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THE FORMULATION OF PEEL-OFF MASK FROM THE ETHANOL EXTRACT OF BILIMBI LEAVES (A*verrhoa blimbi L.*) AS ANTI-ACNE TREATMENT

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ABSTRACT

This research aims to formulate and assess the efficacy of the peel-off mask as an anti-acne of ethanol extract from bilimbi leaves (*Averrhoa bilimbi L*.). The method used was an experiment, evaluating the extract through the inhibition test of Staphylococcus epidermidis bacteria with the paper disk diffusion method. The peel-off mask formulation added the extract with a concentration of 7% (F1), 9% (F2), 11% (F3), and without using extract (F0). The Peel-off mask preparation testing includes the detection of scents, colors, irritation checks, and the determination of peel-off anti-acne mask efficacy. This study was carried out at Akafarma of Banda Aceh and the Chemistry laboratory of FKIP Unsyiah. The findings of the inhibition zone for Staphylococcus epidermidis bacteria at extract concentrations of 100%, 75%, 50% and 25% were 15 mm, 12 mm, 11 mm and 10 mm, respectively. The four peel-off mask formulas were gel, homogeneous, brown, with the distinctive scent of bilimbi leaves, and did not irritate the volunteers' skin. The average decline in acne before and after using the mask for any formula (F0, FI, FII, and FIII) was 19.64%, 22.63%, 28.75% and 50%, respectively. The peel-off mask of ethanol extract of bilimbi leaves (*Averrhoa bilimbi L*.) is effective as an anti-acne treatment.

Keywords: ethanol extract, bilimbi leaves, peel-off mask, and an anti-acne agent

INTRODUCTION

The flawless, soft, and acne-free facial skins is any woman's dream. Most cosmetic products for facial treatment use products extracted from chemicals such as mercury, hydroquinone, etc. When used in the long term, these chemicals are dangerous and can harm the skin. Therefore, beauty products manufactured from natural ingredients, one of which is natural ingredient masks, are used. Natural masks are masks made from natural substances without chemical materials and preservatives (Muliawan dan Suriana, 2013). Masks are one of the remedies for skincare, a functional peel-off mask for use.

The peel-off mask is a gel-based skincare cosmetic preparation that will develop a clear, elastic film coating after being added to the skin for a certain amount of time before it dries out so that it can be peeled off (Rahmi, 2014). To restore and cure facial skin of wrinkles, aging, acne, the use of peel-off face masks is useful and can even be used to shrink pores (Grace, et all., 2015).

Acne (*acne vulgaris*) is a chronic inflammatory disease of the pilosebaceous unit characterized by blackheads, papules, pustules, nodules, cysts, and scars (Saragih, et al., 2016). Acne is an inflammatory disease that can occur on the skin of the face, neck, chest, and back. Overactive oils are responsible for this condition and are compounded by bacterial infections, such as Staphylococcus epidermidis and Propionibacterium acnes. Bacterial infections in acne can be treated with anti-bacteria (Meliana and Cicilia, 2016). Bilimbi (*Averrhoa blimbi Linn*) is one herb that can be used as an anti-bacterial. Bilimbi thrives in every region of Indonesia, one of which is in Aceh. Bilimbi leaves contain flavonoids, saponins, tannins, sulfur, formic acid, peroxidase, calcium oxalate and potassium citrate (Faharani, 2018). Bilimbi leaves have antibacterial efficacy because they contain tannins, flavonoids and saponins (Pendit, et al., 2016).

A previous study has been carried out on the formulation of the peel-off mask formulation of ethanol extract of bilimbi (*Averrhoa blimbi L*) as an anti-acne, where acne has decreased by 84.80% following 4 weeks of use at a concentration of 11%. (Ginting, 2018). Then another research on the stability test of the physical quality of facial gel mask preparations from the extraction of bilimbi leaves (*Averrhoa blimbi L*) with various concentrations of carbopol, where the formula with a concentration of 2% carbopol fulfills better physical quality than the formula with a concentration of 0.5%, 1 % (Daswi, et al., 2018). In other studies have also conducted research on the characteristics of leaf powder preparations and spray of bilimbi leaf extract (*Averrhoa blimbi L*) as facial cleansers, showing that mask products from bilimbi leaf extract have homogeneous properties and a pH value of 5 (Helmi, et al., 2018).

