



THE UTILIZATION AND EFFECTIVENESS OF ESSENTIAL OIL FROM LEMONGRASS (*Cymbopogon citratus*) AS A SPRAY REPELLENT

PEMANFAATAN DAN EFEKTIVITAS MINYAK ATSIRI DARI BATANG SERAI (*Cymbopogon citratus*) SEBAGAI SPRAY REPELEN

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Abstract

The lemongrass plant (*Cymbopogon citratus*) contains essential oil components consisting of 3 components, namely citronellal, citronellol, geraniol, and other components that are traditionally used as mosquito repellents. This study aims to utilize lemongrass stem essential oil in mosquito repellent preparations and find out at what concentration of lemongrass stem essential oil can be used as an anti-mosquito preparation. Essential oils are obtained using the steam distillation method. This research is experimental through laboratory testing. Three spray-repellent preparations were made with concentrations of 4%, 6%, and 8%. The tests carried out were organoleptic and preparation effectiveness tests against ten adult mosquitoes. The results of the study showed that spray repellents from lemongrass essential oil with concentrations of 4 and 6% were more effective in repelling and killing mosquitoes.

Keywords : *effectiveness, essential oil, lemongrass, Cymbopogon citratus, repellent*

Abstrak

Tanaman Serai (*Cymbopogon citratus*) mengandung komponen minyak atsiri yang terdiri dari 3 komponen yaitu sitronelal, sitronelol, geraniol dan komponen lainnya yang secara tradisional digunakan sebagai antinyamuk. Penelitian ini bertujuan untuk memanfaatkan minyak atsiri batang serai dalam bentuk sediaan repelen nyamuk dan mengetahui pada konsentrasi berapakah minyak atsiri tersebut dapat digunakan sebagai pengusir nyamuk. Minyak atsiri yang diperoleh menggunakan metode destilasi uap air. Penelitian ini bersifat ekperimental melalui pengujian laboratorium. Sediaan spray repelen dibuat sebanyak tiga formula dengan konsentrasi 4%, 6%, dan 8%. Pengujian yang dilakukan adalah uji organoleptis dan uji efektifitas sediaan terhadap sepuluh ekor nyamuk dewasa. Hasil penelitian menunjukkan bahwa sediaan spray repelen dari minyak atsiri batang serai dengan konsentrasi 4 dan 6% efektif dalam mengusir dan membunuh nyamuk.

Kata Kunci : *efektivitas, minyak atsiri, batang serai, Cymbopogon citratus, repelen*



INTRODUCTION

Lemongrass (*Cymbopogon citratus*) is very beneficial for health. The lemongrass plant is useful for anti-inflammatory, anti-mosquito, relieving pain, and improving blood circulation. Other benefits of the lemongrass plant are for coughs, muscles, stomach pain, irregular menstruation, and swelling after giving birth (Fauzi, 2017). The roots of the lemongrass plant are used as a urine laxative, sweat laxative, phlegm laxative, and an ingredient for gargling and warming the body, while lemongrass leaves are used as a stomach laxative, appetite enhancer, postpartum treatment, fever reducer, and seizure reliever (Lombonauung, 2022).

Lemongrass contains component oil the usual essential (*volatile oil*). Called oil essential. Oil Lemongrass essential oil contains 3 components main that is citronellal, citronellol, and geraniol (Fatmawati, 2019). Lemongrass oil is the material standard in making soap, shampoo, toothpaste, lotion, gel, pesticide vegetable, disinfectant, ingredient shine, and anti-mosquito (Suwarni *et al.* , 2022).

Possible efforts done to avoid biting mosquitoes is with method installing wire gauze on the window at home, installing mosquito net sleep, and using repellent. Repellent is a material used to reject mosquitoes as well as give protection and prevention from biting mosquitoes. An example material active chemical used as repellent is DEET (N, N - diethyl -meta- tuloamide) which is used on the skin or clothes. Ways of working repellent in reject mosquito is with disguise the smell from skin with method block receptor sour lactate on the antenna mosquitoes and eliminate desire mosquito approach skin. This matters because mosquitoes can look for prey through the smell of sour lactate, sourced carbon dioxide from skin moist and warm. Using repellent made from chemistry in a way repeatedly impacts negative health like irritating skin and raises effect resistance (Marlik *et al.*, 2022). Because of that's necessary other possible alternatives are used to change material chemistry by utilizing material experience like lemongrass oil which smells of typical stings so which makes mosquitoes dodge.

