

# Formulation Study of Topical Lotion from Zodia Leaf Extract (*Evodia suaveolens*) Against *Aedes Aegypti*

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**Abstract.** Zodia is a typical plant from Papua that is traditionally used by the community to repel mosquitoes. The content of essential oils in zodia leaf is linalool and  $\alpha$ -pinena which is able to repel mosquitoes. The aim of this study was to make a formula and physical evaluation of lotions from zodia leaf extracts. Lotion of Zodia leaf was formulated using the fusion method. Evaluation of lotion preparations includes organoleptic, pH, spreadability, stickiness, viscosity and protection. The results of the lotion evaluation from leaf extract obtained F I as a placebo that organoleptic white, odorless, semisolid, PH 7, homogeneous, does not appear red stains, spreadability 6.3 cm, stickiness 2.3 seconds, viscosity 6.67. F II has a light green organoleptic, characteristic odor, semisolid, PH 7, homogeneous, does not arise red stains, spreadability 7 cm, stickiness 1.5 seconds, Viscosity 5.3. FIII has a brownish green Organoleptic, distinctive odor, semisolid, PH 7, homogeneous, does not appear red stain, spreadability 5.9 cm, stickiness 1.2 seconds, viscosity 6.0. FIV has a brownish green organoleptic, distinctive odor, semisolid, PH 6, homogeneous, does not appear red stain, spreadability 5.2 cm, stickiness 1.3 seconds, viscosity 6.33. These four has qualified physical evaluations as lotions. The Result of repellency of lotion from Zodia leaf extract against *Aedes aegypti* at a concentration of 25% with a repellency 75%.

## 1. Introduction

*Evodia suaveolens* are Indonesian native plants. Papuans using this plant as a repellent. This plants have a height of between 50 to 200 cm (75 cm on average) are believed to be able to repel mosquitoes and other insects from around the plant. *Evodia suaveolens* is active as a repellent because it contains evodiamine and rutaecarpine compounds. Evodiamin has also been shown to inhibit cyclooxygenase-2 and NF- $\kappa$ B activation [1-2]. In addition it contains essential oils as linalool and  $\alpha$ -pinena, linalool at a concentration of 0.03mg/cm<sup>2</sup> produces a repellency of *T. castaneum imago* up to 83% [3-4].

In Indonesia, the use of insecticides is growing so that more insecticide products on the market. currently insecticide products are targeted not only for government agencies, but also for households with various forms and different application methods such as (repellent, aerosol, burn, and mat). The ingredients of this insecticide are made from carbamate, pyrethroid, organophosphate, and organochlorine groups which are harmful to the human body [5]. Therefore it is necessary to develop a formulation that is safe and environmentally friendly.

The choice of lotion is a formula that has an emulsion form that is easily washed with water and is not sticky when compared to other topical preparations. In addition, its liquid form allows for quick



and easy application to the skin. Lotion preparations can be said to be good by carrying out quality control including organoleptic test in terms of shape, odor, color, taste, Spreading test on good lotion preparations ranging from 50-70 mm, Adhesion test of less than 4 seconds, Test of protection for lotion preparations does not appear red stains, PH Test for mosquito repellent skin lotion ranges from 3.47 to 5.61 and the pH of skin lotion (Standard) is 5.82 [6]. Soap with 1.5% essential zodia oil works as repellent for three hours [7].

Based on this background, it is necessary to research on the formulation of Zodia leaf extract (*Evodiasuaveolens*) and repellent effectiveness. The formulation will be carried out a physical evaluation of the quality of the lotion from zodia leaves, including organoleptic test, pH, spreadability, stickiness, protection and viscosity.

