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Formulation and Activity Test Of Oil Spray Deodorant Preparations In Black Cumin Seeds (Nigella Sativa L.) Against Staphylococcus Epidermidis Causes Of Body Odor

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ABSTRACT
Staphylococcus epidermidis bacteria are able to convert amino acids into isovaleric acid which causes unpleasant odors. This research aims to determine whether the essential oil of black cumin seeds (Nigella sativa L.) can be formulated into a deodorant spray physically stable and it has activity against Staphylococcus epidermidis which causes body odor. The research method was laboratory experimental using water distillation to extract essential oils and formulate deodorant spray preparations with concentrations of F1 (1%), F2 (3%), and F3 (5%). Evaluation of preparations includes organoleptic tests, homogeneity tests, pH tests, viscosity tests, spray pattern tests, dry time tests, emulsion type tests, irritation and hedonic tests, stability tests and antibacterial activity tests of preparations. The results of the research showed that the evaluation of the deodorant spray preparation of essential oil of black cumin seeds (Nigella sativa L.) had a P value of >0.05 so that this preparation was physically stable, while the statistical results of the antibacterial activity test obtained a P value of <0.05 indicating that there was a significant difference. This preparation has different activity diameters, including F1 (1%) in the medium category at 8.47 mm, F2 (3%) and F3 (5%) in the strong category with activity above 10-20 mm. It was concluded that the essential oil of black cumin seeds (Nigella sativa L.) can be formulated into a deodorant spray that is physically stable and has activity against Staphylococcus epidermidis which causes body odor.

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INTRODUCTION

Indonesia is a region in Southeast Asia that has a tropical climate. Exposure to hot sunlight in tropical climates causes most people to sweat excessively during the day. Excessive sweating can cause a person to lack self-confidence. It is feared that excessive sweating will be mixed with microorganisms which can cause problems such as unpleasant body odor (Masrijal et al., 2022).

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Bromhidrosis or body odor is something that really interferes with activities and is quite an important problem because it can cause feelings of lack of self-confidence. Body odor can be caused by a lack of maintaining body hygiene and due to bacterial activity. Bacteria that can cause body odor include the Corynebacterium group, Propionibacteria group, Staphylococcus epidermidis, Staphylococcus aureus, Pseudomonas aeruginosa, and Streptococcus pyogenes (Nurhaini et al., 2022). The bacteria chosen for research was Staphylococcus epidermidis which is capable of converting amino acids into isovaleric acid. Staphylococcus epidermidis bacteria are gram-positive bacteria with white or yellow colonies. Staphylococcus epidermidis bacteria are facultative anaerobes. This bacteria is often found on the skin and under certain circumstances can cause disease (Alyidrus dkk., 2022). Staphylococcus epidermidis bacteria is one of the bacteria that causes body odor (Nurhaini et al., 2022).

The presence of Staphylococcus epidermidis bacteria mixed with sweat means that using soap and water as a body wash when bathing is relatively ineffective in preventing body odor. Therefore, several other alternatives are used, such as using anti-body odor cosmetic preparations (Veranita et al., 2021). In the past, people used alum as a natural ingredient to eliminate body odor. Along with technological developments, some of them have used deodorants. Deodorant is a cosmetic product used to treat body odor caused by sweat mixed with bacteria. Deodorant in reducing body odor works by suppressing the growth of bacteria that cause body odor. There are many types of deodorant, including solid deodorant (stick), roll-on, spray and cream (Nurhaini et al., 2022). Deodorants in the form of powder, stick powder and cream lotion are also often found in the community (Ervianingsih & Razak, 2019).

Deodorant spray is a cosmetic preparation that is applied by spraying it on certain parts of the body (armpits). Deodorant spray can also help absorb sweat, cover or reduce body odor even though it is sprayed. The advantage of deodorant spray compared to other forms of deodorant is that the deodorant spray applicator does not come into direct contact with the user's skin in the application system, making it more hygienic (Masrijal et al., 2022). The deodorants that are widely distributed and used by the public are deodorants made from synthetic materials.