The purpose of this research was to determine the inhibition of the ethanol extract of bilimbi leaves (*Averrhoa bilimbi L*) against the growth of Staphylococcus Epidermidis bacteria at extract concentrations of 100%, 75%, 50%, and 25% and to formulate and evaluate the effectiveness of the peel-off mask from the ethanol extract of billimbi (*Averrhoa bilimbi L.)* as an anti-acne agent.

METHODOLOGY

The materials used were bilimbi leaves, 96% ethanol, aquadest, Staphylococcus epidermidis, Nutrient Bort (NB) media, Muller Hinton Agar (MHA) media, tetracycline antibiotics, Polyvinyl Alcohol (PVA), Hydroxy Propyl Methyl Cellulose (HPMC), glycerin, sodium lauryl sulfate, and nipagine. The instruments used in this test are a set of maceration tools, rotary evaporators, and bacteria testing tools.

Experimental analysis is the method used in this study. The examination of the extract was carried out by using the paper disk diffusion system via the inhibition procedure of Staphylococcus epidermidis bacteria. This study was conducted in 2020. The research site was conducted at the Chemistry laboratory of the Banda Aceh Academy of Pharmacy and Food Analyst of Harapan Bangsa Darussalam Foundation, and the chemistry Laboratory of FKIP Unsyiah. The population in this test was the leaves of bilimbi (*Averrhoa blimbi* L.). The sample was bilimbi leaves taken in Lhoksemawe. The work procedures are:

Making ethanol extract of bilimbi leaves.

The simplicia powder was extracted by maceration of 96 percent ethanol solvent, solvent ratio 1:5. Bilimbi leaves' powder and the mixed solvent are then tightly closed and shielded from sunlight and then let stand for around 3 x 24 hours for the extraction process. The filtrate and residue are isolated using a funnel fitted with a filter cloth and coarse filter material. After the filtrate is collected, it is evaporated at 40^{o}C until the extract thickens or around 10% (Pendit, dkk. 2018).

Testing the antibacterial activity of the ethanol extract of Bilimbi leaves.

A test solution was formulated using a dilution formulation from the ethanol extract of bilimbi leaves with concentrations of 25, 50, 75, and 100 percent (w / v). Colonies of bacteria of Staphylococcus epidermidis were taken from pure colonies using ose needles that were sterilized in a bunsen fire and then inoculated into NB medium stirred until turbid, then incubated for 24 hours in an incubator at 35^{o}C.

One ml of the bacterial suspension assay was taken and uniformly inoculated on the MHA media with a sterile cotton swab left for 3 minutes before the bacterial suspension was absorbed into the water. Aseptically, 1 antibiotic disk (positive control) and 4 disks containing varying amounts of the test solution and 1 negative control blank disk (containing solvent) were mounted on the surface of the MHA media. Every single paper disk is regularly inoculated at some distance so that the formed inhibition zones are not overlapped. Then the Petri base is correctly numbered, incubated 24 hours long and the diameter of the transparent zone created by a caliper/ ruler around the paper disk can be determined.

Preparation of Peel-off mask preparation of ethanol extract of bilimbi leaves as an anti-acne substance.

