar. The oil phase was gradually loaded into the water phase while crushed to form a cream base, then water was added. Galangal rhizome extracts were fed into the cream base in bits. The mixture was stirred until homogeneous (Sulastri et al., 2016).

### RESULTS AND DISCUSSION

#### Yield of Thick Extract

Evaporation process yielded 26.17 grams or 26.17% extract. When evaporation process in waterbath, ethanol will evaporate first than water. This means that in the yield of 26.17% was still containing water. The amount of rendement in the extract according to Afif (2006) was caused by factors of extraction method, amount of solvent, extraction time, powder size and temperature. Water levels that exceed the requirements allow fungal growth (MOH, 1986). Figure 1 shows thick extract of Galangal rhizome (*Alpinia galangal* L.).

#### Cream Physical Stability Testing

**Organoleptic Testing**

Organoleptic testing was including the check for the color, consistency, and smell of cream preparations.

**Homogeneity Testing**

Samples of cream were taken as much as 0.1 g then smeared on a transparent glass. Observation was the made in the event of phase separation.

**pH Testing**

pH measurements were carried out using a universal pH indicator.

### Table I. Cream Formulas

<table>
<thead>
<tr>
<th>Components</th>
<th>Concentrations (w/w)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Formulation 1</td>
</tr>
<tr>
<td>Galangal rhizome extract</td>
<td>10%</td>
</tr>
<tr>
<td>Stearic acid</td>
<td>10%</td>
</tr>
<tr>
<td>α-tocopherol (Vitamin E)</td>
<td>0.01%</td>
</tr>
<tr>
<td>Methyl paraben</td>
<td>0.15%</td>
</tr>
<tr>
<td>Triethanolamine (TEA)</td>
<td>2%</td>
</tr>
<tr>
<td>Glycerine</td>
<td>5%</td>
</tr>
<tr>
<td>Propyl paraben</td>
<td>0.03%</td>
</tr>
<tr>
<td>Aquadest ad</td>
<td>30g</td>
</tr>
</tbody>
</table>

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Figure 1. Thick extract of Galangal rhizome (*Alpinia galangal* L.)
Organoleptic Testing

In the preparations of the first formula, the cream were soft and tend to thick. In the second formula, it was thick, and in the third formula was very thick. This was because the concentration of the base and emulgator that played a role in the formation of cream consistency in each formula (Table II).

The brown color of cream is obtained from the color of Galangal rhizome extract. This was different with the yellowish white color obtained in the research of (Rahmalia et al., 2010).

The typical smell of cream was resulted from Galangal rhizome smell. In O/W type of cream, the presence of stearic acid can cause the cream to be softer that its viscosity is lower. Cream base types that have high viscosity will cause the diffusion coefficient of a drug in the base to be low, so the release of the drug from the base will be small (Lachman et al., 1989). Stearic acid in Allen (2005) is used at concentrations of 1-20%. Stearic acid was neutralized using a flavoring agent or triethanolamin to not to irritate the skin so that it can be used in cream preparations. Triethanolamine is a mixture comprising mainly 2-2-2-nitrilotriethanol (C$_2$H$_4$OH) 3N, together with 2,2-iminoliosetanol and a small amount of 2-aminoethanol (Anonym, 1995). Triethanolamine is usually combined with fatty acidic substances to form water-soluble soaps (Triethanolamine stearate) (Voigt, 1984) used as a regulator of pH, surfactant, foam and cleanser (Anonym, 1995).

Cream viscosity is influenced by the presence of fatty acids contained in the cream, namely stearic acid. The more the amount of fatty acids used, the resulting cream will also be harder. Triethanolamine may also be a water-phase emulsifier which is thinner than the oil phase (stearic acid) so the consistency of the resulting cream was then decreased. The use of stearic acid as an emulsifier in a topical preparation will form a thick base and its viscosity is determined by the amount of triethanolamine used (Allen, 2009). Allen (2009) also mentioned that the formulation of cream preparations with the use of staric acid emulsifier and TEA can affect the viscosity and pH of the preparation.

Homogeneity Testing

Homogeneity test was done by observing the color of the preparation visually and see if there were parts that were not mixed well in the cream. The cream can be claimed to be homogeneous if there is color homogeneity and no particles are found in the cream (Ida & Noer, 2012). Homogeneity affects the effectiveness of therapy because it is associated with the same drug levels in each application. Cream is a preparation in which the application is applied to the treatment site, so that each part of the active ingredient must have

### Table II. Organoleptic Test

<table>
<thead>
<tr>
<th>Formula</th>
<th>Test</th>
<th>Physical appearance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Smell</td>
<td>Specific</td>
</tr>
<tr>
<td>1</td>
<td>Color</td>
<td>Brown</td>
</tr>
<tr>
<td></td>
<td>Consistency</td>
<td>Soft and tend to be thick</td>
</tr>
<tr>
<td></td>
<td>Smell</td>
<td>Specific</td>
</tr>
<tr>
<td>2</td>
<td>Color</td>
<td>Brown</td>
</tr>
<tr>
<td></td>
<td>Consistency</td>
<td>Thick</td>
</tr>
<tr>
<td></td>
<td>Smell</td>
<td>Specific</td>
</tr>
<tr>
<td>3</td>
<td>Color</td>
<td>Brown</td>
</tr>
<tr>
<td></td>
<td>Consistency</td>
<td>Very thick</td>
</tr>
</tbody>
</table>
equal opportunity to occupy the therapeutic site. This condition can be achieved when the cream is homogeneous. All formulas were homogenous.

The homogeneity of a cream preparation is influenced by several factors such as temperature accuracy for melting, and stirring. If the temperature used for the fusion of an ingredient does not match the melting point of the material, then the material will not dissolve and mix with other ingredients. The final result will be fine particles in the glass as a test indicator of its homogeneity. In addition, the cream homogeneity is also influenced by the Galangal rhizome extract which is not evenly mixed and homogeneous during mixing. Figure 2 shows the homogeneity test of cream.

**pH Measurement**

The pH measurement needs to be done to determine the safety of cream preparations when used so that they do not irritate the skin (Juwita et al., 2013). If the preparation is too acidic it will irritate the skin, while too basic cream will cause the skin to become dry during use (Ainaro et al., 2015). Ph testing showed that the pH test results for all formulas of cream preparations were 6. This result was as expected, where both cream preparations have acidity that matches the normal pH range of the skin, which is 4.5 to 6.5 (Naibaho, 2013).

**Stability Testing**

Stability testing was performed to ensures the identity, strength, quality, and purity of the product to be persist during the expected storage time period.

Formula 1 is more stable than formula 2 and formula 3 because because the less use of emulgator stearic acid. Formula 2 contained 15% stearic acid and formula 3 contained 20% stearic acid. Figure 3 shows the stability of cream.

According to (Rowe et al., 2009), combination of stearic acid and triethanolamine will form a salt of triethanolamine stearate which is anionic and produces fine grains thus stabilize the type of oil emulsion in water or vanishing cream.
CONCLUSION

According to our study, it can be concluded that, galangal rhizome (Alpinia galanga L.) can be be formulated into cream preparation, and the formula of cream using stearic acid of 10% and triethanolamine of 2% as emulsifier (Formula 1) has more stable than Formula 2 (stearic acid of 15% and triethanolamine of 3%) and formula 3 (stearic acid of 20% and triethanolamine of 4%) for 10% of Galangal rhizome extract (Alpinia galanga L.).

DAFTAR PUSTAKA