Previous research conducted by Al-Fatina *et al.*,(2022) regarding making aromatherapy candles from lemongrass oil as a mosquito repellent, showed that lemongrass oil at a concentration of 3% was effective as a mosquito repellent. Based on this description, it is necessary to develop a pharmaceutical preparation such as a repellent spray to facilitate the use of lemongrass as an anti-mosquito. This research used 3 variations of lemongrass essential oil concentration, namely 4%, 6%, and 8%. This research aims to utilize the essential oil of lemongrass stems in the form of repellent preparations and find out at what concentration the essential oil can be used as a mosquito repellent.

RESEARCH METHODS

Tools and materials

The tools used in this research were a set of distillation tools, a spray bottle with a pump at the top, a beaker glass, a digital scale, a measuring cup, an Erlenmeyer, a separating funnel, and a

mosquito testing cage. The materials used in this research were lemongrass essential oil (*Cymbopogon citratus*), 70% alcohol, distilled water, and *Culex quiquifasciatus* mosquitoes.

Sampling

Lemongrass plant used in study This obtained from Lamcot Village, Darul Imarah Subdistrict, Aceh Besar. Lemongrass taken is fresh, nice, and colorful lemongrass white and greenish.

Procedure Work

Determination Plant

Before conducting the research, a determination was first carried out on the lemongrass plant, which aims to ensure that the identity of the plant used is a species of *Cymbopogon citratus*.

Distillery Oil Essential Lemongrass

Taken as much as 10 kg of lemongrass stalks cleaned, then air-dried. Furthermore ready-made lemongrass stalks dry cut small Then bruised and inserted to layer on vessel tool distillation. On layers, the lower vessel is filled with water. Furthermore, tool distillation is turned on and counted until the water boils (100°C). When water boils, water vapor will appear bringing particles of oil essential got the lemongrass stalks condenser. Water vapor together with oil collected into the funnel separator for separating oil essential with water (Sukardi *et al.*, 2021). Oil essential oils obtained as much as 12 mL (Figure 1.)



Figure 1. Oil essential lemongrass

Repellent Spray Formula

Preparation repellent in study This is made with 3 variations of concentration oil essential lemongrass.



Table 1. Formulation Repellent Mosquito Oil Essential Lemongrass

Material	Formulas		
	F1 (4%)	F2 (6%)	F3 (8%)
Oil essential lemongrass	2 mL	3 mL	4 mL
Alcohol 70%	ad 50 mL	ad 50 mL	ad 50 mL

(Widiani and Kartini, 2012)

Making Repellent Spray Preparation

First, weigh all the necessary ingredients, then calibrate the 50 mL bottle. Put some 70% alcohol into a spray bottle. Then each essential oil was added according to the treatment (2 mL, 3 mL, and 4 mL). Then 70% alcohol was added again until the calibration mark was 50 mL. Then the bottle is closed and shaken until mixed (Widiani and Kartini, 2012).



Figure 2. Repellent spray preparation with variation concentration oil essential lemongrass stems (F1, F2 and F3)

Evaluation Repellent Spray Preparation

Evaluation preparation repellent mosquito done for 7 days that is, on the day first, third, fifth, and seventh. To test effectiveness preparation is only done on the day first and day seventh.

a) Organoleptic test

Organoleptic tests are done to see the appearance of physique preparation with the method do observation to color and smell from preparations that have been created (Nayaka et al, 2023).

b) Test effectiveness preparation repellent mosquito

Test effectiveness preparation was done with method sprayed preparation repellent mosquito on a cloth Then affixed in A box testing with size 40 x 50 cm. Then 10-head mosquitoes were released into each box. Evaluation is done with observation and recording time in minutes Which number mosquitoes perch and go. Testing preparation was done for 60 minutes. The same thing was done to test control with the use of 70% alcohol (Widiani and Kartini, 2012).



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

Information :

C = Amount of mosquitoes

T = Amount dead mosquitoes

Data analysis

Deep data study This is analyzed in a way descriptive.