Polyvinyl alcohol (PVA) can be applied with hot aquadest until it ultimately expands into a gel foundation, and HPMC is applied with cold aquadest and continuously agitated until

it develops. Nipagine and sodium lauryl sulfate were dissolved in hot aquadest then added with nipagine solution, sodium lauryl sulfate solution and glycerin to the formed PVA mass, stirred until homogeneous then allowed to cool. The foundation of the peel-off mask is then mixed and added with 96 % ethanol. The bilimbi leaves ethanol extract was weighed by concentration (0, 7, 9 and 11 percent), then a little peel-off mask base was applied and crushed until homogeneous, with a peel-off base of up to 100 grams and stir until homogeneous. Finally, the evaluation of the physical consistency preparations (organoleptic test) of masks, skin sensitivity checks, and assessing the efficacy of anti-acne on volunteers was carried out.

RESULTS AND DISCUSSION

The ethanol extract of bilimbi leaves was obtained through the extraction process of maceration. The maceration method is beneficial in the insulation of natural compounds since it is inexpensive and straightforward. Maceration is a simplicia extraction process using a suitable solvent with several times stirring at room temperature (Arifullah. 2013). The ethanol extract of bilimbi leaves was made by the maceration method using 96 percent ethanol solvent with a 1:5 ratio of content and solvent (w/v) resulting in the best treatment ratio (Pendit, dkk. 2018). Another study also made ethanol extract from bilimbi leaves using the same ratio of 1: 5 (Insani, dkk. 2016). Ethanol is a solvent that is universal and selective in dissolving the desired chemical compounds and is more efficient in the degradation of non-polar cell walls so that more of the desired compounds will be found (Tiwari, et all. 2011). Besides, there is also research on making bilimbi leaves' extract (*Averrhoa bilimbi L*) by maceration using 96% ethanol, making a peel-off mask (Zainudin, dkk. 2019).

Figure 1. Ethanol Extract of Bilimbi Leaves (Source: Research Documentation, 2020)

The leaf Simplicia powder used was 1.5 kg and 7.5 L solvent. The maceration results were then evaporated at 400C to obtain ethanol extract from the bilimbi leaves. The extract

obtained is brownish-green with an extract weight of 210 grams. The results of ethanol extraction can seen in Figure 1.

Based on the findings of the antibacterial activity tests of extract ethanol of the bilimbi leaves (*Averrhoa bilimbi L.*) on the growth of the *Staphylococcus epidermidis* bacteria, the diameter of the inhibition zone is shown in Table 1 and Figure 2.

Table 1. Diameter of inhibition zone of bilimbi leaves' extract (*Averrhoa bilimbi L.*) on the growth *of Staphylococcus Epidermidis* bacteria.

Concentration of Bilimbi Leaves' Extract (%)	Inhibition Zone Diameter Against *Staphylococcus epidermidis* Bacteria (mm)
100	15
75	12
50	11
25	10
Aquadest Steril (-)	0
Tetrasiklin (+)	45

(Source: Resarch Documentation, 2020)

Table 1 indicates that the ethanol extract from bilimbi leaves has been shown to prevent the development of *Staphylococcus Epidermidis* bacteria in the disc diffusion study of the inhibition zone formed in this study. The concentrations of the bilimbi leaves extract started with inhibition zones 15, 12, 11, and 10 mm, from the highest to the lowest, i.e., 100%, 75%, 50% and 2 %, respectively. Bilimbi leaves' extract contains alkaloids, flavonoids, phenolics, tannins, and terpenoids (Ibrahim, et al., 2014). The study also showed that tannins, saponins, triterpenoids and flavonoids are bilimbi extracts that prevent bacterial growth by various mechanisms (Saputra and Anggaini, 2016). The leaves of bilimbi (*Averrhoa blimbi* L) contain flavonoids which are known to have antibacterial effects against acne-causing bacteria which are suitable to be developed into peel-off masks.

