International Journal of Integrative Sciences (IJIS)
Vol. 3, No.1, 2024: 59-68

Utilization of Citrus Peel Waste Into Anti-Mosquito Spray Preparations as An Alternative to Malaria Prevention

Firdaus Adwi Pangga[1], Hajar Hikmah Fahbulan[2], Indah Sayekthi Dwi Wardani[3], Rosita I. Dehi[4*], Fitriah A. Iriani[5]
Department of Pharmacy, Health Polytechnic, Ministry of Health, Jayapura
Corresponding Author: Rosita I. Dehi Rositadehi97@gmail.com

A R D C C L L I N F O

Keywords: Citrus Sinensis L, Spray, Repellent

Received : 4 November
Revised : 2 December
Accepted: 10 January

A B S T R A C T

Malaria is one of the infectious diseases that is still a health problem for the community. *Anopheles* sp mosquitoes are vectors for spreading malaria caused by *plasmodium sp*. parasites. The content of citric acid in oranges, makes this fruit has a sour taste that gives a fresh aroma. Essential oils found in orange peels can generally be used as anti-mosquito spray deodorizers. Orange peels can repel mosquitoes because mosquitoes do not like the smell of fragrances. Essential oils contain gologan organic compounds terpenes and terpenoids that are oil-soluble (lipophilic). This study aims to determine the use of citrus peel waste into mosquito repellent spray preparations as an alternative to malaria prevention with variations of active substances infusion of orange peel F1 (20%), F2 (40%). The sample used in this study was an infusion of citrus fruit peel (*Citrus Sinensis* L). The results of organoleptis test research have a distinctive aroma of sweet orange fruit peel, yellow color and liquid form. While the average pH for all is to have a pH of 5, and for homogeneity tests all three homogeneous formulas are seen in macroscopic and microscopic ways. Test mosquito protection power, in this study the average results obtained for F1 is 43%, and F2 63% for mosquito protection standards is 90%

DOI: https://doi.org/10.55927/ijis.v3i1.7492
ISSN-E: 2985-905
https://journal.formosapublisher.org/index.php/ijis

INTRODUCTION

Mosquito *Anopheles sp* is a vector for spreading malaria caused by parasites *plasmodium sp*. Malaria can be transmitted through female mosquitoes that suck the blood of malaria-positive people (Arifianto, 2018). In the human body, parasites develop into a form that is ready to be sucked by mosquitoes. This form will be transmitted to other humans through mosquito intermediaries. In the mosquito's body, the parasite develops until it becomes a parasitic form that is ready to be transmitted to the human body. The spread of malaria can also be through blood transfer.

The diversity of Indonesia's abundant natural resources with a variety of plants that live in Indonesia's tropical forests is seen as a source of natural materials that can be used as mosquito repellent. The use of sweet orange plants is expected to reduce malaria transmission rates through steps to prevent malaria vector bites. Sweet orange (*Citrus sinensis (L.) Osbeck*) is a fruit grown in tropical or subtropical climates and is an important fruit commodity in the market both domestically and globally.

Repellent is a material that has the ability to keep insects away from humans so as to avoid insect bites or interference by insects to humans.(Dwina *et.al*., 2015)

Spray preparations are solution preparations that are inserted in a sprayer device so that their use is sprayed. A solution is a homogeneous mixture of two or more kinds of substances consisting of solute and solvent (Marzuki et al., 2010).

This study aims to determine the use of citrus peel waste into mosquito repellent spray preparations as an alternative to malaria prevention, including, testing the optimum formula on sweet orange peel mosquito repellent spray preparations (Citrus Sinensis (L.) Osbeck*) and knowing the quality of physical tests of sweet orange peel mosquito repellent spray preparations* (Citrus Sinensis *(L.)* Osbeck). such as organoleptis test, homogeneity test, pH test, transferred volume test and effectiveness test of mosquito repellent sprey preparation of sweet orange fruit peel *(Citrus Sinensis* (L.) *Osbeck*)

LITERATURE REVIEW

Formulation Based on that essential oil Sweet orange peel functions as a mosquito repellent, by adding propilenglikol which serves to increase the solubility of essential oils then adding 96% ethanol which serves as a carrier agent, and aquadest . The process of making this citrus peel essential oil spray preparation follows the reference that has been done by Iin Indawati, et al (2022) How to use and make lime peel infusion spray as an anti-mosquito (*Repellant*). Socialization activities for prevention and use of Lime Peel Infusion Spray. With the results of the hedonic test of the preparation that got an average score of 3, it means that respondents like the preparation of *Lime* Peel Infusion Spray.