RESULTS AND DISCUSSION

Research result

Plant Determination

Determination of lemongrass plants was carried out at the Plant Systematics Laboratory, Department of Biology, Faculty of Mathematics and Natural Sciences, Syiahkuala University. The determination results showed that the plant samples used in this study were indeed the species *Cymbopogon citratus*.

Mosquito Identification

Mosquito identification was carried out at the Animal Systematics Laboratory, Department of Biology, Faculty of Mathematics and Natural Sciences, Syiahkuala University. The identification results show that the mosquito used in this study is a species of *Culex quinquifasciatus*.

Organoleptic Test of Lemongrass Essential Oil

Lemongrass essential oil has a clear yellow color and a characteristic odor from lemongrass stalks.

Organoleptic Test of Repellent Spray Preparations.

The results of the organoleptic test for repellent spray preparations on the first, third, fifth, and seventh days are presented in Table 2 below.

Table 2. Organoleptic Test Results for Rapelen Spray Preparation of Lemongrass Stem Essential Oil

Parameter	Preparation	Days to-			
		1	3	5	7
Color	F1	Cloudy white	The cloudy white has sediment, when shaken it mixes completely	The cloudy white has sediment, when shaken it mixes completely	The cloudy white has sediment, when shaken it mixes



Parameter	Preparation	Days to-			
		1	3	5	7
Form	F2	Cloudy white	again	again	completely again
			The cloudy white has sediment, when shaken it mixes completely again	The cloudy white has sediment, when shaken it mixes completely again	The cloudy white has sediment, when shaken it mixes completely again
			The cloudy white has sediment, when shaken it mixes completely again	The cloudy white has sediment, when shaken it mixes completely again	The cloudy white has sediment, when shaken it mixes completely again
	F3	Cloudy white	again	again	completely again
			The cloudy white has sediment, when shaken it mixes completely again	The cloudy white has sediment, when shaken it mixes completely again	The cloudy white has sediment, when shaken it mixes completely again
			The cloudy white has sediment, when shaken it mixes completely again	The cloudy white has sediment, when shaken it mixes completely again	The cloudy white has sediment, when shaken it mixes completely again
F1	liquid	liquid	liquid	liquid	
		liquid	liquid	liquid	
		liquid	liquid	liquid	
Smell	F1	Typical lemongrass stalks	Typical lemongrass stalks	Typical lemongrass stalks	Typical lemongrass stalks
			Typical lemongrass stalks	Typical lemongrass stalks	Typical lemongrass stalks
			Typical lemongrass stalks	Typical lemongrass stalks	Typical lemongrass stalks
F2	liquid	liquid	liquid	liquid	
		liquid	liquid	liquid	
		liquid	liquid	liquid	
F3	liquid	liquid	liquid	liquid	
		liquid	liquid	liquid	
		liquid	liquid	liquid	

Test Repellent Spray Preparations Against Mosquitoes

Table 3. Observation Results of the Effectiveness Test of Mosquito Repellent Preparations

Days to	Preparation	Parameter						
		Number of mosquitoes that land (tail)	Up to the minute	Mosquitoes stay for a long time	Number of dead mosquitoes	Dies at minute	% Protection power	Number of mosquitoes still alive
1	F1 (4%)	1	15	2 seconds	2	1 tail at 38 minutes, and 1 tail at 46 minutes	80%	8
		2	24	2 seconds		1 tail at 30 minutes, and 1 tail at		
	F2 (6%)	5	37	3 seconds	2	1 tail at 30 minutes, and 1 tail at	80%	8



						38 minutes		
						3 tails at 20 minutes, and 3 tails at 34 minutes	40%	4
	F3 (8%)	2	20	2 seconds	6			
						1 tail at 37 minutes, and 1 tail at 43 minutes	80%	8
	F1 (4%)	2	20	2 seconds	2			
						2 tails at 26 minutes, and 1 tail at 35 minutes	70%	7
7	F2 (6%)	2	16	1 second	3			
						2 tails at 20 minutes, and 2 tails at 40 minutes	40%	4
	F3 (8%)	1	10	2 seconds	6			

Discussion

On research This is oil essential lemongrass stems (*Cymbopogon citratus*) were formulated become spray preparation. Compared to preparation topical others, for example, gel and cream, more spray preparations are liked because practical use is through spraying. Several studies have too formulated anti-mosquito spray preparation with material active from material nature (Widiani and Kartini, 2012; Banne *et al.*, 2022; Marlik *et al.*, 2022; Nayaka *et al.*, 2023). In research, This used three repellent spray preparation formulas (Table 1), where there are different concentrations namely 4%, 6%, and 8%.