Continuous use of synthetic deodorant will be bad for the body. One of the active ingredients of synthetic deodorants is aluminum chlorohydrate. Where aluminum salts which are commonly used in deodorants can increase the risk of cancer if used continuously (Nurhaini et al., 2022). Using an inappropriate concentration of alcohol can also have bad effects on the body, such as irritating the skin. Therefore, it is necessary to pay attention to the alcohol concentration that is safe for use. The use of alcohol in topical preparations can irritate the skin if used in concentrations >50%(Ain Thomas & Sidangoli, 2021)60 – 90% if used as a solvent in topical preparations.

It is found that there is a risk of disease arising from the use of synthetic deodorants, so a safer alternative material is needed by using plants as natural ingredients to inhibit and kill the growth of bacteria that cause body odor, especially Staphylococcus

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epidermidis. Seeing that Indonesia is a country that is rich in a variety of plants and many of them have the potential to be used as herbal plants (Alydrus, & Nurul Khofifahl, 2022; Jumardin dkk., 2023) is one that can be used as a deodorant from natural ingredients is black cumin (Nigella sativa L.). Black cumin seeds have pharmacological activities including being an antibacterial which can treat diarrhea, acne, typhoid fever, mild skin infections and dental caries.

Research conducted (Kurniati et al., 2016) states that black cumin seed oil (Nigella sativa L.) contains thymoquinone and α-pinene compounds which have antibacterial activity so that in research conducted on the bacteria Staphulococcus epidermidis in 0.5% black cumin seed oil (Nigella sativa L.) it produces antibacterial activity of 14.16 ± 1.23 mm (strong), 1% concentration with an activity size of 12.52 ± 3.82 mm (strong), 2% concentration produces activity of 15.15 ± 1.22 mm (strong), and 4% concentration produces antibacterial activity of 19.73 ± 3.13 mm (strong). Other research conducted (Agistia et al., 2021) stated that the emulgel preparation from black cumin seed oil (Nigella sativa L.) against Staphylococcus epidermidis starting from a concentration of 3% was able to produce an antibacterial activity of 11.57 mm (strong), a concentration of 5% with an activity of 14.51 mm (strong) and a concentration of 7% produces antibacterial activity of 17.45 mm (strong). Other research conducted (Priani et al., 2020) in a microemulsion preparation of 5% black cumin oil (Nigella sativa L.) produced an antibacterial activity of 14.39 ± 0.37 mm (strong).

METHODS

This research method is a laboratory experiment to determine a good and physically stable formula for the use of black cumin seed essential oil (Nigella sativa L.) to make deodorant spray. The research includes dosage formulation, physical quality evaluation including organoleptic tests, homogeneity tests, pH tests, spray pattern tests, dry time tests, emulsion type tests, irritation tests, hedonic tests, preparation stability tests and also testing of the Staphylococcus epidermidis bacteria which is the cause body odor. The research was carried out at the Phytochemistry Laboratory of Megarezky University, Makassar, the Pharmaceutical Preparation Technology Laboratory and the Microbiology Laboratory of Megarezky University.

Tools used include Autoclave (Hirayama®), Stirring rod, Beaker glass (Iwaki®), Chocolate bottle, Spray bottle, Bunsen, Petri dish (Iwaki®), Porcelain cup, Erlenmeyer (Iwaki®), Measuring cup (Iwaki®), Heating mantle (Electrothermal®), Incubator (B-One®), Tricle band, Watch glass, Refrigerator (GEA E300), Hose needle, Preparation glass, Clamps, Condenser, Round bottom flask, Laminar air flow , Digital micropipette, Oven (model OV-30-OL), Spirtus, pH meter, Drop pipette, Tweezers, Test tube (Iwaki®), Analytical balance (Fujitsu FR-AR), Stative, 10 mL vial, Brookfield viscometer, and Vortex mixer.

Made deodorant sprayby preparing the tools and materials needed first. Measure the essential oil of black cumin seeds (Nigella sativa L.) using a measuring cup and then put it

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in a beaker. Add 0.5 mL of Croduret 50 then stir until homogeneous. Add 15 mL of propylene glycol and stir until homogeneous. Add 60 mL of 70% Ethanol then add enough Aquadest to 100 mL and add enough perfume. The deodorant spray preparation is transferred into a spray bottle(Kurniasih, 2021).