According to research by Agnes Monica Silalahi (2018) Test of Anti-Mosquito Effect of Sweet Orange Skin Essential Oil (Citrus sinensis L.) There is an effectiveness of losio mosquito repellent of various concentrations of sweet orange peel essential oil with concentrations of 9% and 11%

H1 : Spray preparations Orange fruit peel infusion is a basic mixture of spray and orange fruit peel extract obtained by using the infusion method

H2: Sweet orange peel contains citronella, flavonids, tannins and lemonin which can act as larvicides.

H3: Sweet orange peel functions as a mosquito repellent *which is* a material that has the ability to keep insects away from humans so as to avoid insect bites or interference by insects to humans

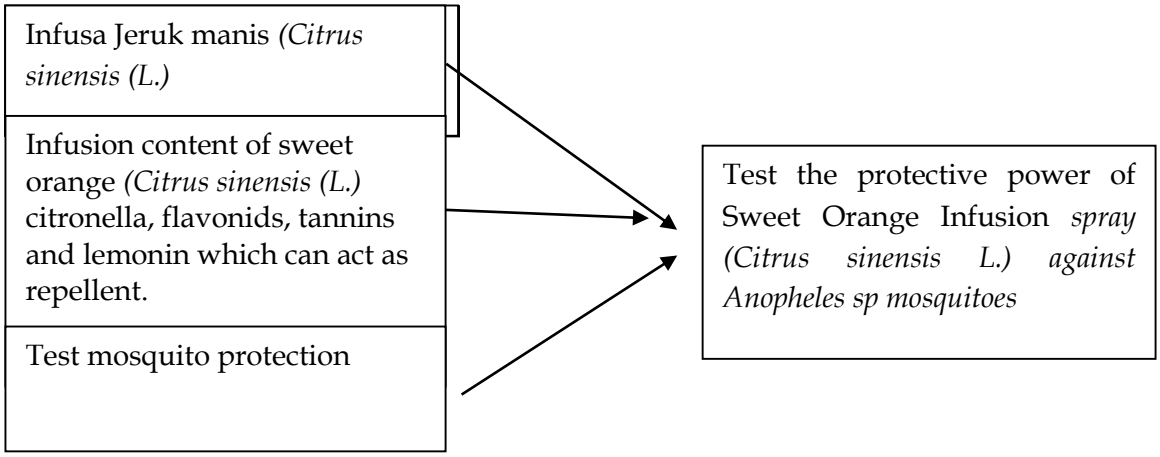

Figure 1. Conceptual Framework Test the protective power of Sweet Orange Infusion *spray (Citrus sinensis L.) against Anopheles sp mosquitoes*

METHODOLOGY

This research is an experimental laboratory research. The study was conducted to make and determine the *repellent* activity of sweet orange peel spray solution (Citrus Sinensis *(L.)* Osbeck) against *female Anopheles sp* mosquitoes with variations in concentration of 20%, 40%, positive control, and negative control

The data collection technique carried out in this study is observation. Observation is a data collection technique by observing the ongoing process. Observation is carried out by testing and recording results that have been observed from physical quality including pH tests, homogeneity tests, and mosquito protection power.

Research Instruments

1. Tools
   The tools used in this research were aluminum foil, stirring rod, porcelain cup, 50 mL beaker, 5 mL, 10 mL, 25 mL, 100 mL and 250 mL measuring cup, hot plate, micro pipette, glass plate, pH paper, microscope, mortar, horn spoon, centrifuge, stamper, stirrer, analytical balance and preparation container.
2. Material
   The materials used in this research were propylene glycol, ethanol, distilled water, and sweet orange peel.

a) Making Spray Preparation Formulations

a. Master Formula

The master formula by (Akobar et.al., 2021) with the research title "Formulation And Evaluation Of Polyherb Mosquito Repellent Emugel" uses ingredients as in the table.

