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STANDARDIZATION OF EXTRACT AND CHARACTERIZATION OF EMULGEL FORMULA OF LENGKUAS (*Alpinia galanga* (L.) Willd) RHIZOME EXTRACT

STANDARDISASI EKSTRAK DAN KARAKTERISASI FORMULA EMULGEL EKSTRAK RIMPANG LENGKUAS (*Alpinia galanga* (L.) Willd)

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ABSTRACT

The lengkuas rhizome has an antifungal activity. The non-specific parameters for extracts of lengkuas rhizome need to be standardized to obtain the extracts with consistent good quality. The lengkuas rhizome extract emulgel topical preparations are easily mixed with active substances that are hydrophobic or hydrophilic. This study aims to obtain a lengkuas rhizome extract emulgel formula that has good quality and good physical properties. Extraction of lengkuas rhizome was obtained using a maceration method with 96% ethanol solvent. The extract is standardized by non-specific parameters. After that, the extract was formulated in the form of emulgel preparation with 10% concentration. The physical properties of emulgel were evaluated. The results of the study showed that the extract yield is of (14.66±0.056)%; powder drying shrinkage (8.63±0.134)%; extract water rate (5±0)%; powder total ash rate (3.24±0.017)%; and extract (1.30±0.035)%; acid-insoluble ash rate powder (2.66±0.10)%; and extract (0.87±0.031)%; extract type weight 1.01; and the physical properties of emulgel preparations were homogeneous emulgel, semisolid form, light brown color, distinctive smell of lengkuas rhizome extract, stable at 5^{o}C and 25^{o}C for 24 hours; pH 7; spreadability (2.45±0.03) g.cm.s-1; stickiness (8.80±0.72) seconds; o/w emulsion type; and viscosity (1.37±0.22) Pa.s. This study obtained extracts of lengkuas rhizomes that meet the requirements of non-specific parameter standardization in general and the formulation of lengkuas rhizome extract emulgel had good physical properties.

Keywords: *lengkuas rhizome extract, non-specific parameter standardization, emulgel*

ABSTRAK

Rimpang lengkuas memiliki aktivitas sebagai antifungi. Ekstrak rimpang lengkuas perlu dilakukan standardisasi parameter non spesifik untuk memperoleh sediaan yang terjamin mutunya secara konsisten. Sediaan topikal emulgel ekstrak rimpang lengkuas merupakan sediaan yang mudah bercampur dengan zat aktif yang bersifat hidrofob atau hidrofil. Penelitian ini bertujuan untuk mendapatkan formula emulgel ekstrak rimpang lengkuas yang memiliki mutu yang baik serta sifat fisik yang baik. Ekstraksi rimpang lengkuas diperoleh dengan menggunakan metode maserasi dengan pelarut etanol 96%. Ekstrak distandardisasi dengan parameter non spesifik. Selanjutnya ekstrak diformulasikan dalam bentuk sediaan emulgel dengan konsentrasi 10%. Emulgel dievaluasi uji sifat fisik. Hasil penelitian diperoleh rendemen ekstrak (14,66±0,056)%; susut pengeringan serbuk (8,63±0,134)%; kadar air ekstrak (5±0)%; kadar abu total serbuk (3,24±0,017)%; dan ekstrak (1,30±0,035)%; kadar abu tidak larut asam serbuk (2,66±0,10)%; dan ekstrak (0,87±0,031)%; bobot jenis ekstrak 1,01; dan uji sifat fisik sediaan emulgel diperoleh emulgel homogen, bentuk semisolid, berwarna coklat muda, bau khas ekstrak rimpang lengkuas, stabil pada suhu 5^{o}C dan 25^{o}C selama 24 jam; pH 7; daya sebar (2,45±0,03) g.cm.s-1; daya lekat (8,80±0,72) detik; tipe emulsi o/w; dan viskositas (1,37±0,22) Pa.s. Penelitian ini diperoleh ekstrak rimpang lengkuas yang memenuhi persyaratan standardisasi parameter non spesifik secara umum dan formulasi emulgel ekstrak rimpang lengkuas mempunyai sifat fisik yang baik.