Evaluate deodorant spray preparations

1) Organoleptic test
2) Homogeneity test
3) Test pH
4) Viscosity Test
5) Test Spray Pattern
6) Dry Time Test
7) Emulsion Type Test
8) Irritation and hedonic tests
9) Deodorant spray stability test
10) Test the antibacterial activity of the deodorant spray preparation

a. Sterilization of tools
   Sterilize the tools by washing them thoroughly first and drying them. Glassware in the form of Erlenmeyer flasks, test tubes and vials were covered with sterile cotton wrapped in gauze and all sides were wrapped in HVS paper. Petri dishes wrapped in HVS paper. Glassware and petri dishes were sterilized using an oven at 170˚C for 60 minutes. The blades and tweezers were sterilized by soaking them in 70% ethanol for 5 minutes and then spreading them over a bunsen. Spoits of 1 cc and 10 cc were sterilized in an autoclave at 121°C for 15 minutes.
b. Making test media
   A total of 1.68 grams of Nutrient Agar (NA) media was dissolved in 60 mL of distilled water. Heat the medium until it boils and stir with a stirrer. Sterilize in an autoclave for 15 minutes at 121˚C and wait until warm. Nutrient Agar media is poured into a sterile petri dish as much as 10 mL. NA media is allowed to stand until it solidifies.
c. Bacterial rejuvenation process
   Rejuvenation of the Staphylococcus epidermidis bacteria was carried outgrown on Nutrient Agar (NA) media by streaking the bacteria using a loop needle from pure culture. Staphylococcus epidermidis that has been etched on the media is then incubated at 37˚C for 24 hours.
d. Preparation of bacterial suspension
   A suspension of Staphylococcus epidermidis bacteria was made by inserting one cycle of bacterial culture into 10 mL of 0.9% physiological NaCl and then homogenizing it until it became cloudy in a vortex mixer.
e. Antibacterial activity testing using the disc diffusion method
   The antibacterial activity test was carried out against Staphylococcus epidermidis bacteria using the disc diffusion method by pouring 10 mL of NA media into a petri

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dish and leaving it until it solidified. Soak the paper discs in each deodorant spray preparation on NA media which has been inoculated with Staphylococcus epidermidis bacteria. Incubated at 37°C for 24 hours then measuredclear zonegenerated around the disc using a caliper. Notedantibacterial activitywhich is obtained.

Data obtained from the evaluation results of deodorant spray preparations were analyzed using a normality test to see whether the data was distributed normally or not. A significance value <0.05 means the data is not normally distributed, whereas a significance value >0.05 indicates the data is normally distributed. The analysis was continued with paired sample t-test analysis to determine whether there were significant differences or not. If the P value <0.05 then it means there is a significant difference, whereas if the P value>0.05 there is no significant difference. Data from the results of the deodorant spray antibacterial activity test were analyzed using a normality test then continued with SPSS (Statistical Program for Social Science) analysis using the one way ANOVA (Analysis of Variance) method with a confidence level of 96%. If the results of the normality test obtain a significant value of P<0.05, it is declared to have a significant difference, conversely, if the significant value is P>0.05, the data is declared to have no significant difference.

RESULTS AND DISCUSSION

The results of research on the distillation of black cumin seed essential oil (Nigella sativa L.) which was carried out using a simple distillation method using 6000 g samples with distilled water as a solvent which was carried out in the phytochemical laboratory at Megarezky University, Makassar. The distillation results are obtained as follows

Distillation of Essential Oils

Table 1.Result of distillation of black cumin seed essential oil (Nigella sativa L.)

Sample	Sample weight (g)	Essential oil volume (mL)	Yield (%)
Black Cumin Seeds (Nigella sativa L.)	6000	26	0.43

Data source: Primary Data

Based on the results of observations in Table 1, 6000 g of black cumin seeds (Nigella sativa L.) were distilled using the water distillation method using distilled water as a solvent, and approximately ±26 mL of essential oil was obtained with a yield of 0.43%.

