INTERNASIONAL CONFERENCE ON
MULTIDISCIPLINARY APPROACHES IN HEALTH SCIENCE
VOLUME 3, No 1. Tahun 2025 , ISSN 3032-4408 (Online)
https://ejournal.poltekkes-denpasar.ac.id/index.php/icmahs

Effectiveness Of Aromatherapy Candle With Citronella Essential Oil Extract As Mosquito Repellent

I Wayan Sali, S.KM., M.Si [1*], Ida Ayu Putri Genta Widyasari[2*]

[1] Environtmental Health Departement, Polytechnic of Health Denpasar, Bali
[2] Center of Excellence for Science and Technology Health Polytechnic Ministry of Health for Health Tourism and Cancer

Article history
Posted : 2025-09-20
Reviewed : 2025-12-05
Received : 2025-12-13

ABSCTRACT

Mosquitoes act as vectors of disease. Efforts that can be made and are environmentally friendly are by making aromatherapy candles with plants that have mosquito repellent power such as citronella plants (Cymbopogon nardus) which contain essential oils. So far, many people have relied on synthetic insecticides in the form of mosquito coils, sprays, and electricity. Exposure to synthetic insecticides has a serious impact on health, ranging from mild irritation, nervous disorders, endocrine system, to an increased risk of cancer. The mechanisms of pesticide carcinogenicity include DNA damage, increased oxidative stress, and changes in cell cycle regulation, which can trigger lung, liver, stomach, intestinal cancer, leukemia, non-Hodgkin's lymphoma, brain cancer, and thyroid cancer. The high use of pesticides in Indonesia, both in the agricultural and household sectors, increases the risk of public health because the accumulation of exposure occurs every day The type of study was Post Test Only Control Group Design. The study involved one group of control group and experimental treatment group with the addition of citronella essential oil in candles with a concentration of 5%, 15%, and 25%. The percentage of death of the control group was 6%, 5% concentration was 17%, 15% concentration was 28%, and 25% concentration was 48%. The calculation of the percentage of effectiveness of aromatherapy candles with citronella essential oil (Cymbopogon nardus) is the highest reaching 44% at a concentration of 25% essential oil. The number of mosquitoes that died in the control group was 6, 5% was 17, 15% was 28, and 25% was 48 in all replications. And can develop variations in the type of active ingredients and concentrations used as natural insecticides, and can test their effectiveness on different types of mosquitoes.

Keywords: mosquito, aromatherapy candle, cancer, concentration, citronella

Corresponding author: putrigentaidaayu@gmail.com

INTERNASIONAL CONFERENCE ON
MULTIDISCIPLINARY APPROACHES IN HEALTH SCIENCE
VOLUME 3, No 1. Tahun 2025 , ISSN 3032-4408 (Online)
https://ejournal.poltekkes-denpasar.ac.id/index.php/icmahs

INTRODUCTION

Indonesia is a country that has geographical conditions with high rainfall and is suitable for the life of various kinds of mosquitoes that act as vectors of disease. High rainfall can cause stagnant water everywhere and has the potential to become a breeding ground for mosquitoes. Mosquitoes can reproduce quickly, starting from mosquitoes laying eggs to becoming adult mosquitoes only takes 12 days and then after becoming adult mosquitoes, mosquitoes will mate .

Mosquitoes act as disease vectors, where mosquitoes will transmit diseases when biting and sucking blood. Mosquitoes have different biting times, namely the diurnal group where mosquitoes are more active biting in the morning to evening, the nocturnal group where mosquitoes are more active biting at night, while the crepuscular group is a mosquito that is active throughout the day (Sabir et al., 2017) . Mosquitoes as disease vectors, such as Aedes aegypti, transmit dengue fever caused by the dengue virus.

Long-term exposure to insecticides, influenced by their formula content, can cause chronic toxicity and harm health. This type of toxicity is often associated with the appearance of cancer due to the continuous use of insecticides, especially in enclosed areas with a long duration of use (Raini, 2019) . In addition, several types of pesticides have been associated with an increased risk of blood cancer (leukemia), non-Hodgkins lymphoma, brain cancer, liver cancer, and thyroid cancer (Kumar, 2008; Suhartono, 2014) at (Pamungkas, 2016) . This happens because pesticides can be mutagenic, damage DNA, and disrupt normal cell regulation. Thus, the use of chemical insecticides is not only harmful to the environment, but also contributes to the increased incidence of cancer in humans. As an alternative, natural insecticides such as plant-based repellents are safer and more environmentally friendly. Repellents are materials that repel insects, including flies, by disrupting their senses, making them a safer and environmentally friendly alternative. This is because natural insecticides are more easily degraded by environmental factors, so that the results of their decomposition will return to nature in the form of non-toxic compounds (Zega et al., 2021) .

Corresponding author: putrigentaidaayu@gmail.com

The toxic content in natural pesticides is generally specific only to the target organism, so it is relatively safe for humans and the environment.

