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Test of Stoping Power of Peel-Off Masker Gel Combination of Kelor Leaf Extract (Moringa Oleifera L) and Kunyit Extract (Curcuma Domestica Val) Against The Bacteria Staphylococcus Aureus)

Rahmah[1], Suryadi Imran[2], Shonia Khoirunnisa[3]
[1] Kemenkes Jambi Health Polytechnic and Rahmah@gmail.com
[2] FIKes Universitas Adiwangsa Jambi and suryadiimran72@gmail.com
[3] Kemenkes Jambi Health Polytechnic and shoniaanisa@gmail.com

ABSTRACT

The peel off gel mask of Moringa leaves and turmeric is a skin care cosmetic preparation in the form of a gel and after being applied to the skin within a certain time it will dry out which is used as an anti-acne. This study aims to determine the inhibitory ability of the peel off gel mask combination of Moringa leaf extract and turmeric extract against Staphylococcus aureus bacteria for each formula and to determine the best formulation with maximum inhibitory value. The type of research used in this research is Quasy Experimental research. The results showed that Moringa leaf extract and turmeric were able to inhibit the growth of Staphylococcus aureus bacteria with an average diameter of the inhibition zone for each formula, namely F1 (7%: 3%) which was 12.44 mm, F2 (6%: 4%) was 12, 14 mm, F3 (5% : 5%) is 12.00 mm, F4 (4% : 6%) is 11.84 mm, and F5 (3% : 7%) is 11.66 mm, then for alcohol (96%) = 10 mm, and for positive control (clindamycin) = 34 mm, and negative control (aquadest) = 0 mm. All the results of the inhibition test were included in the strong category. The best formulation is shown by F1 which is 12.44 mm.

Keywords: *Peel-off Gel Mask, Moringa Leaf, Turmeric, Zone of Inhibition, Staphylococcus Aureus, Clindamycin.*

1. INTRODUCTION

Moringa (Moringa Oleifera) is a resilient tropical plant that thrives easily in regions such as Indonesia and other tropical areas around the world. Its cultivation is gaining international attention as a promising agricultural program. Known by various nicknames, including "The Miracle Tree," "Tree for Life," and "Amazing Tree," the Moringa tree earns these titles due to the remarkable health benefits offered by its leaves, fruits, seeds, flowers, bark, and roots. The Moringa plant is adaptable to different soil types, requires minimal maintenance, withstands drought conditions, and is simple to propagate [1]. In Indonesia, Moringa is referred to by several local names: the people of Sulawesi call it kero, wori, kelo, or keloro, while the Madurese refer to it as maronggih. In the Sundanese and Malay languages, it is simply known as moringa.

Research conducted by [1] reveals that moringa leaves are rich in phenolic compounds, which play a crucial role as antioxidants, combating free radical damage. Specifically, fresh moringa leaves contain about 3. 4% phenol, while the concentration in extracted moringa leaves is approximately 1. 6% [2]. Additionally, a study by [3] indicates that moringa leaf extract comprises 8. 22% tannins, 1. 75% saponins, and 0. 19% phenols. Moringa leaves are also known to contain various bioactive components, including flavonoids, saponins, tannins, and polyphenols, which exhibit antimicrobial properties [4].

The antibacterial action of these bioactive compounds involves increasing the permeability of bacterial cell walls, leading to damage of the bacterial cell membranes and eventual lysis of the cells [5].

Turmeric is rich in curcuminoids, the natural pigments that contribute to its vibrant orange-yellow hue, making up approximately 2. 5% to 6% of its composition (Winarto, 2004). The primary constituents found in turmeric rhizomes include essential oils, curcumin, resin, oleoresin, desmethoxycurcumin, bisdesmethoxycurcumin, as well as fats, proteins, calcium, phosphorus, and iron [6]. Among the various fractions of curcuminoids, curcumin stands out as a key compound. Furthermore, turmeric rhizomes contain essential oils, starch, bitter compounds, resins, cellulose, and several minerals, with essential oil content ranging from 3% to 5%. Additionally, turmeric possesses other coloring agents, such as monodesmethoxycurcumin and bisdesmethoxycurcumin, with each fresh rhizome containing around 0. 8% of these compounds [7].