Evaluation of Deodorant spray preparations

a. Organoleptic test

Table 2.Observation results of organoleptic tests of deodorant spray preparations of black cumin seed essential oil (Nigella sativa L.)

Formulas	Organoleptic test					
	Before cycling test			After cycling test		
	Color	Smell	Texture	Color	Smell	Texture
F0	Clear	Perfume	Liquid	Clear	Perfume	Liquid
F1	White	Perfume	Liquid	White	Perfume	Liquid

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	Organoleptic test					
F2	Milk white	Perfume	Liquid	Milk white	Perfume	Liquid
F3	White bone	Perfume	Liquid	White bone	Perfume	Liquid

Data source: Primary Data

Based on the results of observations in Table 2 of the organoleptic test of the deodorant spray preparation of black cumin seed (Nigella sativa L.) essential oil before and after the cycling test, the F0 results showed that it had a clear color, a perfume smell and a liquid texture. F1 has a white color, a perfume smell and a liquid texture, F2 has a milky white color, a perfume smell and a liquid texture, while F3 has a bone white color, a perfume smell and a liquid texture. Each concentration of this deodorant spray preparation has a stable color, odor and perfume.

b. Homogeneity test

Table 3. Observation results of homogeneity test of deodorant spray preparation of black cumin seed (Nigella sativa L.) essential oil

	Homogeneity test		
Formulas	Before cycling test	After cycling test	Condition
F0	Homogeneous	Homogeneous	
F1	Homogeneous	Homogeneous	No coarse grains
F2	Homogeneous	Homogeneous	
F3	Homogeneous	Homogeneous	

Data source: Primary Data

Based on the results of observations in Table 3 of the homogeneity test of the deodorant spray preparation of black cumin seeds (Nigella sativa L.) before and after the cycling test, each concentration was homogeneous because there were no particles or coarse grains so that this preparation was physically stable.

c. Test pH

Table 4. Observation results of pH test of deodorant spray preparation of black cumin seed (Nigella sativa L.) essential oil

	Test pH			
Formulas	Before cycling test	After cycling test	Condition	Sig
F0	6.43	6.66		
F1	6.25	6.37	4.5 – 6.5	0.76 P>0.05
F2	6.06	6.17		
F3	5.93	6.06		

Data source: Primary Data

Based on the results of observations in Table 4, the pH test of the deodorant spray prepared from black cumin seeds (Nigella sativa L.) before cycling had F0 6.43, F1 6.06, F2 6.25, F3 5.93, while after cycling the F0 test had a pH of 6 .66, F1 6.37, F2 6.17 and F3

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6.06 where after the cycling test there was an increase in pH which was influenced by temperature changes during storage but statistical data showed a P value> 0.05 which means there was no significant difference so the value The pH is said to be stable.

d. Viscosity test

Table 5. Observation results of viscosity test of deodorant spray preparation of black cumin seed (Nigella sativa L.) essential oil

Formulas	Viscosity test		Condition	Sig.
	Before cycling test	After cycling test		
F0	40 mPas	44 mPas		
F1	46 mPas	47 mPas	<150 cP	0.47 P>0.05
F2	44 mPas	45 mPas	(Hayati et.al., 2019).	
F3	42 mPas	40 mPas		

Data source: Primary Data

Information :

Based on the results of observations in Table 5, the viscosity test of deodorant spray preparations of black cumin seed essential oil (Nigella sativa L.) before the cycling test had a viscosity value of F0 40 mPas, F1 46 mPas, F2 44 mPas, and F3 42 mPas while after the cycling test F0 had a viscosity of 44 mPas, F1 47 mPas, F2 45 mPas and F3 40 mPas. Based on the results of statistical data, it shows a P value of> 0.05, which means there is no significant difference so the viscosity value is said to be stable.

e. Test the spray pattern

Table 6. Observation results of spraying pattern test of deodorant spray preparation of black cumin seed (Nigella sativa L.) essential oil

Formulas	Spray pattern	
	Before cycling test	After cycling test
F0	Good	Good
F1	Good	Good
F2	Good	Good
F3	Good	Good

Data source: Primary Data

Based on the results of observations in Table 6, the spray pattern test of the black cumin seed (Nigella sativa L.) essential oil deodorant spray preparation before and after the cycling test has a good spray pattern, which meanssprays out uniformly and in the form of small particles sprays out uniformly and in the form of small particles so that this preparation is said to be stable.