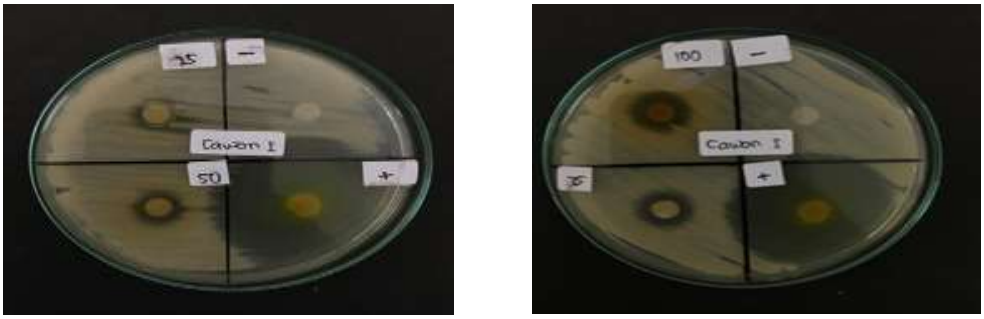

Figure 2. Inhibition test results of ethanol extract of Bilimbi Leaves Against *Staphylococcus Epidermidis* bacteria (Source: Research Documentation, 2020)

The antibacterial agent's efficacy can be seen based on the diameter of the inhibition zone. In the exceptionally high category, the inhibition zone diameter of 20 mm and beyond is 10-20 mm in the high category, 5-10 mm in the moderate category and 5 mm and below is in the poor category (Susanto. 2012). Based on the diameter of the inhibition region, the effects of the ethanol extract of bilimbi leaves belong to strong category, which means that the bilimbi leaf extract may inhibit the bacteria *Staphylococcus Epidermidis.*

For the peel-off mask, the anti-acne peel-off mask is made using a regular formulation. This primary method is modified where such ingredients such as pH buffers, dyes and perfumes are not used, which are useful for obtaining a suitable composition in the manufacture of peel-off mask bases. So that the preparation of the peel-off mask obtained by the ethanol extract mask of bilimbi leaves (*Averrhoa bilimbi L.)* is clear and stable. Making a peel-off mask for bilimbi leaves extract using four formulations with modified preparations without using F0 extract (blank), mixing the peel-off mask gel base then adding the extract with a concentration of FI (7%), FII (9%) and FIII (11%). The formula for each mask formulation can be seen in the following table.

Table 2. The peel-off mask-making formula of ethanol extract of bilimbi leaves (*Averrhoa bilimbi L.*) as an anti-acne agent

Materials	Blank	(% b/b)			Function
	Formula 0	Formula I	Formula II	Formula III	
Ethanol Extract of Bilimbi Leaves	-	7	9	11	Active substance
PVA	6	6	6	6	Gel Formers
HPMC	2	2	2	2	Viscosity Enhancer
Glycerin	6	6	6	6	Moisturizer
Sodium Lauril Sulfate	2	2	2	2	Surfactants
Nipagin	0.1	0.1	0.1	0.1	Preservative
Etanol 96%	20	20	20	20	Solvent
Aquadest	Ad 100	Ad 100	Ad 100	Ad 100	Solvent

(Source: Research Documentation, 2020)

The resulting mask is a peel-off mask for ethanol extract of bilimbi leaf (*Averrhoa bilimbi L.*) with a weight of 100 grams of each mask, the form of a semi-solid peel-off mask (gel) can be seen in Figure 3. The peel-off mask tests were formed to evaluate the physical

quality of mask preparations including homogeneity and organoleptic tests. Furthermore, the volunteers' skin irritation testing was also carried out and anti-acne effectiveness testing.

Figure 3. F0, FI, FII, and FIII peel-off mask (Source: Research Documentation, 2020)

The homogeneity examination carried out in this study aims to see whether the preparations are evenly distributed when used. Based on the results of research that has been carried out on the preparation of a peel-off mask from the ethanol extract of bilimbi leaves, it can be seen in Table 3 and Figure 4.