Simplisia, also known as herbs, refers to dried natural substances utilized for therapeutic purposes. These materials remain in their unprocessed state, except where indicated otherwise. Typically, the drying temperature for simplisia does not exceed 60°C. The term "simplisia" denotes natural medicinal materials that retain their original form and have not undergone any alterations [8].

Extraction is a refined process that involves obtaining concentrated preparations by drawing active compounds from plant or animal sources, known as simplisia, using an appropriate solvent. Once the active components are extracted, the solvent is nearly completely evaporated, resulting in a mass or powder that adheres to established quality standards. The extraction of natural medicinal materials relies on the principles of dissolution, whereby the active substances initially contained within the cells are drawn into the solvent, creating a solution [9].

Extracts are created from simplisia that contain therapeutic or specific functional substances. These sources, which can be of either animal or plant origin, encompass a variety of compounds, some of which possess medicinal properties like alkaloids, glucosides, resins, essential oils, and fats.

The primary aim of extraction is to isolate and concentrate the maximum number of beneficial substances while discarding those that are ineffective. This not only simplifies their use and enhances absorption but also improves their taste, storage, and overall medicinal efficacy compared to the original simplisia [10].

In essence, simplisia consists of raw natural ingredients used in medicine, preserved in their dried state without any processing. Simplisia is classified into three main categories: vegetable simplisia, animal simplisia, and mineral simplisia [11].

The essential oil content in turmeric typically ranges from 3% to 5%. Additional color compounds, including monodesmethoxycurcumin and bisdesmethoxycurcumin, are also present; each fresh rhizome contains about 0. 8% of these three curcuminoid compounds. Overall, the rich composition of turmeric contributes to its wide range of health benefits and culinary uses.

Gel or jelly is a semi-solid system characterized by a suspension of small organic particles or large organic molecules embedded in a liquid. It can also be described as a semi-solid dispersion made up of either small inorganic particles or large organic molecules soaked in liquid [1].

While gels typically contain water, they can also incorporate ethanol and oils as carrier phases. These preparations are generally clear and translucent, housing active ingredients in a dissolved state. Common gelling agents used in the formulation of gels include carbomer 940, hydroxypropyl cellulose, and hydroxy methyl cellulose.

A peel-off gel mask is a cosmetic skincare formulation that takes the form of a gel and dries on the skin after application. Once dried, it creates a flexible, transparent film that can be easily peeled away. Research conducted by [12] indicates that the highest average inhibition zone is observed at a turmeric rhizome extract concentration of 45%, yielding a diameter of 12. 5 mm, which is classified as a strong inhibitory response. Specifically, this 45% turmeric extract gel preparation demonstrates an inhibition zone diameter of 19 mm, effectively inhibiting the growth of Staphylococcus aureus bacteria.

Antibacterial agents are compounds that can disrupt bacterial growth or kill harmful microbes by interfering with their metabolic processes. The mechanisms of these antibacterial compounds involve inhibiting cell wall synthesis, compromising the permeability of bacterial cell walls, blocking enzyme activity, and preventing the synthesis of nucleic acids and proteins.

Staphylococcus aureus is a gram-positive bacterium that appears round and ranges from 0. 7 to 1. 2 μm in diameter. This bacterium is particularly resilient compared to non-spore-forming bacteria and can survive for 6 to 14 weeks in a dehydrated state on various surfaces, including thread, paper, cloth, and even in pus.

Peel-off gel masks are not only easy to remove, lifting away like flexible membranes [4], but they also have the added benefits of relaxing facial muscles, refreshing the skin, and providing moisture and softness. The findings from [1] further emphasize the efficacy of turmeric rhizome extract in skincare, particularly in combating skin bacteria like Staphylococcus aureus. Masks are specialized treatments designed to enhance skin tone and nourish the skin through various cosmetic ingredients. They provide numerous benefits for facial care, including hydration, stimulation of skin cells, and the removal of dirt and dead skin cells. Additionally, these masks help normalize skin affected by acne and dark spots, reduce excess oil, prevent and diminish wrinkles and hyperpigmentation, and improve blood circulation [6], [7].

2. METHODS

The research design employed is a quasi-experimental approach, which incorporates controls but is unable to fully regulate external variables that may influence the outcomes of the experiment. This study utilizes the Disc Diffusion method.