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f. Test dry time

Table 7.Observation results of dry time test of deodorant spray preparation of black cumin seed (Nigella sativa L.) essential oil

Formulas	Dry time		Sig.
	Before cycling test	After cycling test	
F0	2 minutes 05 seconds	2 minutes 25 seconds	
F1	2 minutes 13 seconds	2 minutes 30 seconds	
F2	2 minutes 28 seconds	2 minutes 33 seconds	0.53 P>0.05
F3	2 minutes 56 seconds	2 minutes 38 seconds	

Data source: Primary Data

Based on the results of observations in Table 7, the dry time test for deodorant spray preparations of black cumin seeds (Nigella sativa L.) has a dry time before cycling test at F0 of 2 minutes 05 seconds, F1 2 minutes 13 seconds, F2 2 minutes 28 seconds, and F3 2 minutes 56 seconds, while after the cycling test at F0 it was 2 minutes 25 seconds, F1 2 minutes 30 seconds, F2 2 minutes 33 seconds, and F3 2 minutes 38 seconds. Based on the results of statistical data, it shows a P value of> 0.05, so this preparation is said to be stable because there are no significant differences.

g. Emulsion type test

Table 8. Observation results of the emulsion type test for deodorant spray preparation of black cumin seed (Nigella sativa L.) essential oil

Formulas	Emulsion type	
	Before Cycling test	After Cycling test
F0	M/A	M/A
F1	M/A	M/A
F2	M/A	M/A
F3	M/A	M/A

Data source: Primary Data

Based on the results of observations in Table 8 of the emulsion type test for deodorant spray preparations of black cumin seed oil (Nigella sativa L.) before and after the cycling test, it has an oil in water (O/W) emulsion type and is stable and does not change.

h. Irritation and hedonic tests

Table 9. Observation results of irritation test of deodorant spray preparation of black cumin seed (Nigella sativa L.) essential oil

Formulas	Irritation Test			
	Reaction (1)	Reaction (2)	Reaction (3)	No reaction (4)
F0	-	-	-	20
F1	-	-	-	20
F2	-	-	-	20
F3	-	-	-	20

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Formulas	Irritation Test			
F4	-	-	2	18
Total	-	-	2	98

Data source: Primary Data

Based on the results of observations in Table 9, irritation tests were carried out on deodorant spray preparations of black cumin seed essential oil (Nigella sativa L.) F0, F1, F2, and F3 which were tested by spraying the preparation onto the lower arms of 20 panelists where the results showed that it did not occur. irritation on the skin of each panelist, whether itching, redness or heat after spraying preparations F1, F2 and F3, while F4 had a hot reaction as many as 2 people

Table 10. Observation results of hedonic tests of deodorant spray preparations of black cumin seed (Nigella sativa L.) essential oil

Formulas	Irritation Test				
	Do not like	Do not like it much	Simply Like	Like	Really like
F0	0	0	6	13	1
F1	0	0	4	13	3
F2	0	0	2	13	5
F3	0	0	4	9	7
F4	0	3	6	10	1
Total	0	3	22	58	17

Data source: Primary Data

Based on the results of observations in Table 10 of the hedonic test or liking test which was tested on 20 panelists by filling in a questionnaire, the results showed that at F0, 1 person liked it very much, 13 people liked it a lot, and 6 liked it quite a bit. There are 3 people who like F1 very much, 13 people like it very much, 4 people quite like it. In F2 there were 5 people who liked it very much, 13 people who liked it and 2 people who liked it quite a lot, while in F3 there were 7 people who liked it very much, 9 people who liked it and 4 people who liked it quite a bit.