Table 3. Homogeneity Test Results

Peel-off mask formula	Homogeneity test parameters
F0	Homogenous
F1	Homogenous
F2	Homogenous
F3	Homogenous

(Source: Research Documentation, 2020)

Note :

F0 : Peel-off mask without ethanol extract of bilimbi leaves (blank)
F1 : Peel-off mask ethanol extract of bilimbi leaves 7%
F2 : Peel-off mask ethanol extract of bilimbi leaves 9%
F3 : Peel-off mask ethanol extract of bilimbi leaves 11%

The homogeneity examination of the peel-off mask preparation of the ethanol extract of bilimbi leaves can be seen in Table 3, that the four formulas (F0, F1, F2, and F3) are homogeneous. At the time of testing, there were no lumps or coarse grains visible on the transparent glass. A peel-off mask is said to be homogeneous in the absence of coarse grains (Daswi, et al., 2018).

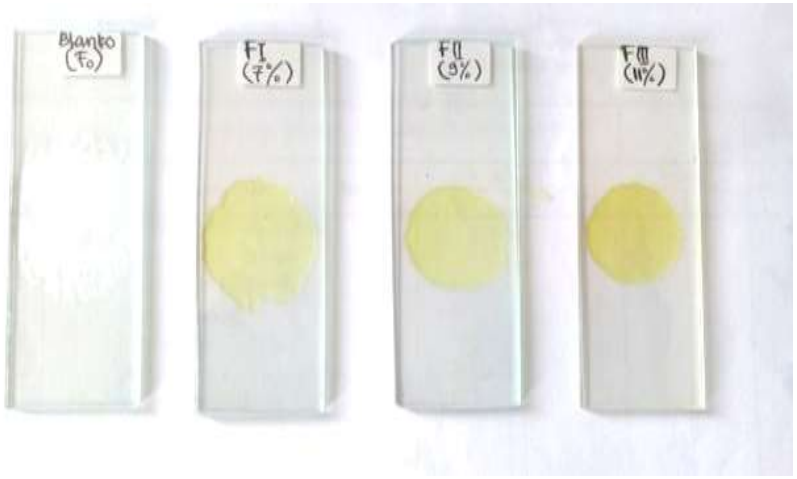

Figure 4. Homogeneity test results (Source: Research Documentation, 2020)

During 4 weeks of storage with inspection periods per 7, 14, 21, and 28 days, the stability assessment of the preparation was carried out. The preparation of the peel-off mask was kept at room temperature, and improvements in the scent and color of the preparation of the peel-off mask of bilimbi leave ethanol extract were detected as can be seen in Table 4.

Table 4. Observations of the stability of the peel-off mask preparation

Parameter	Formula	Time (Week)			
		1	2	3	4
Color	F0	Clear	Clear	Clear	Clear
	F1	Light brown	Light brown	Light brown	Light brown
	F2	Light brown	Light brown	Light brown	Light brown
	F3	Dark brown	Dark brown	Dark brown	Dark brown
Scent	F0	Ethanol	Ethanol	Ethanol	Ethanol
	F1	Typical	Typical	Typical	Typical
	F2	Typical	Typical	Typical	Typical
	F3	Typical	Typical	Typical	Typical

(Source: Research Documentation, 2020)

Note :

Typical : The scent of bilimbi leaves

The Observation of the shape, color, and scent of a peel-off mask preparation can be observed visually (Zhelsiana, 2016). The observation result of peel-off mask preparation of ethanol extract of bilimbi leaves showed that the color and scent of the mask preparation did not change for 4 weeks of storage at room temperature. The colors for the blank without extract (F0) are transparent, F1 and F2 are light browns, while in F3 are dark brown until the fourth week of storage. The different colors in the mask formulas are due to the influence of the amount of extract added. The scent for F0 smells of ethanol because the ethanol extract of the

bilimbi leaves has not been added while (F1, F2, and F3) has a typical smell: the scent of bilimbi leaves. This shows that the peel-off mask preparation of the ethanol extract of bilimbi leaves is stable.

The skin irritation test for volunteers had three standard criteria: redness, itching, and swelling (Ginting, 2018). Visuals could examine the skin change of the volunteers. The irritation test is carried out by applying the preparation to human skin (Karmila and Nirawati, 2016). The results of the irritation test for peel-off mask preparation of ethanol extract of bilimbi leaves (*Averrhoa bilimbi L.)* can be seen in Table 5.