## 2. Method

The ingredients used are the leaves of zodia (*Evodiasuaveolens*), stearic acid, cetyl alcohol, lanolin, glycerin, triethanolamine, methyl paraben, and aquadest. A total of 1.8 kg of fresh zodia leaves (*Evodia suaveolens*) were immersed using 70% ethanol as much as 2700 ml. The immersion process is placed in a dark bottle and tightly closed. Then stir to achieve homogeneous conditions. The solution is immersed for 5 days at room temperature with occasional stirring, then the solution is filtered with a flannel cloth, so that the filtrate is obtained and accommodated in a glass beaker covered with aluminum foil. The filtrate was evaporated using a water bath to obtain a thick extract.

In this study, researchers used four formulas, where in each formula there were variations in the content of the active substance (Table 1).

**Table 1.** Lotion formulation from zodia (*Evodia suaveolens*) leaf extract

Portion	Formula	I	II	III	III
	Compounds	Composition (w/v %)			
I	Cetyl alcohol	0.5	0.5	0.5	0.5
	Stearic acid	3	3	3	3
	Lanolin	1	1	1	1
II	Zodia leaves extract	-	15	20	25
	Glycerin	2	2	2	2
	Methyl paraben	0.1	0.1	0.1	0.1
	Triethanolamine	0.75	0.75	0.75	0.75
	Aquadest	92.65	77.65	72.65	67.65

The first part ingredients are put into a porcelain cup and melted on a water bath. After the substance has dissolved, pour it into a warm mortar and mix it with other ingredients such as triethanolamine, glycerin, and zodia leaf extracts (*Evodiasuaveolens*). Then add distilled water gradually to 100 grams and while stirring until homogeneous. After all the ingredients are mixed and the temperature has dropped, put in the container that has been provided.

*Organoleptic* Lotions were visually observed including color, odor, shape. *Viscosity Test* lotion is inserted into the beaker glass and placed under the spindle hanger. The spindle is mounted on a spindle hanger, then the spindle is lowered to the bottom of the dip into the lotion of the zodia leaves (*Evodia suaveolens*). the red needle is observed on a scale, read the number indicated by the needle. *Homogeneity Test* Take lotion preparations then apply on a transparent glass. Homogeneity is indicated by the presence or absence of coarse grains. *PH test* Attach the stick pH to the lotion preparation to be tested. observe the change in color on the pH stick. Adjust the color with a pH indicator paper that has been determined Viscosity. *Stickiness test* Weigh 0.25 grams of lotion place it on two objects that have been determined. Press with a load of 1 kg for 5 minutes. Put the glass object on the test equipment. Add 80 gram load on the test equipment. Note the release time of the glass object. *Scattering Test* The lotion is placed on a round glass below with a millimeter scale. Then by

adding 50 grams of load in stages until sufficient diameter is obtained to see the effect of the load on the spreadability of the lotion [8]. *Protection test* Lotion is smeared on paper containing color indicators. If there is no red stain means the lotion can provide protection against liquid KOH.

To calculate the repellency power of Lotion From Zodia Leaf Extract as a repellent mosquito *Aedes aegypti* using the formula [9] :

$$\text{repellency (\%)} = \frac{\Sigma C - \Sigma T}{\Sigma C} \times 100\%$$

### 3. Results and Discussion

The process of extracting zodia leaves is done by maceration method. Zodia leaves (*Evodia suaveolens*) macerated with 70% ethanol solvent for 10 days. The choice of maceration method is because the process is easy and the equipment used is simple. The maceration process uses dark colored glass bottles because it can reflect sunlight that allows entry into the bottle so that it can prevent alcohol from evaporating.

Organoleptic observations, including color, odor and consistency. Based on the organoleptic test of the four lotion formulas from zodia leaf extract according to good lotion quality because it has a thick and homogeneous consistency (Table 2). A good lotion must have a thickness level that is not too low and not too high and has a viscosity of 3-12 dPas. The thickness of the lotion that is too high will result in the more difficult drug to be released from the lotion preparation, whereas if the thickness is too low it will reduce the length of time the lotion stays on the skin when used.