Test the antibacterial activity of the deodorant spray preparation of black cumin seed (Nigella sativa L.) essential oil against Staphylococcus epidermidis which causes body odor

Table 11. Antibacterial activity test results of deodorant spray preparations of black cumin seed (Nigella sativa L.) essential oil against Staphylococcus epidermidis which causes body odor

Formulas	Antibacterial Activity Test					
	Replication			Diameter	Category	Sig.
	I	II	III	average		
F0	0	0	0	0	-	
F1	10.3	7.3	7.83	8.47	Currently	
F2	13,16	13.6	18.96	15.24	Strong	0.00 P<0.05

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	Antibacterial Activity Test				
F3	17.53	15.83	23.33	18.89	Strong
F4	15.03	12.4	16.73	14.72	Strong

Data source: Primary Data

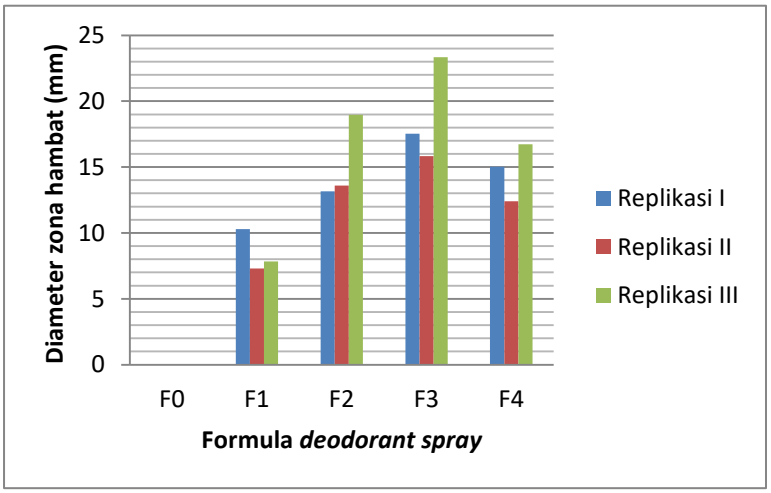

Figure 1. Graph of antibacterial activity of deodorant spray
Data source: Primary Data

Based on the results of observations in Table 11 of the antibacterial activity test of deodorant spray preparations of black cumin seed essential oil (Nigella sativa L.) F0 was 0.0 mm, F1 8.47 mm, F2 15.24 mm, F3 18.89 mm, and F4 14 .72mm.

The sample used in this research was black cumin seeds (Nigella sativa L.) because this plant is one of the herbal plants which is known to have many benefits for the human body, one of which is antibacterial. The antibacterial content of black cumin seeds comes from thymoquinone and α-pinene which are found in the essential oil. This research was conducted with the aim of finding out whether the essential oil contained in black cumin seeds (Nigella sativa L.) can be formulated into a physically stable deodorant spray preparation, and to find out whether this preparation has antibacterial activity against Staphylococcus epidermidis which causes body odor.

Black cumin seeds contain essential oils which are obtained through the distillation process using the water distillation method. The water distillation method is carried out by making the sample to be distilled come into direct contact with boiling water so that the distilled sample can float or be completely submerged depending on the specific gravity and number of samples being distilled. The reason for distilling water is because it has the advantage that the time required to obtain essential oils is relatively shorter and the equipment used is simple. However, the weakness is that it cannot be used for samples that cannot withstand hot steam (Pertiwi & Wulandari, 2022). The water distillation process was carried out by extracting 6000 g of black cumin seed (Nigella sativa L.)

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essential oil using distilled water as a solvent. The distillation results obtained ± 26 mL of essential oil with a yield of 0.43%.

Black cumin seed essential oil is formulated in a deodorant spray preparation. The advantages of deodorant spray are:There is no direct contact between the deodorant applicator and the skin during the application process so that the cleanliness of the preparation is still maintained (Masrijal et al., 2022).The deodorant spray preparation of black cumin seed (Nigella sativa L.) essential oil was made with concentrations of 1%, 3% and 5% because based on preliminary tests it has antibacterial activity with medium category antibacterial activity at a concentration of 1% and strong at 3% and 5%. The deodorant spray preparation of black cumin seed essential oil (Nigella sativa L.) uses additional ingredients including propylene glycol, croduret 50, 70% ethanol, perfume and distilled water.