Efforts that can be made and are more environmentally friendly are by making aromatherapy candles using environmentally friendly materials that have minimal side effects. One of the processed household materials such as lemongrass that can be made is candles. Generally, people only utilize candles as a source of lighting that is used when the electricity source is not active (extinguished). Seeing the dangers of synthetic insecticides, innovations that are environmentally friendly and safe for health are needed. One alternative that is starting to be developed is aromatherapy candles based on plant essential oils. Citronellal, citronellol and geraniol compounds in lemongrass can function as anti-mosquito or repellent. (Halim & Fitri, 2020)

Compared to conventional insect repellents, citronella aromatherapy candles have significant advantages. First, the use of natural ingredients reduces the risk of exposure to harmful synthetic chemical compounds. Secondly, when using eco-friendly wax bases such as soy wax, far fewer pollutants are produced than paraffin wax (Oktarina et al., 2021) . Third, this product is energy efficient because it does not require electricity. Fourth, aromatherapy candles have added value as a natural room fragrance product, so they can provide comfort as well as protection from mosquitoes.

The use of aromatherapy candles made from soy wax combined with citronella essential oil (Cymbopogon nardus) comes as a much safer solution. Citronella essential oil contains bioactive compounds such as citronellal, citronellol, and geraniol which are proven to be repellent against mosquitoes. These compounds work naturally to repel mosquitoes without exposing the human body to toxic synthetic chemicals. Thus, citronella aromatherapy candles are not only effective in controlling vectors of infectious diseases such as dengue fever, but also contribute to cancer prevention efforts indirectly by reducing public exposure to carcinogenic substances from conventional insecticides.

Corresponding author: putrigentaidaayu@gmail.com

VOLUME 3, No 1. Tahun 2025 , ISSN 3032-4408 (Online)
https://ejournal.poltekkes-denpasar.ac.id/index.php/icmahs

RESULTS

This research was conducted in the physics laboratory of the Environmental Health Department of the Ministry of Health of Denpasar with the results of temperature and humidity measurements obtained during the research, the room temperature with a value of 27.4℃ , and 27.3℃ while the humidity obtained a value of 62.0 %RH.

Table 1. Mosquito Mortality Rate in All Replications in Each Treatment

Treatment	Number of Dead Mosquitoes Replication						Amount	Average
	1	2	3	4	5	6		
Kontrol	1	1	2	2	0	0	6	1,00
5%	2	2	3	3	3	4	17	2,83
15%	4	4	4	5	5	6	28	4,67
25%	7	7	8	8	9	9	48	8,00

This average calculation was obtained by dividing the total number of dead mosquitoes in each group by the number of replications performed, which was six times. The control group showed an average mosquito mortality of 1.00 per replication. In the group treated with a concentration of 5%, the average mosquito mortality was recorded at 2.83 mosquitoes. The group with a concentration of 15% showed an average mosquito mortality of 4.67 mosquitoes, while the group with a concentration of 25% produced the highest average mosquito mortality, which was 8.00 mosquitoes per replication.

The normality test was carried out using the Shapiro - Wilk method to get a significant value (sig.) > 0.05 which means the data is normally distributed. While the homogeneity test (Levene's Test) variance shows the number> 0.05 which means the data has hompgen. The results of the One Way ANOVA test can be 0.000 <0.05, which means that there are significant differences in each treatment.

Corresponding author: putrigentaidaayu@gmail.com

To see the effectiveness of using aromatherapy candles with citronella essential oil extract (Cymbopogon nardus) (Cymbopogon nardus) is calculated using the Schneider-Orelli formula proposed by Punter (1981) in (Inayah and Sukendra, 2019).

Table 2. Test Results of Effectiveness of Aromatherapy Candles with Citronella Essential Oil Extracts (Cymbopogon nardus)

Treatment	Number of Dead Mosquitoes						Effectiveness Percentage (%)
Kontrol	1	1	2	2	0	0	0%
5%	2	2	3	3	3	4	11%
15%	4	4	4	5	5	6	23%
25%	7	7	8	8	9	9	44%

Judging from the calculation of the percentage of effectiveness of aromatherapy candles with citronella essential oil (Cymbopogon nardus), the highest only reached 44% at 25% essential oil concentration, and the lowest in the control group, namely without the addition of essential oil extract.

DISCUSSION

The higher the concentration of citronella essential oil (Cymbopogon nardus) used in aromatherapy candles, the higher the effectiveness in causing mosquito mortality. This significant difference supports the hypothesis that citronella essential oil extract (Cymbopogon nardus) is effective as an active ingredient in mosquito control.