Kata kunci*: ekstrak rimpang lengkuas, standardisasi parameter non spesifik, emulgel*

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INTRODUCTION

The use of plants can be used as a treatment for various types of diseases, one of which is a disease caused by fungi. Diseases caused by fungi are still very common, because Indonesia has a tropical rain, climate which leads to high air humidity (RH> 80%) with an average temperature of 28 - 33ºC (Sundarim and Wiem, 2001). Natural ingredients that have anti-fungal activity are *lengkuas*, a plant that has long been used by the Indonesian people as a medicinal ingredient for stomach ailments, scabies, tinea versicolor, and eliminating bad breath (Kusumaningtyas et al., 2008). *Lengkuas* rhizome extract can even function well on molds and yeasts that are resistant to amphotericin B and ketoconazole (Ficker et al., 2003). The research of Fakhrurrazi et al. (2012) revealed that *lengkuas* was able to inhibit the growth of Candida albicans at the 10% concentration, and from Silvina's research, 2006, *lengkuas* rhizome extract at the 10% concentration was more effective to inhibit C. albicans in vitro compared to ketoconazole 2%.

Lengkuas rhizome extract is the active ingredient in this study, so standardization is needed to obtain extracts with guaranteed consistent quality. Standardization is conducted so that the same raw ingredients can be obtained which can guarantee the pharmacological activity of the plant. Standardization is the process of guaranteeing the final product (simplicia, extracts, products or herbal products) in order to have a certain constant parameter value (Zainab et al., 2016).

The *lengkuas* rhizome extract has an active compound component that is hydrophilic and hydrophobic, so a formulation that can dissolve both components is needed. In emulgel preparations, the emulsion incorporated into the gel formula will help increase the solubility of the ingredient that is hydrophobic (Haneefa, et al., 2013). Preparations that have shorter spreading distances show better dispersion coefficients (Gupta and Gaud, 2005) and the higher the stickiness, the longer the gel attaches to the skin and the longer the therapeutic effect will be (Arikumalasari et al., 2013).

METHODS

Materials and Instrumentations

The materials used in this study are *lengkuas* rhizome extract, 96% alcohol (pharmaceutical), hydroxypropyl methylcellulose (pharmaceutical), liquid paraffin (pharmaceutical), tween 80 (pharmaceutical), span 80 (pharmaceutical), propylene glycol (pharmaceutical), methyl paraben (pharmaceutical), propyl paraben (pharmaceutical), toluene (pa) (E-Merck), aqua destilata (pharmaceutical), dilute hydrochloric acid (pharmaceutical, and concentrated hydrochloric acid (pharmaceutical) (E-Merck).

The instrumentations used in this study were waterbath (Memmert), rotary evaporator (Buchi Rotavapor R-200), universal pH (Merck), analytical scales (Ohaus TM AR2140), vacuum (Gast Manufacturing), furnace (benchtop muffle Ney Vulcan D- 130), distillation apparatus (Dean-Stark), Halogen Moisture Analyzer HB43, piknometer (Duran), oven, sticky power tester, distribution power tester, and viscosity tester (viscosimeter Rheosys Merlin VR parallel spindle; 30 mm parallel plate).

Ingredients Preparation

The *lengkuas* rhizome was obtained from Beringharjo Market, Special Region of Yogyakarta, then sorted wet, washed, cut by 2 mm transversely, dried using an oven with a temperature of 40ºC until dry, sorted dry, and then pollinated (Purwani et al., 2012).

Extraction

Simplicia was macerated with 96% alcohol solvent with a ratio of 1:10 for 24 hours with 2x remaceration, filtered to get the macerate, then evaporated by using waterbath until thick extract was obtained (Dwi, 2017).

Non-Specific Parameter Setting

Powder Drying Shrinkage Setting

Five grams of dried *lengkuas* rhizome powder were put in the Halogen Moisture Analyzer using aluminum foil, and then the Moisture Rate was measured at 105ºC temperature until the weight was constant, so that the drying shrinkage in the simplicia powder was obtained. It is said to be eligible if the value of Moisture Rate is less than 10% (Depkes RI, 1994).

Total Ash Rate Setting

Three replications of powder and extract are weighed 2 grams each, and then put into the silicate exchange rate, which has been anchored and slowly spawned by increasing the temperature gradually to 600ºC until they are carbon free. After that, they are cooled gradually until they reach the room temperature, and then put into the desiccator and weighed until they reach a constant weight.