The deodorant spray preparation of black cumin seed essential oil (Nigella sativa L.) carried out several evaluations of the preparation including organoleptic test, homogeneity test, pH test, viscosity test, spray pattern test, dry time test, emulsion type test, irritation test, hedonic test, preparation stability and antibacterial activity test against Staphylococcus epidermidis. The preparation stability test is carried out to determine the physical stability of the preparation during the specified storage period and extreme temperatures. The stability test of the preparation was carried out using the cycling test method by storing the deodorant spray preparation in the refrigerator at a temperature of 4°C for 24 hours and then transferring it to the oven at a temperature of 40°C for 24 hours counted as one cycle. The cycling test was carried out repeatedly until it reached 6 cycles and then the deodorant spray preparation was evaluated.

Organoleptic tests were carried out to determine the color, odor and texture of the deodorant spray preparation of black cumin seed (Nigella sativa L.) essential oil before and after the cycling test., F0 is clear, F1 is white, F2 is milky white, and F3 is bone white. The smell and texture of each concentration has the smell of perfume and has a liquid texture. The results of the observations that have been made indicate that the color, odor and texture of the preparation remain the same and do not change before and after the cycling test.

The homogeneity test is carried out to determine whether there are coarse grains in the preparation that are not yet homogeneous. It states that each formula, both before and after the cycling test, remains homogeneous, as indicated by the absence of coarse grains or particles on the glass preparation, apart from that, when shaking, the preparation is evenly distributed and well homogeneous.

A pH test needs to be carried out to ensure the preparation does not cause irritation to the skin. According to Indriaty et.al. (2022) the preparation should not be too acidic because it can cause irritation and not too alkaline because it can cause dry skin. Based on Table 6, the deodorant spray preparation of black cumin seed oil (Nigella sativa L.) experienced an increase in the pH value after the cycling test due to the hydrolysis process during temperature changes (Sani et.al., 2021). Based on the results of statistical data, the

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paired sample t-test of the deodorant spray preparation of black cumin seed oil (Nigella sativa L.) has a value of 0.76, where the P value is> 0.05, which indicates that there is no significant difference between each formula before and after the cycling test. so that the preparation has a stable pH value.

The viscosity test is carried out to determine the flow rate of a dosage form. It is hoped that the deodorant spray preparation has a viscosity that is not too low because it will be too runny so the preparation will drip when applied to the skin. The viscosity value of the spray preparation is approximately less than 150 cP (Hayati et.al., 2019) which meansThe deodorant spray preparation of black cumin seed oil (Nigella sativa L.) has a viscosity that meets the spray viscosity requirements. Each formula has a different viscosity value which is influenced by the oil concentration, according to what is stated in (Nurhaini, et.al., 2022) that the higher the concentration of essential oil used, the lower the resulting viscosity.

The viscosity value after the cycling test for the deodorant spray preparation experienced an increase in the viscosity value, this could be caused by the evaporation of the alcohol in the preparation (Sani et,al., 2021) and the decrease in the viscosity value after the cycling test was due to the separation between the oil phase and the water in the preparation. Based on the results of statistical data, paired sample t-test, the deodorant spray preparation of black cumin seed oil (Nigella sativa L.) has a P value of 0.47, where the P value is> 0.05, which means there is no significant difference between each formula before and after cycling test so that the preparation has a stable viscosity. The dry time test was carried out with the aim of seeing how long it takes for each preparation of black cumin seed oil (Nigella sativa L.) deodorant spray to dry and absorb completely into the skin. Based on Table 9, the dry time test for F0, F1, F2 and F3 before and after the cycling test takes ± 2-3 minutes to dry and absorb completely into the skin. In accordance with the results of the paired sample t-test analysis, the result was 0.53 where the P value was > 0.005, which means there was no significant difference in the deodorant spray preparation before or after the cycling test.

The emulsion type test was carried out with the aim of proving that the preparation made had an O/W emulsion type. Testing the emulsion type, the observational data obtained where the deodorant spray preparations of black cumin oil (Nigella sativa L.) F0, F1, F2, and F3 after being dripped with methylene blue show an even blue color, which means that the deodorant spray preparation is a preparation with emulsion type O/W (oil/water) both before and after cycling test.