Table 1. Master Formula

Bahan	Konsentrasi (v/v%)			
	0%	5%	10%	15%
Propilenglikol	5 ml	5 ml	5 ml	5 ml
Ethanol	25 ml	25 ml	25 ml	25 ml
Minyak Atsiri	-	2,5 ml	5 ml	7,5 ml
Aqua Destillata	50 ml	50 ml	50 ml	50 ml

Table 2. Formula (With Modification)

Material	**Concentration**	
	20%	**40%**
Orange Peel Infusion	10 ml	20 ml
Propilen glikol	5 ml	5 ml
Etanol	25 ml	25 ml
Aquadestilata	50 ml	50 l

b. Spray Making

1. Process for Making Sweet Orange Peel Extract
   a) Prepare the tools and materials to be used.
   b) Wash orange peels using wet sorting with water
   c) Chop the washed orange peel
   d) Dry it using the oven
   e) Then smooth it using a blender
   f) After that, boil it and filter it using filter paper to produce sweet orange peel extract.
2. Process for Making Anti-Mosquito Spray Solution
   a) Prepare the tools and materials to be used.
   b) Perform calibration on a 50 ml container
   c) Put the propylene glycol into the beaker glass
   d) Add the sweet orange peel infusion into the beaker glass, stir until homogeneous
   e) Add ethanol little by little, mix until homogeneous
   f) Add the remaining distilled water until the calibration mark
   g) Put the preparation into a 50 ml container
   h) Do an evaluation

c. Evaluation

1. Organoleptic Test

   Organoleptic tests are carried out by observing the form, smell and color of the preparation being made (Anief, 1997).

2. Homogeneity Test
   The homogeneity test is carried out by spraying it on a dry and clean glass object and then covering it with a cover glass. The homogeneity test can be said to be good if the preparation does not contain coarse particles, has an even texture and does not clump (Ministry of Health, 2000).
3. Test pH
   The pH test is carried out using a pH meter. The measuring electrode is dipped so that the tip of the electrode is completely submerged, the pH obtained is recorded. The pH of the spray must match the skin's pH, namely 4.5-6.5 (Wasitaatmadja, 1997).
4. Displaced Volume Test
   The transferred volume test was carried out using 2 50 ml measuring cups when the preparation was transferred from measuring cup (1) to measuring cup (2).
5. Mosquito Protection Power Test
   a) Prepared Anopheles sp mosquitoes. Place 20 females in the test container.
   b) On the arm of proband 1, a solution prepared as a control test preparation was applied.
   c) On the arm of proband 2, a commercial preparation (soffel) was applied as a positive control
   d) Probandus 3's arm was sprayed with a solution base preparation as a negative control.
   e) After being sprayed, the arm is then put into the mosquito protection test container for (1st test, for 15 minutes, 2nd for 30 minutes, 3rd for 60 minutes..., 6th for 360 minutes) the test is carried out for 6 hours .
   f) Then observe the changes that occur and count the number of mosquitoes that land on the proband's arm.
   g) The condition for a mosquito to be said to land is when it touches the surface of the skin.

RESULTS

1. Organoleptic Test

Results of organoleptis testing preparation Spray infusion Sweet orange fruit peel **(***Citrus Sinensis* (L.) *Osbeck*)

Table 2. Test Results of organoleptis infusion of citrus fruit peel *(Citrus Sinensis* (L.) *Osbeck*) base Spray

Formula	**Organoleptic results**		
	Color	**Smell**	**Shape**
F1 20%	Yellow	The special aroma of the active substance of the sweet orange peel extract	Liquid

F2 40%	Conden sed Yellow	The special aroma of the active substance of the sweet orange peel extract	Liquid

Source: Data Primer, 2023

2. Homogeneity Test

The results of the homogeneity test of the preparation of Spray Infusion of sweet orange fruit peel *(Citrus Sinensis* (L.) *Osbeck*) spray base are as follows:

Table 3. Homogeneity Test Results Spray Infusion Sweet Orange Peel Base Spray

Formula	**Homogeneity Results**		
	Micro	**Macro**	**Information**
F1 20%	Homogeneous	Homogeneous	Qualify
F2 40%	Homogeneous	Homogeneous	Qualify

Source: Data Primer, 2023

3. pH test

The pH test results of the preparation of Infusion of sweet orange fruit peel *(Citrus Sinensis* (L.) *Osbeck*) base spray are as follows:

Table 4. pH Test Results Spray Preparation Infusion of sweet orange peel (*Citrus Sinensis* (L.) *Osbeck*) spray base