The ash rate is calculated in percentage towards the weight of the test ingredients that are expressed in %, b/b, using the formula in (1) (Depkes RI, 2008).

$$\text{Ash rate (\%)} = \frac{\text{ash constant weight (g)}}{\text{extract weight (g)}} \text{ x } 100\% \quad \text{.....(1)}$$

Acid-Insoluble Ash Rate Setting

Ash was obtained from the setting of the total ash rate, which was boiled with 25 mL of LP dilute hydrochloric acid for 5 minutes, the acid-insoluble part was collected and filtered until they were ash-free, washed with hot water and heated in the exchange rate until they reached a constant weight. The acid-insoluble ash rate is calculated towards the test ingredients that are expressed in % b/b, using the formula in (2) (Depkes RI, 2008).

$$\text{Acid-Insoluble Ash Rate (\%)} = \frac{\text{acid-insoluble ash constant weight (g)}}{\text{extract weight (g)}} \text{ x } 100\% \quad \text{.....(2)}$$

Water Rate Setting

Two grams of the extract are weighed carefully and then put in a dried pumpkin. Approximately 200 mL of toluene saturated water was poured into the pumpkin and 2 mL of aquadestilata was added. After that, a series of tools were attached. Water-saturated toluene was added into the receiving tube through the cooler until the container's neck. The pumpkin is heated carefully for 15 minutes. After the toluene starts boiling, the distillation is set at a speed of less than 2 drops per second, until most of the water is distilled, and then the distillation speed is increased to 4 drops per second. The distillation continued for 5 minutes. The receiver is cooled to room temperature. The volume of water is obtained after the water and toluene separate completely. The water rate is calculated in % v/b, using the formula in (3) (Depkes RI, 2008)

$$\text{Water Rate (\%)} = \frac{\text{final volume (mL)} - \text{initial volume (mL)}}{\text{extract weight (g)}} \text{ x } 100\% \quad \text{.....(3)}$$

Extract Type Weight Setting

The extract type weight was set towards the results of 10% extract dilution in ethanol solvents with the pycnometer tool (Anam et al., 2013). The pycnometer used was clean, dry, and calibrated by setting the pycnometer weight and the newly-boiled water weight at the temperature of 25°C. The temperature of the pycnometer which has been filled with liquid extract is approximately set to 20°C, and then put into the pycnometer. The pycnometer which has been filled with liquid extract is then adjusted to the temperature of 25°C. The excess of the liquid extract is removed and weighed. The empty pycnometer weight was subtracted from the weight of the filled pycnometer. The type weight is obtained by dividing the extract density to the water density in the pycnometer at the temperature of 25°C. (Depkes RI, 2000), using the formula in (4):

$$\text{Extract Type Weight} = \frac{\rho \text{ of extract at T25°C}}{\rho \text{ of ethanol at T25°C}} \quad \text{.....(4)}$$

Phenol Compound Screening Test

A number of samples (0.1 g) were extracted with 20 mL of 70% methanol. 1 mL of the produced solution was taken and then 2 drops of 5% $FeCl_3$ solution were added. Positive reactions are indicated by the formation of green or yellowish green color (Nugrahani et al., 2016).

Table I. Emulgel Base Formulation

Ingredients	Concentration (%)
HPMC	2.5
Liquid Paraffin	5
Tween 80	1.08
Span 80	0.42
Propylene glycol	10
Methyl paraben	0.03
Propyl paraben	0.01
Distilled Aqua	100

Table II. Non Spesific Parameter Standardization Results

Parameter	Results	Requirements	Reference
Drying Shrinkage(%)	8.63 ± 0.134	<10 %	FHI
Water Rate (%)	5 ± 0	<10%	FHI
Powder Ash Rate (%)	3.24 % ± 0.017	<3.9%	FHI
Extract Ash Rate (%)	1.30 ± 0.035	-	-
Powder Acid Insoluble Ash Rate (%)	2.66 ± 0.10	<3.7%	FHI
Extract Acid Insoluble Ash Rate (%)	0.87 ± 0.031	-	-
Extract Type Weight	1.01	-	-

Emulgel Formulation

The Lengkuas Rhizome Extract Emulgel Formula in this study can be seen in Table I (Yenti et al., 2014). Firstly, each Emulgel base ingredient was weighed. After that, the emulgel base is made as the following steps. The oil phase is made by mixing span 80 with Liquid paraffin at 70ºC, the water phase is made by mixing tween 80 and some water at 70ºC. The oil phase is added to the water phase at 70ºC while still being stirred until the emulsion is formed. The gel is made by dispersing the HPMC little by little into hot water at 80ºC, and crushed until the gel base is formed. Methyl paraben and propyl paraben are dissolved in propylene glycol, and then mixed with gel. After that, the emulsion and gel that have been formed are mixed with the Homogenizer at a speed of 700 rpm for 45 minutes until emulsions are formed. 10% of lengkuas rhizome extract were put into the mouth gradually is added and then crushed until it is homogeneous. At last, each formula is stored in an emulgel container (Yenti et al., 2014).