Irritation tests are carried out to determine the safety level of the preparation after being applied to the skin before it reaches consumers. The irritation test was carried out by spraying each preparation on the lower arm of 20 panelists who had different skin conditions. Irritation test panelists are included in the panelist criteria, namely 12-25 years old, female and male, have normal skin conditions without allergies, and are willing to sign informed consent. Based on Table 9, each of the 20 panelists who filled out the questionnaire stated that the deodorant spray preparation of black cumin seed essential oil

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(Nigella sativa L.) F0, F1, F2, and F3 did not cause irritation after leaving it for about 5-10 minutes each. inner arm then the preparation is safe to use.

The hedonic test was carried out with the aim of determining the level of preference for the deodorant spray preparation of black cumin seed (Nigella sativa L.) essential oil. Based on Table 12, the hedonic test or liking test was tested on 20 panaelists by filling in a questionnaire after observing the deodorant spray preparation. The results obtained from F0 were 1 person really liked it, 15 people liked it, and 4 liked it quite a bit. There are 3 people who like F1 very much, 13 people like it very much, 4 people quite like it. In F2 there were 5 people who liked it very much, 13 people who liked it and 2 people who liked it quite a lot, while in F3 there were 7 people who liked it very much, 9 people who liked it and 4 people who liked it quite a bit. Based on the results of the Duncan Test statistical analysis, the preferred formulas are F2 (3%) and F3 (5%) while F4 is quite preferred.

Testing of the antibacterial activity of the deodorant spray preparation of black cumin seed (Nigella sativa L.) essential oil against Staphylococcus epidermidis which causes body odor was carried out using the disc diffusion method using paper disks. The test was carried out by soaking the paper disk in the respective concentration of black cumin oil (Nigella sativa L.) deodorant spray which was then placed on NA media which contained a suspension of Staphylococcus epidermidis. This test was carried out in 3 replications to strengthen the research results which had different inhibitory power at each concentration. The deodorant spray preparation of black cumin seed essential oil (Nigella sativa L.) F0 has weak activity with an average diameter of 0 mm, F1 has an average diameter of 8.47 mm which is categorized as medium activity, F2 has an average diameter of 15.24 mm, categorized as strong antibacterial activity, and F3 has an average diameter of 18.89 mm, which is categorized as strong antibacterial activity.

Meanwhile, F4 which was used as a positive control was a commercial deodorant spray preparation (Mufid 3 in 1 Deodorant Bidara) to compare the activity of this preparation with a deodorant spray preparation of black cumin seed oil. The average diameter of F4 antibacterial activity of 14.72 mm is categorized in the strong category. Based on statistical data carried out using the one way ANOVA method, a P value of 0.00 was obtained, where the P value <0.05, which means there is a significant difference in each formula so that the deodorant spray preparation of black cumin seed (Nigella sativa L.) essential oil has different activity diameters for each concentration.

Deodorant spray preparations of black cumin seed essential oil (Nigella sativa L.) concentrations of 1%, 3% and 5% have antibacterial activity against Staphylococcus epidermidis which causes body odor in the medium category at F1 (1%) 8.47 mm, and in the strong category at F2 (3%) 15.24 mm and F3 (5%) 18.89 mm.

CONCLUSION

Based on the results of the research conducted, it can be concluded that: Black cumin seed (Nigella sativa L.) essential oil can be formulated into a deodorant spray preparation of black cumin seed (Nigella sativa L.) essential oil which is physically stable. The deodorant

spray preparation of black cumin seed essential oil (Nigella sativa L.) has antibacterial activity against Staphylococcus epidermidis which causes body odor. There is a significant difference in each formula so that the deodorant spray preparation of black cumin seed (Nigella sativa L.) essential oil has different activity diameters for each concentration. The deodorant spray preparation of black cumin seed essential oil (Nigella sativa L.) F0 has weak activity, F1 has categorized as medium activity, F2 has categorized as strong antibacterial activity, and F3 has strong category of antibacterial activity.

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