The results showed that soywax-based aromatherapy candles with the addition of citronella essential oil extract (Cymbopogon nardus) were able to cause mosquito death with different effectiveness at each concentration. The average mosquito mortality in the control group was only 1.00 head per replicate, while in the 5% treatment it increased to 2.83 heads, at 15% to 4.67 heads,

Corresponding author: putrigentaidaayu@gmail.com

and at 25% it reached the highest average of 8.00 heads per replicate. The results of ANOVA and Post Hoc tests showed significant differences between treatment groups ($p < 0.05$), which confirmed that the higher the concentration of citronella essential oil in aromatherapy candles, the higher the mosquito mortality rate obtained. This fact supports the research hypothesis that citronella is effectively used as an active ingredient for mosquito repellents in the form of aromatherapy candles.

Previous studies also support this finding. Hilmarni et al. (2021) proved that citronella, clove, and kecombrang are effective as active ingredients in aromatherapy candles in repelling mosquitoes, although their effectiveness is not as high as chemical insecticides. Halim & Fitri (2020) explained that citronellal, citronellol, and geraniol in citronella have natural repellent and insecticidal activities, but the stability of the aroma needs to be improved with fixative substances so that the repellency lasts longer. The findings of this study are in line with the literature, that citronella does have potential as an environmentally friendly alternative, although its effectiveness still needs to be improved.

In the context of public health, the use of citronella aromatherapy candles has important preventive value. WHO notes that the use of synthetic pesticides and household insecticides has contributed to the increased risk of cancer through the mechanisms of DNA damage, hormone disruption, and oxidative stress. Therefore, innovations based on natural materials such as soywax aromatherapy candles with citronella can be part of an environmentally friendly vector control strategy. In addition to reducing the risk of exposure to carcinogenic substances, this innovation is also in line with the principles of environmental health, namely preventing disease by suppressing risk factors originating from the environment.

CONCLUSIONS

This study proves that soywax-based aromatherapy candles with the addition of citronella essential oil extract (Cymbopogon nardus) have different effectiveness in causing mosquito death at each concentration. The results showed that the higher the concentration of citronella essential

Corresponding author: putrigentaidaayu@gmail.com

oil used, the higher the effectiveness of aromatherapy candles in killing mosquitoes. The average mosquito mortality in the control group was only 1.00 mosquitoes per replicate, increasing to 2.83 mosquitoes at 5% concentration, 4.67 mosquitoes at 15% concentration, and the highest was 8.00 mosquitoes at 25% concentration. Statistical tests showed significant differences between treatment groups ($p < 0.05$), which confirmed that the variation in concentration had a significant effect on the effectiveness of citronella aromatherapy candles.

Based on the findings, higher concentrations of citronella essential oil particularly 25% are recommended for formulation to maximize the effectiveness of soywax-based aromatherapy candles in mosquito control. Further studies should evaluate product performance under varying environmental conditions and assess burning duration as well as the dispersion characteristics of active compounds. Future research is also advised to include safety assessments, including potential toxicity or irritation, to ensure safe use in indoor settings. Development of eco-friendly commercial products utilizing soywax and citronella essential oil is encouraged as a sustainable alternative for mosquito repellenc

CONFLICT OF INTEREST

The author(s) declare that they have no conflict of interest.

ACKNOWLEDGMENT

The authors would like to thank the Department of Environmental Health and the laboratory staff for their support and facilities provided during this research. Appreciation is also extended to the supervisors for their valuable guidance, as well as to colleagues and family for their continuous encouragement.

Corresponding author: putrigentaidaayu@gmail.com

REFERENCES

Halim, R., & Fitri, A. (2020). Aktivitas Minyak Sereh Wangi Sebagai Anti Nyamuk. *Jurnal Kesmas Jambi*, *4*(1), 28–34. https://doi.org/10.22437/jkmj.v4i1.8940

Oktarina, T. F., Prabowo, W. C., & Narsa, A. C. (2021). Penggunaan Soy wax dan Beeswax sebagai Basis Lilin Aromaterapi. *Proceeding of Mulawarman Pharmaceuticals Conferences*, *14*, 307–311. https://doi.org/10.25026/mpc.v14i1.589

Pamungkas, O. S. (2016). Bahaya Paparan Pestisida terhadap Kesehatan Manusia. *Bioedukasi*, *14*(1), 27–31.

Raini, M. (2019). angga dan Pencegahan Keracunan. In *Media Penelitian dan Pengembangan Kesehatan* (Vol. 19, pp. 527–531).

Sabir, M., Annawaty, A., & Fahri, F. (2017). nventarisasi Jenis-Jenis Nyamuk Di Desa Alindau, Donggala, Sulawesi Tengah. *Natural Science: Journal of Science and Technology*, *6*(3), 263–269. https://doi.org/10.22487/25411969.2017.v6.i3.9200

Zega, U., Fau, A., & Sirsak, D. (2021). *Sebagai Insektisida Alami Dalam Membasmi Lalat Rumah (Musca Domestica)*. *9*(2), 616–620.

Corresponding author: putrigentaidaayu@gmail.com