Emulgel Physical Properties Test

Organoleptic Test

Organoleptic observation includes: form, smell and color which have been conducted every week for 6 weeks at the room temperature (Yenti et al., 2014).

Homogeneity Test

0.1 g of Emulgel are weighed and then applied evenly and thinly on transparent glass, the preparation must show a homogeneous arrangement and coarse grains should not be visible (Yenti et al., 2014).

Stability against Temperature Test

Cold Temperature

Five grams of emulgel are weighed and put into an emulgel container, and then placed in a refrigerator at 5ºC temperature and left for 24 hours. After that, it is taken out of the refrigerator and observed on whether or not there is a separation (Yenti et al., 2014).

Room Temperature

Five grams of emulgel are weighed and put into an emulgel container, and then placed in a refrigerator at 25ºC temperature and left for 24 hours. After that, it is observed on whether or not there is a separation (Yenti et al., 2014).

pH Setting

A half gram of emulgel is diluted with 5 mL of aquadest, then the pH is checked using the universal pH (Naibaho et al., 2013).

Spreadability Test

A half gram of emulgel is placed on a round glass scale and covered with another round glass and then left for 1 minute, after that it is added with 150 g ballast and then the distribution diameter is recorded every 1-minute interval (Garg et al., 2002). Distribution power is calculated using the formula of (5):

$$S = m \times \frac{l}{t} \quad \text{.....(5)}$$

Note:
S = Spreadability
m = Burden weight (150 g)
L = diameter when constant (cm)
T = constant time (second)

Stickiness Test

A quarter gram of emulgel are placed on a predetermined glass object. After that, another glass object is placed on top. The glass object is then attached to the test apparatus and is given a load of 1 kg for 5 minutes. Then, it is released with 80 g load weight. The time is recorded until the two glass objects were detached (Naibaho et al., 2013).

Emulsion Type Setting

The emulsion type is evaluated by applying the prepared preparation in a petri dish, and then added with the drops of blue methylene solution and stirred evenly. If the blue methylene solution is immediately dispersed throughout the preparation, then it has the M/A type of emulsion (Suryani et al., 2014).

Viscosity

The viscosity measurement is done by using Rheosys Merlin VR II Viscometer. The viscosity was measured by a Viscometer equipped with a 30 mm parallel spindle, using 10 points with rotating speeds of 0.1 - 20.0 RPM with a delay time of 30 seconds and integration time of 1 second and carried out in an Integrated Research Laboratory in the Faculty of Pharmacy of Ahmad Dahlan University.

RESULT AND DISCUSSION

Formulation of *Lengkuas* Rhizome Extract (*Alpinia galanga* (L.) Willd)

The *lengkuas* rhizome extract was made using the maceration method using 96% ethanol solvent. Maceration is an extraction method in which the finer material is soaked in a suitable solvent so that it seeps in and softens the cell arrangement so that substances easily dissolve (Ansel, 2005).

The solvent liquid used to be 96% ethanol because it refers to the study conducted by Dwi (2017) which used the same solvent for making lengkuas rhizome extract and obtained a large yield of 17.06%. In addition, ethanol is a universal solvent that attracts most of the chemicals contained in herbs (Runadi, 2007). Another consideration is ethanol as a solvent because it is more selective, so that it is difficult for molds and germs to grow, non-toxic, neutral, and the heat needed for thickening is relatively less (Depkes RI, 1986). Ethanol also does not cause cell membrane swelling and improve the stability of dissolved medicinal substances. Other advantages of ethanol the ability to precipitate albumin and inhibit the action of enzymes (Voigt, 1994). During the maceration process, the diffusion process occurring will affect the degree of difference in concentration, thickness of the boundary layer, and diffusion coefficient. The degree of difference in concentration will affect the stirring process to flatten the concentration of the solution outside the simplicia powder, so that stirring will maintain the degree of difference in the smallest concentration between the solution in the cell and the solution outside the cell (Depkes RI, 1986).

A comparison in percentage states the value of the extract. The yield of the lengkuas rhizome extract was 14.66%, while the results of the study by Dwi (2017) using the maceration method and the same solvent obtained the yield of 17.06%. The difference in yield results could be caused by differences of the growing place of the lengkuas rhizomes, length of drying time, length of the extract thickening time until a smaller yield is produced.