Lemongrass essential oil is made by distilling lemongrass stalks using the water vapor distillation method. The process of making lemongrass essential oil begins with selecting the lemongrass stalks. The lemongrass stalks used are fresh, greenish-white lemongrass stalks to produce quality essential oil. The lemongrass stalks that have been obtained are washed clean, air-dried, cut into small pieces, and bruised then put into a kettle (one kettle contains 3500 grams of dried lemongrass stalks), closed and pressed the on button on the distillation apparatus. Wait until the temperature indicated by the distillation apparatus reaches 100°C. The lemongrass stalks



that are ready are put into the distillation equipment and closed tightly. On the kettle lid, there is a pipe connecting the cooler/condenser. The side of the kettle must be closed tightly so that no steam containing essential oils escapes. The distillation process was carried out for 5 hours. The choice of method refers to Sukardi *et al.*, (2021), because with the distillation method steam penetration occurs evenly into the tissue of the material, the temperature can be maintained up to 100°C, the distillation time is relatively shorter and the oil yield obtained is better when compared to the resulting oil. Water distillation system. The results obtained are collected in a separating funnel in the form of essential oil which is still mixed with water from evaporation. In the separating funnel, the essential oil floats on the surface of the water. To obtain pure essential oil, open the tap on the separating funnel so that the water comes out. The water that is released is partly water so that the essential oil can be sucked out using a syringe. After sucking the essential oil, put it in a vial, then add sodium sulfate powder which aims to separate and remove sediment or remaining dirt during distillation. Every time the essential oil is distilled, 2.5 mL is obtained.

The essential oil of lemongrass (*Cymbopogon citratus*) stems that has been obtained is then made into a mosquito repellent preparation with three formulas and three different concentrations. In the first preparation, 2 mL of lemongrass stem essential oil was used and 70% alcohol was added to the calibration limit mark, the second preparation 3 mL of lemongrass stem essential oil and 70% alcohol was added to the calibration limit mark, and the third preparation was made with 4 mL of lemongrass stem essential oil. And add 70% alcohol to the calibration limit mark. After the formulation is complete, an organoleptic test is carried out. Organoleptic tests are carried out to see the physical appearance of the preparation by observing the shape, color, and odor of each preparation. Organoleptic tests were carried out on the first, third, fifth, and seventh days of observation, and each preparation was tested for effectiveness as a mosquito-repellent preparation. The effectiveness test of the repellent spray preparation was carried out on the first and seventh days of observation using 10 adult mosquitoes. On the first day, an effectiveness test was carried out, each preparation was sprayed on a black cloth and attached to the test box accompanied by a control, and then 10 adult mosquitoes were released and observed for 60 minutes when the mosquitoes landed and left on the cloth. The mosquitoes used in each preparation are different. The same thing was also done on the seventh day of observation. From the results of observations on the first day, the F1 preparation was infested with 1 mosquito at 15 minutes and 2 at 24 minutes 1 mosquito died at 38 minutes and 1 mosquito died at 46 minutes, the number of mosquitoes that were still alive was 8 mosquitoes. The F2 preparation was infested with 5 mosquitoes at 37 minutes 2 dead mosquitoes at 30 minutes and 1 at 38 minutes, the number of mosquitoes that were still alive was 8 mosquitoes, while the F3 preparation on the first day was infested with 2 mosquitoes at 20 minutes and 6 dead mosquitoes, 3 died at 20 minutes and 3 at 34 minutes, the number of mosquitoes that were still alive was 4 mosquitoes. Meanwhile, for the results of observations on the seventh day, the F1 preparation was infested with 2 mosquitoes at 20 minutes and 2 mosquitoes at 24 minutes, and 2 mosquitoes died, 1 died at 37 minutes, 1 died at 43 minutes, the number of mosquitoes that were still alive 8 mosquitoes.