Conducted at the Phytochemistry and Microbiology Laboratories of the Jambi Ministry of Health Polytechnic, within the Department of Pharmacy, the research leverages a variety of tools, including a mortar and pestle, a complete set of glassware (Pyrex), an electronic scale (And-GF 3000), a knife, a blender (Miyako), stirring rods, pH paper, object glass slides, round glass slides, a thermometer, aluminum foil, and a water bath.

The active substances investigated in this research consist of Moringa leaf extract (Moringa Oleifera L.) and turmeric extract (Curcuma Domestica Val), along with several supplementary ingredients, which include Polyvinyl Alcohol, HMPC, Propylene Glycol, Propyl Paraben, Methyl Paraben, ethanol, and distilled water.

Avocado seed extract peel-off gel mask formula (Yulin, 2015 in Sutriningsih et al., 2017).

Ingredient Name	Function	Formula (%)
Avocado seed extract	Active ingredient	1,6
Polyvinyl alcohol	Film-forming	12
HMPC	Gelling agent	2
Propylenglycol	Solvent	15
Methyl paraben	Preservative	0,05

Propyl paraben	Preservative	0,05
Ethanol 96%	Solvent	8
Distilled water ad	Solvent	100

Modified Formula

Moringa Leaf and Turmeric peel-off gel mask formula

Ingredient Name	F 1	F 2	F 3	F 4	F 5
Moringa leaf extract	7%	6%	5%	4%	3%
Turmeric extract	3%	4%	5%	6%	7%
Polyvinyl alcohol	6	6	6	6	6
HMPC	2,5	2,5	2,5	2,5	2,5
Propylenglycol	7,5	7,5	7,5	7,5	7,5
Methyl paraben	0,025	0,025	0,025	0,025	0,025
Propyl paraben	0,025	0,025	0,025	0,025	0,025
Ethanol 96%	4	4	4	4	4
Distilled water ad	50	50	50	50	50

3. RESULTS AND DISCUSSION

The research conducted between June 14 and July 1, 2021, at the Pharmacognosy and Microbiology Laboratories of the Jambi Ministry of Health Polytechnic, specifically in the Pharmacy Department, focused on the "Inhibition Test of a Peel-Off Gel Mask Combining Moringa Leaf Extract (Moringa Oleifera L.) and Turmeric Extract (Curcuma Domestica Val) Against Staphylococcus Aureus Bacteria." The results of this study yielded the following.

3.1 Preparing Moringa Leaf Extract

The preparation of moringa leaf extract involves the maceration method utilizing alcohol as a solvent. Alcohol is a polar solvent, making it effective in attracting compounds such as alkaloids, flavonoids, and tannins. To create the extract, we used 2000 grams of macerated moringa leaves combined with 96% alcohol. This process yielded 100 grams of extract, resulting in a yield of 66. 6%.

Table 1. Evaluation of moringa dry simplisia

Fresh Moringa leaves	Drying time	dried simplisia	Yield
2000 gr	7 hari	200 gr	10%

Table 2. Evaluation of moringa leaf extract

Powdered simplisia	**Extract**	**Randemen**
150gr	100 gr	66,6%

Table 3. Screening test results of moringa leaf extracts

Identification	**Reagent**	**Comparator**	**Observation**	**Result**
Flavonoids	Extract + NaOH 10%	Orange/orange	Formed orange colour	+
Tannins	Extract + FeCl3	Green or blue-black colour	Formed green-black colour	+

Alkaloid	Extract + Meyer	White precipitate	Formed White precipitate	+
Triterpenoids/Steroids	Extract + HCl (*p*) + serbuk Mg	Yellow Colour	Formed Yellowish Green Colour	+

The analysis of active compounds extracted from turmeric revealed the presence of flavonoids, indicated by the formation of a green color. Additionally, the presence of tannins was confirmed by the appearance of a dark blue color, while the presence of alkaloids was evidenced by the formation of a white precipitate.