Non Specific Parameter Standardization

The non specific parameter standardization results of the lengkuas rhizome extract can be seen in Table II.

The powder drying shrinkage is one of the parameters of the quality of the simplicia. The aim of drying shrinkage is to provide maximum limits (ranges) on the amount of compounds lost in the drying process and to meet water standards in the dried simplicia with the requirement of not more than 10% (Depkes RI, 2008). High water content or more than 10% can be a medium for growth of molds and fungi that can reduce the quality of simplicia. In addition, it is also to get simplicia that is not easily damaged so that the material's resistance in the storage process is longer (Depkes RI, 1986).

The setting of drying shrinkage of lengkuas rhizome powder using a Halogen Moisture Analyzer of 8.63% was obtained from an average of 3 replications. The drying shrinkage obtained which is smaller than the requirements from the Indonesian Herbal Pharmacopoeia (no more than 10%) can be influenced by the length of simplicia drying in the oven, which makes the simplicia completely dry so that the water rate in the simplicia is small. While the results of the

study by Rosanti (2007) found that the shrinkage drying of lengkuas powder were 2.69% in this case there were differences in the results of drying shrinkage, which was caused by differences in the growing place of the lengkuas rhizomes and the length of drying time as stated by Rosanti in 2007 that it requires a drying time of 8 days, while in this study, it is only until the simplicia is dried, which only need 2-3 days, resulting in a higher shrinkage drying value than what was found in the study conducted by Rosanti in 2007. The measurement results of the drying shrinkage in this study indicate that simplicia fulfills the predetermined requirements so that simplicia can be declared to have good quality.

The setting of water rate is a measurement of the water content contained in the extract expressed in% v/b. The purpose of setting the water content of the lengkuas rhizome extract is to determine the amount of water content in the extract, related to the purity and contamination that may occur in the process of making the extracts (Depkes RI, 2000). The water rate can affect storage time and can also cause susceptibility to microbial activity. The less the water rate, the less likely the extract is to be contaminated by fungal or mold growth (Depkes RI, 1986).

The method used for setting the water rate as stated in the Indonesian Herbal Pharmacopoeia was the toluene distillation method. The toluene used is the toluene saturated water so that the water obtained does not bind with the toluene so that the actual water rate is obtained (Agustin, 2017). The principle of setting the water rate by

toluene distillation is to evaporate water with chemical liquid carriers that has lower type weight than water.

The water rate of lengkuas rhizome extract is 5.0%, the water rate in traditional medicinal preparations including extracts should not exceed the limit of 10% (Depkes RI, 2008). In the study of Hernani et al. (2007), the water rate of the lengkuas rhizome extract was 7.80%. The water rate obtained in this study is smaller than the results of the study of Hernani et al. (2007) and the requirements of Indonesian Herbal Pharmacopoeia. This can be influenced by the differences in the length of simplicia drying time, solvent evaporation process and extracts thickening time, so that thick extracts are obtained with smaller water rate. Water rate will affect the active substance which is obtained. The high water rate indicates that mold or fungus can easily grow on them, which will affect the stability of the extract, and thus causing a low quality of the extract (Depkes, 1986). The measurement results in this study indicate that the lengkuas rhizome extract fulfills the predetermined requirements, namely the water rate of the extract is not more than 10%.

The setting of total ash rate has the purpose of providing an overview of internal and external mineral content which comes from the initial process to the formation of the extracts. It is carried out by spreading the powder and the extract in the kurs in the furnace at a temperature of 600oC until the charcoal runs out (for 6 hours), followed by weighing to constant weight. In this test, heating of the material occurs at high temperatures where organic compounds and their derivatives are decomposed and evaporated, so that only the mineral and inorganic elements will remain (Depkes RI, 2000).

The ash rate and its' composition depends on the type of material and the method of ignition. Ash content is related with the minerals in an ingredient. The minerals contained in an ingredient are two kinds of organic namely organic salts (salts of malic acid, oxalate, acetate, pectar, etc.) and inorganic salts (phosphates, carbonates, chlorides, sulfates, nitrates and alkali metals) (Agustin, 2017). The setting of total ash rate can be used for various purposes including determining whether or not a processing is good, knowing the type of ingredients used and setting the parameters of nutritional value in food ingredients (Pine et al., 2015). The ash rate is calculated against the weight of the test ingredients stated in % b/b.