In the F2 preparation, 2 mosquitoes landed in the 16th minute 3 mosquitoes landed in the 27th minute and 3 mosquitoes died, 2 mosquitoes in the 26th minute and 1 in the 35th minute, the



number of mosquitoes that were still alive was 7 mosquitoes, while the F3 preparation was On the seventh day of the study, 1 mosquito was infested at 10 minutes and 6 mosquitoes died, 2 mosquitoes at 20 minutes, 2 mosquitoes at 36 minutes and 2 mosquitoes died at 40 minutes. Based on the results of the research above, it can be concluded that the anti-mosquito preparation formulation using the active ingredient lemongrass essential oil (*Cymbopogon citratus*) effectively repels mosquitoes. The higher the concentration used, the more effective it is as a mosquito repellent. This can be seen from preparations with essential oil concentrations of 4% and 6%, where on the first day for the 4% concentration the effectiveness test observations were infested with 3 mosquitoes, and 2 mosquitoes died, while for the 6% concentration, 5 mosquitoes were infested and 2 mosquitoes died. On the seventh day of observation, a concentration of 4% was infested with 4 mosquitoes and 2 mosquitoes died, while for a concentration of 6%, 5 mosquitoes were infested and 5 mosquitoes died.

CONCLUSION

From the results of the research that has been carried out, it can be concluded that the essential oil of lemongrass stems can be used as an active ingredient in making mosquito-repellent preparations. The small amount of essential oil in a preparation affects the ability of lemongrass essential oil to repel mosquitoes. The concentrations used in this study showed that concentrations of 4% and 6% were more effective in repelling and killing mosquitoes.

REFERENCES

- Al-Fatina, A., Nurtalitha, A. R., Nadhifah, S., Ahmad, F. E., Ahmad, S. S., Eric, E. P., Faishol, I., Laili, R.U., Riskha, A., Sukaris, Nur, F., & Andi R.R. (2021). Pembuatan Minyak Sereh dan Lilin Aronaterapi Sebagai Antinyamuk. *DedikasiMU (Journal of Community Service)*. 3 (2), 837-847.
- Banne, Y., Rilyn, N. M., I-Gusti, A.A., Jovie, M.D., Elvie, R., Benedieta, R., & Zulfiayu, S. (2022). Pembuatan Sediaan Spray Repelen Dari Minyak Atsiri Bunga Kamboja Putih (*Plumeria alba*). *Prosising, Seminar Nasional Kefarmasian*, Manado, 4 Oktober 2022.
- Fatmawati. S. (2019). *Bioaktivitas dan Konstituen Kimia Tanaman Obat Indonesia*. Yogyakarta: Deepublish.
- Fauzi, A. (2017). *Aneka Tanaman Obat dan Khasiatnya*. Yogyakarta: Media Pressindo.
- Lombonaung, E. (2022). *Tanaman Obat Keluarga (Toga)*. Yogyakarta: Deepublish.
- Marlik., Mareta, E.P., & Ngadino. (2022). Ekstrak Daun Kenikir (*Cosmos caudatus*) Sebagai Repelen Nyamuk *Culex quinquefasciatus*. *Jurnal Kesehatan Terpadu (Integrated Health Journal)*, 13 (2), 101-107.
- Nayaka, N. M., I-Gede, M.S., Ni-Putu, G. D. (2023). Evaluasi Mutu Fisik dan Uji Iritasi Sediaan Spray Antinyamuk Sari Ekstrak Etanol Daun Ledundi (*Vitex triolia* L.). *Majalah Farmasi dan Farmakologi*, Special Issue, 37-41



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- Sukardi., Hendrix, Y. S., Maimunah, H. P., & Ita, T. A. (2022). Ekstraksi Minyak Atsiri Rimpang Lengkuas Merah *Aplinia purpurata* K.Schum) Metode Destikasi Uap Air. *Teknologi Pangan: Media Informasi dan Komunikasi Teknologi Pertanian*, 13 (1): 19-28.
- Suwarni, Ariani, H.W., & Siti, M. (2022). Pemanfaatan Minyak Sereh Menjadi Berbagai Macam Produk. *Media Farmasi Indonesia*, 12 (1), 1137-1143.
- Widiani, N. P. & Karini. (2012). Formulasi dan Uji Aktivitas Minyak Legundi (*Vitex trifolia* L.) Sebagai Sediaan Antinyamuk. *Prosiding, Seminar Nasional Competitive Advantage*. Jombang.