3.2 Testing Parameters for the Peel-Off Gel Mask with a Combination of Moringa Leaf and Turmeric Extracts

Table 4. Results of the Organoleptic Testing for Peel-Off Masks

Mask Formula	Color	Odor	Shape	Parameters
*Formula 1	Yellowish Moss Green	Strong Moringa Leaf Aroma	Very Thick	Exhibits a semi-solid form with a distinct herbal scent, and is colored similarly to powdered herbal ingredients (Purwanto et al., 2013). |
*Formula 2	Yellowish Green	Characteristic Moringa Aroma	Very Thick	
*Formula 3	Darker Yellowish Green	Combined Aroma of Both	Very Thick	
*Formula 4	Orange	Characteristic Turmeric Aroma	Very Thick	
*Formula 5	Orange pekat	Characteristic Turmeric Aroma	Very Thick	

Description*: meets the requirements

Table 5. Results of Peel-Off Mask Homogeneity Test

Masker Formulation	Homogeneity	Parameter
* Formula 1	Homogeneous	A 1-gram sample of the mask was weighed and applied to a clean, dry glass slide to form a thin layer. The slide was then covered with a cover slip. The peel-off gel mask is considered homogeneous if there are no visible coarse particles, the texture appears smooth, and there are no clumps. The physical homogeneity test follows the method described by Ansel et al. (1989) as referenced in Luthfiyana et al. (2019).
* Formula 2	Homogeneous	
* Formula 3	Homogeneous	
* Formula 4	Homogeneous	
* Formula 5	Homogeneous	

Description*: meets the requirements

The results of the homogeneity testing indicated a uniform distribution, with no coarse grains detected, demonstrating that the preparation is well dispersed.

pH Test Results

Table 6. pH Test Results for Peel-Off Masks

Masker Formulation	Ph	Parameter
* Formula 1	5	The pH measurement was carried out by immersing a pH meter into a sample of the gel peel-off mask made from Moringa leaf and turmeric. For the test, 1 gram of the formulation was dissolved in 10 mL of water, and the pH was recorded using the pH
* Formula 2	5	
* Formula 3	5	

* Formula 4	5	meter. It is essential for the pH of the gel peel-off mask to align with the skin's natural pH range of 4. 5 to 8. 0 (Indradewi Armadany and Sirait, n. d.)
* Formula 5	5	

Note: This product meets the required standards.

The pH testing yielded a result of 5. The pH of the peel-off gel mask formulation should fall within the range of 4. 5 to 8. 0 to ensure it does not cause irritation to the skin.

3.3 Results of Drying Time Tests

Table 7. Drying Time Results for Peel-Off Masks

Mask Formula	Drying Time	Parameter
*Formula 1	15 minutes	A gel of 0. 2 g was evenly applied to the surface of a glass object to create a thin layer, approximately 1 mm thick. The gel was allowed to dry until it could be peeled off. The total time required was recorded (Wardani H, Oktaviani R, 2016). According to Slavtcheff (2000), the standard drying time for formulations should range between 15 to 30 minutes.
*Formula 2	15 minutes	
*Formula 3	15 minutes	
*Formula 4	15 minutes	
*Formula 5	15 minutes	

Description *: Meets the drying time requirement of up to 15 minutes. Testing of the drying time for the 5 formulations resulted in a consistent duration of 15 minutes.

3.4 Results of Spreadability Test

Table 8. Results of Spreadability Test

Load Weight (gr)	F1 (cm)	F2 (cm)	F3 (cm)	F4 (cm)	F5 (cm)	Parameter
0	1,5	1,7	1,4	1,6	1,4	The optimal diameter for comfortable use in semi-solid formulations is 5-7 cm (Parwanto et al., 2013).
5	1,8	2,0	1,7	1,9	1,7	
25	2,5	2,4	2,2	2,4	2,2	
125	5,1	5,0	4,9	5,0	4,8	

Based on the table above, the formulas that meet the requirements are Formula 1, Formula 2, and Formula 4. In contrast, Formula 3 and Formula 5 do not meet the criteria.