The results of this study obtained that the powder total ash rate is 3.24% and the powder total ash rate is 1.30%. The difference in the results of ash rate in the powder which is higher than that of the extract caused by the extract of the lengkuas rhizome which has gone through the processing, so that it can minimize the amount of sand or soil attached to the lengkuas rhizome. In the Khoerunnisa (2015) study, the extract ash rate was 7.53%. The total ash rate that meets the requirements from the Indonesian Herbal Pharmacopoeia is that for lengkuas rhizome powder to be no more than 3.9%. The difference in the results of the ash rate in each study can be caused by the differences in the growing place of simplicia and the extract processing process.

The high ash rate value indicates mineral and inorganic contamination found in powder and extract. This contamination can occur related to the place of growing or during the process of making extracts that are less clean. The higher the rate of ash, the lower the quality of the powder or extract (Agustin, 2017). The results of the measurement of total ash rate in this study showed that results that the lengkuas rhizome powder and extract fulfilled the stipulated requirements.

The levels of acid insoluble ash rate obtained in this study is 2.66% in the lengkuas rhizome powder and 0.87% in the lengkuas rhizome extract. The difference in the results of acid insoluble ash rate in the powder which is higher than that of the extract is caused by the lengkuas rhizomes extracts which have gone through the processing process, so that it can minimize the amount of sand or soil attached to the lengkuas rhizome. Soil and sand are silicate compounds that do not burn so that they are components of acid-insoluble ash. In Khoerunnisa's study (2015) the results of acid insoluble ash rate were 2.93%. The rate of acid insoluble ash can be stated as fulfilling the requirements from the Indonesian Herbal Pharmacopoeia if the rate in the powder is not more than 3.7%. The difference in the results of acid insoluble ash rate can be caused by differences in the place of growth of simplicia and extract processing process. The results of the acid insoluble ash rate and lengkuas rhizome extract rate in this study can be declared as fulfilling the requirements stated in Indonesian Herbal Pharmacopoeia.

The test results for determining the type weight of lengkuas rhizome extract were 1.01. Measuring the type weight of thick extracts can be done as long as the extract can still be poured. The weight of the type of extract type is related to the

purity and contamination of the extract. The results obtained was that the type weight of the lengkuas rhizome extract is >1, which means small extract contamination, because the extract is a thick extract containing little water (Haryani et al., 2013).

Phenol Compound Screening Test

The phenol compound screening test was chosen because Fitriati (2007) stated that some of the antifungal active compounds in lengkuas are phenolic compounds. Therefore, this test can show the presence of active compounds which are antifungal in the lengkuas rhizome extract, the presence of phenol compounds which is indicated by yellowish green discoloration (there is a change in color) when $FeCl_3$ is added. The reactions that occur are expressed as follows: $FeCl_3$ (aq) + 6 ArOH (s) → $6H^+ + 3Cl^- + [Fe (Oar) 6]^{3-}$ (aq) (Nugrahani et al., 2016). In this study, there was a change in color. Thus, there was a class of active phenolic compounds which were anti fungal in the lengkuas rhizome extract.

Emulgel Physical Properties Test

The results of the physical properties test of lengkuas rhizome extract emulgel in this study can be seen in Table III.

Spreadability testing aims to see the ability of the emulgel to spread when applied, the emulgel preparation is expected to be able to easily spread when applied to the skin of the desired part of the body. Spreadability is related to how large the surface of the skin is in contact with topical preparations when applied (Pratama and Zulkarnain, 2015). Preparations that have shorter spreading distances show better dispersion coefficients (Gupta and Gaud, 2005). Spreadability test on emulgel preparation is 2.45 g.cm.s-1, using a load of 150 g and the time when the spread diameter is constant at 480 seconds.

Stickiness is the ability of a preparation to stick for a long time when applied. The longer the stickiness of a preparation, the longer the penetration time of the medicine into the skin so that the absorption of the medicine becomes optimal (Ansel, 2005). Topical preparations are expected to have long stickiness, so that the medicine will be in contact with the skin for longer time, so that the effect of the medicine will be more optimal. The stickiness test on emulgel preparations was 8.80 seconds. The stickiness in this study meets the requirements of good stickiness, which is more than 4 seconds (Ulaen et al., 2012)

Viscosity is a statement to flow from a system with a thicker liquid. The thicker the liquid, the bigger the power required by the liquid to flow (Martin et al., 1993). Viscosity measurement with Rheosys Merlin VR II Viscometer is equipped with 30 mm parallel spindle, using 10 points with rotating speed from 0.1 to 20.0 RPM with 30 seconds delay time and 1 second integration time. The viscosity test showed that at 15.6 RPM, the emulgel viscosity is about 1.37 Pa.s ± 0.22.

