

## Formulation and Effectiveness Testing of Mosquito Repellent Spray Combination of Citrus Oil (*Cymbopogon nardus*) and Patchouli Oil (*Pogostemon cablin*)

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### Abstract

Dengue fever is a health problem caused by the dengue virus whose problem has not been resolved. Various attempts have been made to prevent dengue fever, one of which is chemical-based insecticides, but the use of chemicals can cause side effects ranging from mild to severe. The purpose of this study was to increase the use of natural ingredients as an alternative to mosquito repellents to minimize side effects and determine the effectiveness of the spray repellency against *Aedes aegypti* mosquitoes. This research method used an experimental approach using 20 mosquitoes, which were divided into five groups, namely formulation I (10% lemongrass oil and 2% patchouli oil), formulation II (10% lemongrass oil and 4% patchouli oil), formulation III (10% lemongrass oil and 6% patchouli oil), control (-) (propylene glycol and ethanol 96%) and control (+) (soffel spray) were each given the same treatment. The mist was sprayed on the arm, put in the test cage, and counted the number of mosquitoes perched on the arm for 5 minutes. The percentage of mosquito repellent power in fomulation I am 69%, formulation II is 76%, formulation III is 92%. The data were analyzed by using one-way ANOVA using the LSD (least significant difference) test; there were substantial differences between the treatment group and the level of effectiveness of the repulsion againts the *Aedes aegypti* mosquito.

**Keywords:** Lemongrass oil, patchouli oil, *Aedes aegypti* and mosquito repellent

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### Abstrak

Demam berdarah adalah salah satu masalah kesehatan disebabkan oleh virus dengue yang permasalahannya belum terpecahkan. Berbagai upaya dilakukan untuk mencegah demam berdarah salah satunya dengan penggunaan insektisida berbahan kimiawi, namun penggunaan bahan kimia dapat menimbulkan efek samping mulai dari efek ringan sampai paling berat. Tujuan dari penelitian ini adalah untuk meningkatkan penggunaan bahan alami sebagai alternatif untuk penolak nyamuk agar meminimalkan efek samping dan mengetahui tingkat efektivitas daya tolak spray terhadap nyamuk *Aedes aegypti*. Metode penelitian ini menggunakan metode eksperimental dengan menggunakan nyamuk 20 ekor yang dibagi menjadi 5 kelompok yaitu Formula I (Minyak sereh 10% dan Minyak nilam 2%), Formula II (Minyak sereh 10% dan Minyak nilam 4%), Formula III (Minyak sereh 10% dan Minyak nilam 6%), Kontrol (-) (propilen glikol dan etanol 96%) dan Kontrol (+) (soffel spray) masing-masing diberi perlakuan yang sama. Spray disemprotkan pada lengan kemudian dimasukkan dalam kandang uji dihitung jumlah nyamuk yang hinggap pada lengan selama 5 menit. Dari hasil perhitungan persentase daya tolak nyamuk pada formula I yaitu 69%, formula II yaitu 76% dan formula III yaitu 92%. Daya tolak nyamuk tertinggi pada formula III yaitu 92%. Data yang didapatkan di analisis menggunakan One way anova dengan menggunakan uji LSD (least significant difference), terdapat perbedaan yang signifikan terhadap kelompok perlakuan dengan tingkat efektivitas daya tolak terhadap nyamuk *Aedes aegypti*.

**Kata kunci:** Minyak sereh, minyak nilam, *Aedes aegypti* dan daya tolak nyamuk.

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## INTRODUCTION

In Indonesia, dengue hemorrhagic fever (DHF) is a public health problem because the number of

sufferers is increasing every year and the spread is fast. In South Sulawesi, the incidence increases in January, April, June, October and December when the rainy season begins. The

World Health Organization (WHO) estimates that 50 million dengue infections occur each year and around 2.5 billion people live in dengue endemic countries<sup>1</sup>.

Several attempts are usually made to tackle the vector of the spread of DHF, namely by preventing mosquito bites through fogging (fumigation) and the use of synthetic mosquito coils. circulating in the market contain dangerous ingredients, one of which is DEET (Diethyltoluamide). DEET is very corrosive, so it can cause skin irritation. In the long term, the continuous use of synthetic insect repellent products every day can cause lung cancer and skin cancer within 5-10 years<sup>2</sup>.

In Indonesia there are several types of plants that can be used as natural insecticides. Some natural plants that can be used as substitutes for synthetic mosquito repellents, for example, citronella plants (*Cymbopogon nardus*) and patchouli plants (*Pogostemon cablin*). Lemongrass contains essential oils, namely citronellal and geraniol, both of which can be used as natural antirepellant. Based on research conducted by Bachri, Nursalama, and Nora (2015) states that at a concentration of 10% citronella oil already has the ability as a repellent<sup>2</sup>.