Table 5. Results of the skin irritation test for volunteers

Observation	**Volunteers**											
	F0			**F1**			**F2**			**F3**		
Redness	-	-	-	-	-	-	-	-	-	-	-	-
Itching	-	-	-	-	-	-	-	-	-	-	-	-
Swelling	-	-	-	-	-	-	-	-	-	-	-	-

(Source: Research Documentation, 2020)

Note: (-) : negative
(+) : Positive

The irritation test was performed on 12 volunteers who used the skin behind the ear with a peel-off mask, suggesting that all volunteers gave negative results on the parameters of the irritation reaction. Red skin appearance, itching, or swelling were the criteria observed. It can be inferred from the findings of the irritation test that the peel-off mask preparation of the bilimbi leaf ethanol extract is safe for use. The data for testing the effectiveness of anti-acne on volunteer facial skin can be seen in Table 6.

Table 6. Data on the results of measuring the amount of acne on volunteers' facial skin before and after 4 weeks of using a peel-off mask of ethanol extract of bilimbi leaves (*Averrhoa bilimbi L*.)

Formula	Volunteers	Before Use	After 4-Week Use	Reduction in the number of Acne (%)
Blank (F0)	1	7	7	0
	2	4	4	0
Average				0
F1	1	6	5	16.7
	2	14	10	28.6
Average				22.6
F2	1	5	4	20
	2	16	10	37.5
Average				28.7

Formula	Volunteers	Before Use	After 4-Week Use	Reduction in the number of Acne (%)
F3	1	6	3	50
	2	8	4	50
Average				50

(Source: Research Documentation, 2020)

The parameters of anti-acne peel-off mask ethanol extract of bilimbi leaves (*Averrhoa bilimbi L*.) will be analyzed by looking at significant differences before and after using peel-off mask preparations for volunteers. This test was carried out from before use and after 4 weeks of use. The anti-acne effectiveness test was carried out on 8 volunteers and divided into 4 groups with the criteria of mild-moderate acne, women aged between 20-30 years, no history of related to allergies while testing and volunteering (Wasitaatmadja,2007).

From Table 6 above, it can be seen that the average percentage of reduction in the number of acnes before and after using the peel-off mask for each formula (F0, F1, F2, and F3) is 0%, 22.63%, 28.75%, and 50%. In the F0 formula, there is a reduction in the number of acnes, even though the F0 formula does not add ethanol extract of bilimbi leaves. In the F3 formula (11%), the reduction in the number of acne in volunteers was more, that is, 50%. This is influenced by the amount of added ethanol extract of bilimbi leaves to the peel-off mask preparation. Based on other studies, the higher the concentration of the peel-off mask containing ethanol extract of bilimbi, the more optimal its effectiveness as an anti-acne agent. The peel-off mask formulation of ethanol extract of bilimbi leaves F1, F2, and F3 is useful as an anti-acne.

CONCLUSION

Based on the research findings, it can be concluded that the extract of bilimbi leaves can inhibit the bacteria staphylococcus epidermidis with maximum results obtained at a 100 percent (15 mm) concentration that is categorized into the high category. The leaves of bilimbi (*Averrhoa bilimbi L*.) can be formulated in the form of a peel-off mask by using various extract concentrations. All preparations for the peel-off mask of the ethanol extract of bilimbi leaves FI (7%), FII (9%), and FIII (11%) with each weight of 100 grams, are light brown to dark brown while the blank (F0) is clear, homogeneous, and not irritating.

After 4 weeks of use, the peel-off mask containing ethanol extract from FIII bilimbi leaves (11 percent) has the highest anti-acne efficacy with an overall acne reduction of 50 percent, which is higher than other peel-off mask formulations. The recipe for the peel-off mask for bilimbi leaf ethanol extract (FI, FII, and FIII) is useful as an anti-acne remedy.

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