FORMULA	**Uji pH**	**INFORMATION**
F1 20%	5	Qualify
F2 40%	5	Qualify

Source: Data Primer, 2023

4. Protection Strength Test

The results of mosquito protection testing preparations of sweet orange peel infusion (*Citrus Sinensis* (L.) *Osbeck*) spray base are as follows:

Table 4. Formula Repeatability Average

Formula	15 minutes		30 minutes		60 minutes		120 minutes		240 minutes		360 minutes	
	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2
Active Substance 20%	0	0	3	3	5	4	7	5	9	9	9	10

Active Substance 40%	0	0	3	3	5	3	5	4	7	7	9	10
Control Positive	0	0	3	3	4	3	5	4	7	5	8	9
Control Negative	6		6		7		10		12		14	

Source: Data Primer, 2023

DISCUSSION

Sweet Orange Fruit *(Citrus sinensis (L.) Osbeck*) is a fruit grown in tropical or subtropical climates and is an important fruit commodity in the market both domestically and globally. Essential oils in sweet oranges found in orange peels can generally be used as a mosquito repellent spray deodorizer. Orange peels can repel mosquitoes because mosquitoes do not like the smell of fragrances. Essential oils contain gologan organic compounds terpenes and terpenoids that are oil soluble (lipophilic) The main components of essential oils are menthol, meton and limonene.

The ingredients used are sweet orange peel, 96% ethanol, propylenglycol, aquadest. 96% ethanol and alcohol are used as bases becausesome essential oils are easily soluble, such as orange oil which is very light and volatile. Propilenglikol which functions as a cosolvent. Propilenglikol has a low level of toxicity. In addition, propilenglikol also serves to help the spray stick longer to the skin so that the repellent effect also lasts longer (Utami Diyah Tuah et al, 2022).

After that, the physical quality test of the preparation is carried out, the results of organoleptic testing can be seen in the table that based on the organoleptic test for formula 1 with a concentration of 20% the color obtained from the preparation is yellow, the smell of the preparation is the smell of the aroma typical of extra active substances sweet orange fruit peel and the form is liquid. As for formula 2 with a concentration of 40%, the color obtained from the preparation is a solid yellow color, the smell of the preparation is the characteristic aroma of extra active substances, orange peel and liquid form. This is due to the influence of different concentrations used. The results of homogeneity testing can be seen in the table that based on the homogeneity test for formula 1 with a concentration of 20%, it is a homogeneous preparation and meets the requirements of homogeneity. Meanwhile, the homogeneity test for formula 2 with a concentration of 40% is a homogeneous preparation and meets the homogeneity requirements. The results of observations of the PH test of spray preparations from sweet orange peels showed that both formula 1 which concentrated 20% and formula 2 which concentrated 40% had an average PH of 5. PH test results data of extra spray preparations of sweet orange fruit peel meet the normal PH range of the skin which ranges from 4.5-6.5 (Sari et.al., 2015)

Furthermore, a test of the protective power of the preparation against female Anopheles sp mosquitoes was carried out where in this test used 2 formulas

consisting of a concentration of 20% and a concentration of 40% while the positive control used market spray preparations whose protective power reached 75% and from the results of the protection test against mosquitoes carried out 2 times replication, namely Replication 1 and replication 2 where the results obtained from the spray with a concentration of 20% Obtaining an average protection power of 43% and a concentration of 40% achieving an average protection power of 63%. This shows that the protection power does not meet the requirements, which is 75% so that the extra spray preparation of sweet orange peel is still not potential as a reppellent. This is due to the lack of concentration of preparations of extracts from peels for oranges so that concentrations of peel extracts for oranges must be added in order to produce protective power that can qualify as reppellent.

CONCLUSIONS AND RECOMMENDATIONS

In the Infusion test of sweet orange peel (*Citrus Sinensis* (L.) *Osbeck*) mosquito protection test, the results obtained in the positive control using market preparations whose mosquito protection strength is 75%. The results of spray preparations with a concentration of 20% get an average mosquito protection power of 43% and spray with a concentration of 40% get an average mosquito protection power of 63%.

FURTHER STUDY

Further research is needed to determine the size and amount of compounds contained in the peel of Sweet Orange (Citrus sinesis (L) Osbeck) so that it can be known which compound acts the most as a reppelent.

ACKNOWLEDGMENT

I thank the following individuals for their expertise and assistance throughout all aspects of our study and for their help in writing the manuscript.

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