Based on the description above, the authors are interested in conducting research on the use of natural ingredients from citronella oil

and patchouli oil<sup>7</sup> to be used as natural anti-repellant sprays and can be used as a substitute for synthetic-based anti-repellant.

## METHODOLOGY

### *Characterization of Essential Oils*

#### a. Color determination

Pipette 10 ml of essential oil samples and then put them into a test tube propped up on white paper and observe the color visually<sup>3</sup>.

#### b. Determination of specific gravity

Clean the pycnometer by washing it with ethanol and diethyl ether, dry the inside of the pycnometer and then weigh the empty pycnometer (m). The pycnometer is then filled with distilled water and then weighed (m1). The pycnometer is emptied then washed with ethanol and diethyl ether then dried, the pycnometer is then filled with essential oil samples and then weighed (m2). Presentation of test results by using the formula<sup>3</sup>:

Specific Weight:

$$(m1-m)/(m2-m)$$

Remarks:

m: the mass of the empty pycnometer (g)

m1: mass, pycnometer filled with water) (g)

m2: the mass, the pycnometer contains the sample (g)

#### c. Solubility test in ethanol

As much as 1 ml of essential oil sample, put it in a measuring cup, add ethanol drop by drop after each addition, after homogenizing until a clear solution is obtained<sup>3</sup>.

## Formula Spray Design

Mosquito repellent sprays were made with several concentrations using propylene glycol as a cosolvent and 96% ethanol as a carrier<sup>4</sup>.

**Table 1.** Spray formulation design

<i>Ingredient</i>	<i>Function</i>	<i>Formula 1</i>	<i>Formula 2</i>	<i>Formula 3</i>	<i>Formula 4</i>
Lemongrass oil	Active substance	-	10%	10%	10%
Patchouli oil	Active substance	-	2%	4%	6%
Propilenglicol	Consolvent	15%	15%	15%	15%
Ethanol 96%	solvent	ad 100 ml	ad 100 ml	ad 100 ml	ad 100 ml

### *Spray Stability Test*

- Organoleptic Test

The organoleptic test was carried out by direct visual observation which included examining the shape, smell and color of each formula and then recording the results<sup>6</sup>.

- Homogeneity test

The homogeneity test is carried out by direct visual observation of the preparation whether it produces a homogeneous or inhomogeneous preparation which is indicated by the presence or absence of particles in the preparation and then the results are recorded<sup>8</sup>.

- Clarity test

The clarity test was carried out by direct visual observation by observing that the resulting preparation was clear or cloudy as seen from the color of the preparation, then the results were recorded<sup>8</sup>.

- pH test

The pH measurement was carried out using a universal pH which was dipped into the preparation for 3 seconds, after which the pH indicator was matched based on the color change listed on the packaging and then the pH measurement results were recorded for each formula<sup>8</sup>.

### *Test the Effectiveness of Anti-mosquito Spray Preparations*

The spray preparations that have been made were tested for the effectiveness of the anti-mosquito spray for each spray formulation on probandus. But previously prepared as many as 5 test cages, make sure they are clean and free of insecticides. As many as 20 mosquitoes were put into each test cage. Then the spray was sprayed evenly on the back of the probandus' hand, then the proband's arm was put in the test cage for 5 minutes. The number of mosquitoes that landed

were counted and recorded. After 5 minutes, the arm was shaken so that the mosquitoes flew and did not suck blood. After each test, the test cages were evaluated to see whether or not mosquitoes were full of blood. Mosquitoes that were full of blood were replaced with new mosquitoes. Tests were carried out on each formulation and then replicated 3 times to test the effectiveness of each formula<sup>10</sup>.

The percentage of mosquito repellent power is calculated using the following formula<sup>2</sup>:

%Repelling Power of Mosquitoes :

$$(K-P)/K \times 100\%$$

Information:

K: The number of mosquitoes that landed on the control arm (-)

P: The number of mosquitoes that landed on the treatment arm.

### *Data analysis*

The data obtained from the mosquito repellent test were then analyzed using statistical methods with the One Way Anova test to find out whether or not there was a significant difference between the control group and the level of effectiveness of mosquito repellent.

## **RESULT AND DISCUSSION**

The results of testing the activity of the spray preparation on the repulsion of mosquitoes in diagram 1. Shows that in the negative control the number of mosquitoes that land is still

in large numbers compared to the number of mosquitoes that land on Formulas I, II, III and positive control. Based on the calculation of the percentage of repulsion Mosquitoes in Formula I had 69% protection, Formula II had 76% protection, Formula III had 92% protection and positive control (soffel spray) had 100% protection<sup>9</sup>. The working mechanism of the spray preparation is that the sprayed preparation will stick to the surface of the skin, then evaporate into the air, the aroma will be detected by the smell (olfactory receptor) then the receptors will convert it into impulses which will be forwarded by the central nervous system (brain) so that mosquitoes will express to avoid the smell<sup>5</sup>.