In addition to getting the viscosity value, using the Rheosys Merlin VR II Viscometer also obtained a graph that shows the flow properties of preparations (Hendriana, 2016), Graphs were obtained in the emulgel which follows the type of non-Newtonian flow, then linear regression calculations between shear stress (x) vs shear rate (y) and log shear stress (x) vs. log shear rate (y) were conducted. Then in the log shear stress (x) vs log shear rate (y) equation of the three replications, the R square results closest to 1 were obtained, so that the flow type of the emulgel preparation was non-Newtonian pseudoplastic type. This result is in accordance with the theory presented by Martin et al., 1993 which states that generally, semisolid preparations have non-Newtonian flow properties and polymer-based pharmaceutical preparations such as emulgel preparations showing pseudoplastic flow. The graph of the viscosity test results can be seen in Figure 1.

Tabel III. Emulgel Physical Properties Test Results

Parameter	Results	Requirement
Spreadability (g.cm.s-^{1})	2.45 ± 0.03	-
Stickiness (s)	8.80 ± 0.72	> 4 seconds (Ulaen *et al*., 2012)
Viscocity (Pa.s)	1.37 ± 0.22	-
Flow Type	Non-Newton - Pseudoplastic	Pseudoplastis (Martin *et al*., 1993)
pH	7	5-7 (Swastika *et al*., 2013)
Emulsion Type	m/a or o/w	-
Organoleptis	Stabil (semisolid form, light brown color, distinctive smell of the lengkuas rhizome)	-
Homogeneity	Homogeneous	-
Stability towards Temperature	No changes (Stabil)	-

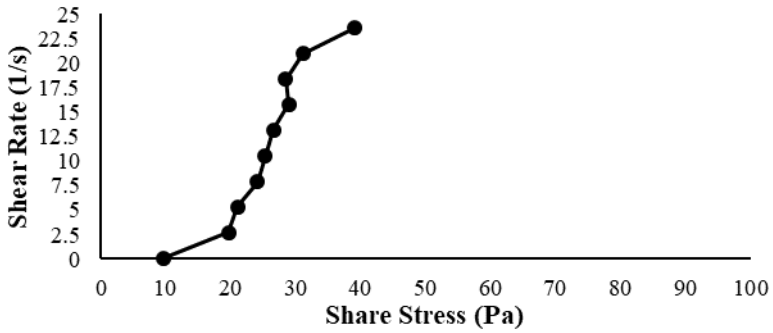


Figure 1. Viscosity Test Results Graph

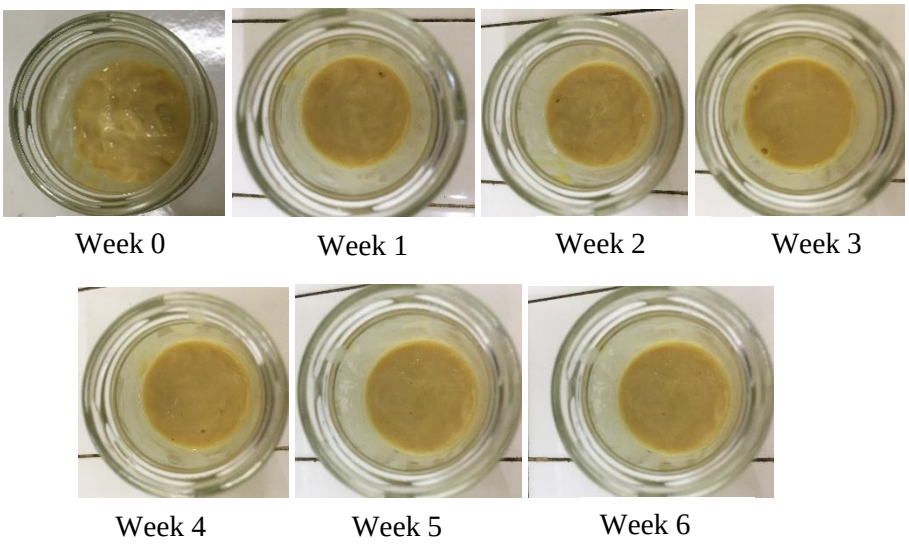


Figure 2. Organoleptic Observation Results

The higher the viscosity value, the higher the thickness level of the substance (Arikumalasari et al., 2013). Viscosity is related to the spreadability and stickiness of a topical preparation. Spreadability is inversely proportional to the viscosity and stickiness of the preparation, so the greater the viscosity of a preparation, the greater the stickiness and the smaller the spreadability produced (Setyaningrum, 2013).