3.5 Results of Diameter Measurements for Bacteriostatic Activity

Table 9. Diameter Measurements of Inhibition Zones Induced by Peel-Off Masks Against the Growth of *Staphylococcus aureus*

Replicate Count (p)	Inhibition Zone Diameter (mm)					(Control+) clindamycin	Control- (aquadest)	Alkohol 96%
	F1	F2	F3	F4	F5			
P1	12,5	12,4	11,9	12,1	11,8	34	0	2,5
P2	12,4	12,2	12,2	11,9	12,1	34	0	2,6
P3	12,3	12,3	12,1	11,7	11,6	34	0	2,3
P4	12,5	11,9	11,8	11,8	11,5	34	0	2,8
P5	12,5	11,8	12	11,7	11,3	34	0	2,2
Average Diameter (mm)	12,44	12,14	12	11,84	11,66	34	0	2,48

Description:
P: Repetition

F1: Formula 1 - Peel-off Gel Mask with a concentration of 7% / 3%
F2: Formula 2 - Peel-off Gel Mask with a concentration of 6% / 4%
F3: Formula 3 - Peel-off Gel Mask with a concentration of 5% / 5%
F4: Formula 4 - Peel-off Gel Mask with a concentration of 4% / 6%
F5: Formula 5 - Peel-off Gel Mask with a concentration of 3% / 7%
All mask formulas fall under the strong category.

The measurements reveal the diameter of the inhibition zones created by peel-off masks against the growth of *Staphylococcus aureus*. The average diameters were recorded, demonstrating the varying levels of antibacterial effectiveness compared to the controls.

Table 10. of Category for Resistance Zone Diameter

Diameter	Resistance Strength
≤ 5 mm	WeakModerate
6 – 10 mm	Sedang
11 – 20 mm	Strong
≥ 21 mm	Very Strong

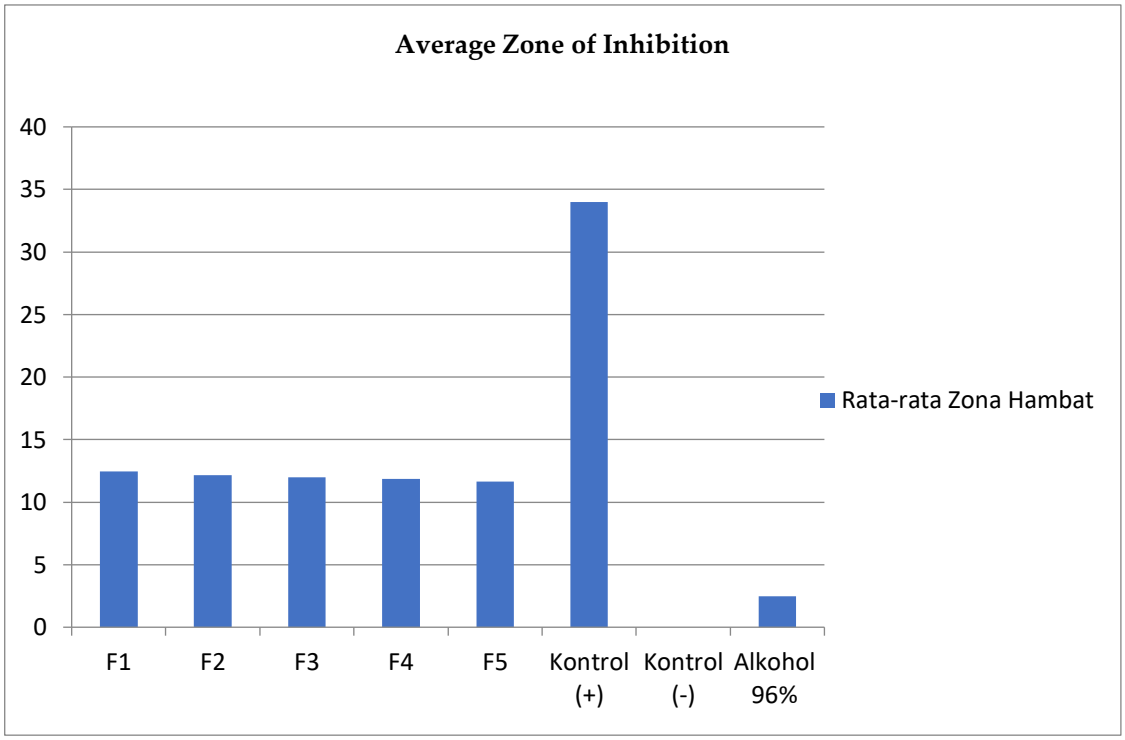

Figure 1. Zone of Inhibition

- F1: Formula 1 Peel-off Gel Mask with a concentration of 7% / 3%
- F2: Formula 2 Peel-off Gel Mask with a concentration of 6% / 4%
- F3: Formula 3 Peel-off Gel Mask with a concentration of 5% / 5%
- F4: Formula 4 Peel-off Gel Mask with a concentration of 4% / 6%
- F5: Formula 5 Peel-off Gel Mask with a concentration of 3% / 7%