Insectide test results are considered to have good effectiveness if the protective power value is between 98-100%, less than this value is considered less effective (Sometimes, 2009). From the test results it can be seen that the positive control is still more effective than preparations made either from Formula I, II, and III. In the positive control, the active ingredient DEET (diethyltoluamide) works by manipulating the smell and taste that comes from the skin by blocking receptors on the mosquito antenna to prevent mosquitoes from detecting the skin<sup>4</sup>.

## **CONCLUSION**

Citronella oil (*Cymbopogon nardus*) and patchouli oil (*Pogostemon*

*cablin*) can be formulated as sprays and are effective against mosquitoes with LSD analysis showed that the concentration had a good level of effectiveness against mosquito repellent, namely formula III with a concentration of citronella oil (*Cymbopogon nardus*) 10% and patchouli oil (*Pogostemon cablin*) 6%.

## REFERENCES

1. Nirwana, Wa Ode Cakra, Chandrawati Cahyani, dan Vivi Nurhadianty. 2016. Kajian Daya Proteksi Produk Repelan Nyamuk Demam Berdarah Dengue Dalam Bentuk Lotion Berbasis Minyak Atsiri Lokal (Minyak Sereh Wangi Dan Minyak Nilam). *Jurnal Teknik Kimia* 11 (1): 1–6.
2. Riris, Magdalena., Miranti U., & Junjun, F. (2019). Uji Efektivitas Repellent Minyak Atsiri Daun Serei Wangi *Cymbopogon nardus*(L)Randle Yang Dikombinasi Dengan Minyak Atsiri Daun Kayu Putih (*Melaleuca leucadendron* Linn.). Dan VCO (Virgin Coconut Oil) Terhadap Nyamuk *Aedes aegypti*. *Jurnal Ilmiah Kedokteran. Universitas Tadulako*.
3. Susetyo, R, dan Reny, H. 2004. Kiat Menghasilkan Minyak Sereh Wangi. Jakarta. Penebar Swadaya
4. Aritonang, Berliana, N, R, S., Kenny, C. (2017). Uji Efektivitas Infusa Kulit Buah Jeruk Nipis (*Citrus aurantifolia*) Dengan Perbandingan Spray Anti Nyamuk Bermerek Terhadap Nyamuk *Aedes aegypti*. *Jurnal Sains Dan Teknologi Laboratorium Medik. Pekanbaru*.
5. Muhamat, dkk.(2016). Daya Proteksi Minyak Atsiri Zodia (*Euvodia suaveolens*) Dalam Bentuk Spray Terhadap Tempat Hinggap Nyamuk *Aedes aegypti* L. Dan *Culex quinquefasciatus*. Universitas Lambung Mangkurat. Kalimantan Selatan.
6. Bachri, Nurjannah, Nursalma, dan Natalia Nora. 2015. Pembuatan Ekstrak Sereh (*Cymbopogon nardus* L.) Dalam Sediaan Lotio. *As-Syifaa* 07 (02): 190–96. <https://doi.org/10.1017/Cbo9781107415324.004>.
7. Afdhallyah, Nur. 2015. Uji Aktivitas Minyak Daun Nilam (*Pogostemon cablin* benth) Terhadap Penyembuhan Luka Sayat Pada Mencit Jantan (*Mus musculus*).
8. Kadang, Yuniharce., Muh, F.H., & Rezza Y. 2019. Formulasi Dan Uji Mutu Fisik Lotion Antinyamuk Minyak Sereh Wangi (*Cymbopogon nardus* L Rendle) dengan Kombinasi Minyak Nilam (*Pogostemon cablin* Benth). *Akademi Farmasi Sandi Karsa Makassar*.
9. Rusli, Nirwati, dan Yolanda Wirayani Rante Rerung. 2018. Formulasi Sediaan Lilin Aromaterapi Sebagai Anti Nyamuk Dari Minyak Atsiri Daun Nilam (*Pogostemon cablin* benth) Kombinasi Minyak Atsiri Buah Jeruk Nipis (*Citrus aurantifolia* swingle). *Jurnal Mandala Pharmacon Indonesia* 4 (1): 68–73. <https://doi.org/10.35311/Impi.Vo1.26>.
10. Zen, Suharno, dan Rasuane Noor. 2016. Inventarisasi Tanaman Yang Berpotensi Sebagai Bioinsektisida Nyamuk *Aedes aegyptii* Di Kota Metro Provinsi Lampung. *BIOEDUKASI (Jurnal Pendidikan Biologi)* 7 (2): 139–43. <https://doi.org/10.24127/bioedukasi.v7i2.616>.