Setting of pH on emulgel preparations is useful to figure out the pH of emulgel preparations. The pH test of the preparation aims to determine the safety of emulgel preparations when used so as not to irritate the skin, skin preparations should have a pH that is more or less the same as the pH of the skin so that it does not easily irritate the skin which is between 5-7 (Swastika et al., 2013). If the pH of the preparation is lower than the physiological pH of the skin, it will result in skin irritation. Preparations with a higher pH, resulting in irritation and dry skin (Young, 2002). The pH test is carried out by using universal pH paper, and based on the pH test results, the emulgel preparation has a pH of 7, so that the emulgel preparation has a pH that matches the pH range of the skin (5-7).

Emulsion type tests are carried out to ascertain whether the emulsion type of emulgel is as expected, that is typed O/W. This test is carried out using methylene blue liquid, if the blue color spreads evenly, then the emulsion type is O/W. In this study, when drops of methylene blue solution are added on the emulgel, blue color is spread evenly, so that the type of emulsion is in accordance with the expected type O/W. O/W type is more acceptable because it is easily applied to the skin and leaves a feeling of comfort compared to the W/O type (Dipahayu et al., 2014).

Organoleptic observations were carried out by observing the shape, smell and color of the

emulgel preparation, observing the 0, 1, 2, 3, 4, 5, 6 weeks so that the observations were carried out for 6 weeks. Organoleptic tests were carried out to see the physical appearance of the preparation by observing the shape, color, and smell of the preparations that had been made (Allen, 2002). The organoleptic observations on emulgel preparations found that the shape of the preparation is semisolid, then the distinctive smell of lengkuas rhizome extract, and light brown color. During the 6-weeks-storage with room temperature, the emulgel preparation did not experience changes in shape, smell or color so that it could be said that the emulgel had good stability, and was stable in storage at room temperature within 6 weeks, this could prove that the emulgel preparation could maintain the stability of active compounds contained in lengkuas rhizome extract which are phenolic compounds, whereas phenolic compounds are easily oxidized which is known as auto-oxidation, which is a reaction caused by the presence of light and oxygen (Setyaningtyas et al., 2018). The observation results can be seen in Figure 2.

Homogeneity examination is related to the therapeutic effects produced by emulgel preparations. If the emulgel is not homogeneous, then the active substance is not evenly distributed on the emulgel base, so that the part of the emulgel which does not contain active substances makes the therapeutic effect produced from emulgel preparations less. Observations were conducted by applying emulgel on transparent glass. Based on observations of the emulgel, there is no visible coarse grains on transparent glass so that the emulgel can be said to be homogeneous. This proves that emulgel preparations can mix well and homogeneously with lengkuas rhizome extract that has hydrophobic or hydrophilic properties.

Observation of emulgel stability on temperature aims to see the stability of the emulgel when stored at a certain temperature. This test was observed at two different temperatures, namely cold temperature (5ºC) and at room temperature (25ºC) and observations were made with 24-hour storage. After being stored for 24 hours at a predetermined temperature, it is then observed whether there is a phase separation that occurs in the emulgel. The results of this observation found that emulgel preparations that were stored for 24 hours at cold and room temperature did not separate. There is no change in the emulgel form. This proves that the emulgel formula can mix with *lengkuas* rhizome extract so that there is no cracking in the preparation.

CONCLUSION

The non-specific parameter standardization of lengkuas extract obtained the results of extract yield (14.66 ± 0.056) %; powder drying shrinkage (8.63 ± 0.134) %; extract water rate (5 ± 0) %; powder total ash rate (3.24 ± 0.017) %; and extract (1.30 ± 0.035) %; powder acid-insoluble ash rate (2.66 ± 0.10) %; and extract (0.87 ± 0.031) %; extract type weight 1.01. The test results of physical properties of emulgel obtained the spreadability of (2.45 ± 0.03) g.cm.s-1; stickiness (8.80 ± 0.72) seconds; viscosity (1.37 ± 0.22) Pa.s; pseudoplastic flow type; pH 7; emulsion type m/a; stable emulgel at 6 weeks stored in the semisolid form, light brown color, distinctive smell of lengkuas rhizome extract; homogeneous emulgel; and stable at 5ºC and 25ºC for 24 hours.

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