K+: Positive control using clindamycin antibiotic
- K-: Negative control using Aquadest

Discussion

1. **Phytochemical Screening of Moringa Leaf Extract**

The results of the phytochemical screening reveal that Moringa leaf extract is rich in several bioactive compounds, including flavonoids, tannins, alkaloids, and triterpenoids/steroids. The presence of flavonoids is indicated by a color change to a yellowish-orange hue, resulting from the reduction of the benzopyrone nucleus in the flavonoid structure. Tannins are identified by a color shift to a blackish-green shade, which occurs when tannins react with FeCl3 to form a complex compound. Alkaloids are recognized by the formation of a white precipitate, a byproduct of the potassium-alkaloid complex that forms when Mayer's reagent interacts with alkaloid compounds. Lastly, triterpenoids/steroids are confirmed by the appearance of a yellowish-green color, attributed to the oxidation reaction within the terpenoid/steroid group that leads to the development of conjugated double bonds, specifically pentaenilic compounds [9].

2. Phytochemical Screening of Turmeric Extract

The analysis of turmeric extract also indicates the presence of flavonoids, tannins, and alkaloids. Similar to Moringa, the presence of flavonoids is confirmed through a color change to yellowish-orange, resulting from the reduction of the benzopyrone nucleus. Tannins exhibit a blackish-green color change in the presence of FeCl3, highlighting their interaction to form a complex compound. The identification of alkaloids is marked by the formation of a white precipitate due to the potassium-alkaloid complex formed in the reaction between Mayer's reagent and alkaloid compounds.

3. Parameter Testing for Peel-Off Gel Mask Containing Moringa Leaf and Turmeric Extracts

In the next phase, we will assess the characteristics and efficacy of a peel-off gel mask formulated with a combination of Moringa leaf extract and turmeric. This test aims to evaluate the synergistic effects of these two potent natural extracts in skincare applications.

Organoleptic Test

In this study, we conducted an organoleptic evaluation of peel-off gel mask preparations containing a blend of moringa and turmeric leaf extracts. This assessment involved examining the product's shape, color, and aroma, relying on the five human senses as essential tools to gauge the quality of the mask preparations. Ideal mask quality is characterized by a semi-solid consistency, appealing color, and scent reflective of the active ingredients used. Observations from the organoleptic testing revealed that varying concentrations of the active extracts influenced the aroma significantly. Specifically, as the concentration increased, the scent of moringa and turmeric became more pronounced and distinctive. In Formulation 1, the mask displayed a yellowish moss green color with a strong, characteristic fragrance of moringa and a very thick texture. Formulation 2 exhibited a yellowish green hue accompanied by a robust moringa scent. Formulation 3 showed a more vibrant yellowish green color and a pronounced smell of both moringa and turmeric. For Formulation 4, the color shifted to orange, accompanied by a notable turmeric aroma, while Formulation 5 presented a thick orange appearance with an even stronger turmeric scent. When evaluating the texture, all five formulations displayed similar consistencies and viscosities, due to the uniform concentration of HPMC used across the board.

4. Homogeneity Test

The homogeneity test was performed to determine the uniformity of the prepared mixture. This assessment involves checking for the presence or absence of fine or coarse clumps and ensuring that all components are well-integrated [10]. Ensuring homogeneity is crucial to prevent irritation and to guarantee that the active ingredients are evenly distributed upon application to the skin, thus achieving dosage uniformity. In our findings, the peel-off gel mask preparation consisting of a combination of moringa leaf extract and turmeric demonstrated excellent homogeneity. The uniformity of a preparation relies on the similarity of the properties between the base and the active

substances. If significant differences exist between the base and the active ingredients, it could lead to clumping, resulting in a dosage form that contains larger, uneven particles.