**Table 2.** Results of Lotion viscosity test from zodia leaf extract.

Replication	Viscosity			
	Formula I	Formula II	Formula III	Formula IV
1	7.0	6.0	7.0	5.0
2	6.0	5.0	5.0	7.0
3	7.0	5.0	6.0	7.0
$\bar{x} \pm SD$	6,67±0,57	5.33±0.57	6.00±1.00	6.33±1.15

Homogeneity is an important requirement for good pharmaceutical preparations. Homogeneous preparations will provide the same properties for each use. The homogeneity of the zodia leaf extract (*Evodia suaveolens*) can be seen organoleptically, which is seen from a flat color and no coarse particles or grain. Homogeneity test results showed that the five formulas showed a uniform color arrangement and there were no particles or coarse grains.

One of the criteria for a good lotion must have a pH that matches the pH of the skin which is 3.5 - 5.5. Lotion that is too acidic will cause skin irritation while the pH of the lotion that is too alkaline will cause dry skin. Based on the acidity test (pH) of the four formulas meet the standard with an average pH of lotion that is 6.75. These results indicate that the content of zodia (*Evodia suaveolens*) leaf extract has no effect on pH changes. But according to pH of mosquito repellent skin lotion ranged from 3.47 to 5.61 and the pH of skin lotion (Standard) was 5.82 [6].

The ideal lotion must have good spread ability. The spread of lotion test is carried out to find out how much the lotion has spread on the skin. The greater the load is given the greater the spread of the power of each formula. The spread of 5-7 cm shows the semifluid consistency which is very convenient in use. All of the four formulas fulfilled a good spread, namely Formula I (6.3 ± 0.3), Formula II (7 ± 0.1), Formula III (5.9 ± 0.3), Formula IV (5.2 ± 0.7).

**Table 3.** Results of the Spreadability of Zodia leaf extracts

Replication	Spreadability (Seconds)			
	Formula I	Formula II	Formula III	Formula IV
1	6,3	7,2	6.0	5.6
2	6,1	6,9	5.5	5.8
3	6,7	6,9	6.2	4.4
$\bar{x} \pm SD$	6.3±0.3	7±0.1	5.9±0.3	5.2±0.7

In addition to being able to spread well, lotion must have a stickiness that meets the standard of not more than 4 seconds. The stickiness test was carried out to determine the strength of the lotion attached to the skin. Based on the stickiness test of the four zodia leaf extracts (*Evodia suaveolens*) lotion formula, all formulas that have stickiness that are in accordance with the standard are in formula I ( $2.3 \pm 0.05$ ), formula II ( $1.5 \pm 0.15$ ), and formula III ( $1.2 \pm 0.20$ ) and Formula IV ( $1.3 \pm 0.25$ ).

**Table 4.** Results of Stickiness test Lotion Zodia leaf extract (*Evodiasuaveolens*)

Replication	Stickiness (seconds)			
	Formula I	Formula II	Formula III	Formula IV
1	2.3	1.6	1.2	1.6
2	2.4	1.4	1.0	1.1
3	2.4	1.7	1.4	1.4
$\bar{x} \pm SD$	2.3±0.05	1.5±0.15	1.2±0.20	1.3±0.25

A lotion protection test is carried out to determine the ability of the lotion to protect the skin from external influences such as dust, pollution, and sunlight. The lotion protection test is carried out using 0.1 N KOH. The lotion preparation can provide protection against 0.1 N KOH liquid if no red stains appear on the 0.1 N KOH droplets on filter paper. Based on the protective power test of the four formulas, it was found that the zodia leaf extract (*Evodia suaveolens*) for 15 to 300 seconds did not appear red stains on filter paper, this means that the lotion is able to provide protection or protection to the skin, so the lotion meets the quality standards of protective power. topical preparations.