5. Phytochemical Screening of Moringa Leaf Extract

The phytochemical screening of Moringa leaf extract revealed the presence of several bioactive compounds, specifically flavonoids, tannins, alkaloids, and triterpenoids/steroids. The detection of flavonoids is indicated by a color change to a yellowish-orange hue, resulting from the reduction of the benzopyrone nucleus inherent in the flavonoid structure. Tannins are identified through a color change to a blackish-green, a reaction that occurs when tannins interact with FeCl3, leading to the formation of a complex compound. The presence of alkaloids is confirmed by the formation of a white precipitate, which results from the reaction between Mayer's reagent and the alkaloid compounds, producing a potassium-alkaloid complex. Finally, the indication of steroids/triterpenoids is marked by a yellowish-green color, which arises from oxidative reactions within the terpenoid/steroid group, specifically through the establishment of conjugated double bonds in pentaenilic compounds [11].

6. Phytochemical Screening of Turmeric Extract

Similar tests conducted on turmeric extract also confirmed the presence of flavonoids, tannins, and alkaloids. The positive identification of flavonoids in turmeric follows the same pattern, showing a yellowish-orange color change due to the reduction of the benzopyrone nucleus. The detection of tannins similarly results in a blackish-green color shift due to their interaction with FeCl3, forming a complex. Alkaloids are again evidenced by the formation of a white precipitate, resulting from the reaction between Mayer's reagent and alkaloid compounds.

7. Parameter Testing of Peel-Off Gel Mask Combining Moringa Leaf Extract and Turmeric

a. **Spreadability Test**

The spreadability test assesses how easily the peel-off gel mask can be applied to the skin. An effective formulation should demonstrate a spreadability of 5-7 cm. The results showed that the spreadability of Formula 1, containing 7% Moringa leaf extract and 3% turmeric, was 5. 1 cm. Formula 2, with 6% Moringa and 4% turmeric, recorded a spreadability of 5 cm. Formula 3, featuring 5% Moringa and 5% turmeric, had a spreadability of 4. 9 cm. Formula 4, comprising 4% Moringa and 6% turmeric, achieved a spreadability of 5 cm, while Formula 5, with 3% Moringa and 7% turmeric, was measured at 4. 8 cm. Among the four formulas, Formula 1, Formula 2, and Formula 4 fell within the desired range of good spreadability. However, Formulas 3 and 5 did not meet the criteria.

b. Drying Time Test

To determine the efficacy of the peel-off gel mask, a drying time test was performed to evaluate how long it takes for the preparation to dry once applied to the skin. This assessment is crucial for ensuring user comfort and overall effectiveness of the product.

CONCLUSION

Based on the research findings, it can be concluded that the peel-off mask formulation combining moringa leaves and turmeric has a significant antibacterial effect against Staphylococcus aureus. The most effective formulation was identified as formulation 1, which consists of 7% moringa leaves and 3% turmeric, demonstrating a strong inhibition capacity measured at 12. 44 mm.

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BIOGRAPHIES OF AUTHORS

	Hj. Rahmah. Place of birth: Jambi, 10 April 1962. NIDN: 1010046201. Occupation as a lecturer in the Pharmacy Department of Poltekkes Kemenkes Jambi. Last Education Master of Biomedical Sciences. Email:hjrahmahstikba@gmail.com.HP: 081366290676

	Suryadi Imran, He completed his undergraduate education at Gadjah Mada University in 2003 as a professional nurse, then continued his Masters in Nursing Management, graduating in 2012. and is currently studying for a doctoral degree at Philipines Women's University. Works as a lecturer at two universities, Jambi University, and Adiwangsa Jambi University, apart from that he is active as an emergency training instructor and has published 3 books, namely a leadership management book, a health statistics book, and an anatomy and physiology book. suryadiimran72@gmail.com
	Shonia khoirunnisa, Place of Birth: Jambi, 06 May 2000 Occupation: Pharmacy Vocational Student at Bintang Farma Pharmacy. Education: D III Pharmacy. Address: Jl. KH. M Ja'far RT 06 Kel. Arab Melayu Kec. Pelayangan Jambi City. Mobile phone number: 089509861372 email: shoniaanisa@gmail.com