**Table 5.** The Result of repellency Zodia leaf extract against *Aedes aegypti* Mosquito

Replication	Repellency					
	Placebo	15%	Placebo	20 %	Placebo	25%
1	3	2	3	1	4	2
2	5	2	4	1	5	1
3	2	1	3	0	3	0
Repellency		50%		60%		75%

According to Table 5 obtained repellency with an effective concentration is 25%. Determination of the 75% repellency index level based on the classification of Su & Jilani (1982) has a strong repellency (75%-95%). *Evodia suaveolens* are a family of Rutaceae, which contains evodiamine and rutaecarpine compounds. The results of analysis by gas chromatography, oil extracted from the leaves of this plant contained linalool (46%) and  $\alpha$ -pinene (13.26%). Linalool is already very well known as an insect repellent. Linalool at a concentration of 0.03mg / cm<sup>2</sup> produces repellency against *T. castaneum* imago up to 83% Linalool (3,7-Dimethyl-1,6-octadien-3-ol) is a contact poison that increases sensory nerve activity in insects, with a concentration that greater cause motor nerve stimulation that can cause seizures and paralysis of several types of insects [10][4].

#### 4. Conclusion

Based on physical evaluations that have been carried out that the quality of the four zodia leaf extract formulas (*Evodiasuaveolens*) has met the standard lotion preparation formulation. Zodia leaf extract has a strong repellency at a concentration of 25% which is able to resist the *Aedes aegypti* mosquito.

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#### References

- [1] Zhang YT, Huang ZB, Zhang SJ, Zhao JH, Wang Z, Liu Y, & Feng N. 2012. In Vitro Cellular Uptake of Evodiamine and Rutaecarpine Using A Microemulsion. *International Journal of Nanomedicine* 7: **2465–2472**.
- [2] Astriani Y dan Widawati M 2017 Potensi Tanaman Di Indonesia Sebagai Larvasida Alami Untuk *Aedes aegypti* *SPIRAKEL* **8 2**.
- [3] Lestari F dan Susanty E, 2017. Uji Potensi Minyak Atsiri Daun Zodia (*Evodia Suaveolens* Scheff) Sebagai Insektisida Nyamuk *Aedes Aegypti* L Dengan Metode Elektrik Potency Of Essential Oil Of Zodia (*Evodia Suaveolens* Scheff) Leaves As Repellant Of *Aedes Aegypti* L With Electric Method *Pharmacy* **14 01**
- [4] Purgazhvendan S.R., Ronald Ross P., Elumalai E. 2012. Insecticidal and repellent activities of four indigenous medicinal plants against stored grain pest *Tribolium castaneum* (Coleoptera:Tenebrionidae). *Asian pasific journal of tropical disease* (2012) **s16-s20**.
- [5] Susanti L dan Boesri H 2012 Toksisitas biolarvasida ekstrak tembakau dibandingkan dengan ekstrak zodia terhadap jentik vektor demam berdarah dengue (*Aedes aegypti*) *Buletin Penelitian Kesehatan* 40 (2) pp **75–84**
- [6] Setyaningsih, Dwi, Hambali E, dan Nasution M 2016 Aplikasi Minyak Sereh Wangi (*Citronella Oil*) dan Geraniol dalam Pembuatan Skin Lotion Penolak Nyamuk. *Jurnal Teknologi Industri Pertanian Bogor*
- [7] Simaremare, Eva Susanty, Manurung, Leoventina Gunawan, Elsy, Maryuni, Agnes Eri, Zodia (*Evodia suaveolens* Scheff) in Liquid Soap as Repellent Against *Aedes aegypti* L,
- [8] Ummu Arifah Zam Zam, Sutaryono, 2013, Yetti O.K, Formulasi Krim Ekstrak Etanol Buah Strawberry (*Fragaria Sp.*), *CERATA Journal Of Pharmacy Science* vol. **4 1**
- [9] Boewono DTHB. 2009, Pedoman Teknis Uji Insektisida, Besar Penelitian dan pengendalian Vektor dan Reservoir Penyakit, Salatiga
- [10] Kardinan, A. 2003. *Tanaman Pengusir dan pembasmi nyamuk*. Agromedia Pustaka. Jakarta.