BIOMA: Berkala Ilmiah Biologi

Available online: https://ejournal.undip.ac.id/index.php/bioma/index

Antifungal activity of hair tonic extract from straw mushroom (*Volvariella volvacea*) against the growth of *Malassezia furfur*

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A B S T R A C T

Malassezia furfur (*M. furfur*) is one of several types of fungi that can cause the scalp to experience flaking, known as dandruff. Dandruff can be eliminated using anti-dandruff agents available on the market. In addition, there are natural ingredients that can act as antifungal agents against the fungus that causes dandruff. The straw mushroom (*Volvariella volvacea*) is one such fungus that contains secondary metabolites such as saponins, tannins, flavonoids, and alkaloids, which function as antifungal agents. This study was quantitative research using an experimental method and a completely randomized design (CRD), consisting of 6 treatments and 4 replicates in the form of positive control, negative control, and straw mushroom extract hair tonic with concentrations of 10%, 30%, 50%, and 70%. The parameters observed were the diameter of the inhibition zone, which indicated antifungal activity, and the evaluation of the hair tonic preparations (pH test, organoleptic test, skin irritation test, and viscosity test). The results of the study showed that the mushroom extract hair tonic had antifungal activity in inhibiting the growth of *M. furfur*. Based on the DNMRT test analysis, P0 (positive control) was significantly different from P1 (negative control) and the other treatments (P2, P3, P4, P5). This study concluded that there is activity in the hair tonic extract of straw mushrooms in inhibiting the growth of *M. furfur*, with the best concentration being 30%.

Keywords: Dandruff; fungi; inhibition zone; organoleptic

1. INTRODUCTION

Fungi are part of the biodiversity that grows extensively in Indonesia. The uniqueness of fungi lies in their various shapes, colors, and sizes. There are approximately 1,500,000 species of fungi in the world, consisting of macrofungi and microfungi. There are 28,700 identified species of macrofungi (Asri & Handayani, 2022:209). Fungi are organisms that do not have chlorophyll, so they cannot produce their own food. Fungi are organisms with cell walls composed of chitin, bodies formed by hyphae, and are eukaryotic organisms. Fungi absorb nutrients through their cell walls and secrete extracellular enzymes into the environment. Fungi grow in habitats such as wood, litter, tree branches, and logs, which are commonly found in forests (Manalu et al., 2022:3).

Fungi have both beneficial and harmful roles; some fungi are edible, while others can cause disease or infection. A number of fungi in Indonesia are commonly used as raw materials in food production. In addition to being used as food, fungi can also be used to make useful products such as raw materials for cosmetics and natural medicines. There are several types of fungi that are harmful to the body or other living things. One type of fungus that can be harmful is *M. furfur* (Novita et al., 2020:69).

M. furfur is one of several types of fungi that can cause skin disorders. *M. furfur* can cause a condition of the scalp that results in flaking like dandruff (pityriasis capitis). Pityriasis capitis is a scalp disorder characterized by an excessive layer of dead skin cells on the scalp, appearing as white or gray flakes scattered throughout the hair, often accompanied by itching, and causing aesthetic concerns (Putri et al., 2020:122). Hair conditions with excessive oil glands, warm and humid temperatures, and poor personal hygiene are ideal factors for the growth of *M. furfur* fungus and cause dandruff (Damayanti et al., 2024:96).

Dandruff usually occurs in hot and humid environments. Many Indonesians have experienced dandruff problems, triggered by the tropical climate, high temperatures, and high humidity (Aisyah et al., 2020:16). A survey conducted on the community of Sungkai Village, Bajubang District, Batanghari Regency, Jambi Province showed that 83.3% of the village community (54 people) had experienced dandruff problems, with 33.3% of them (15 people) saying that they had experienced dandruff problems for more than a year.

In general, dandruff on the human head can be treated using active anti-dandruff ingredients that contain keratolytic and antimicrobial agents such as zinc pyrithione (ZPT), sulfur, imidazole, selenium sulfide,

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Received: 5 July 2025, **Accepted:** 18 Jun 2026
Cite this article as: Cahyani *et al.* (2026) *BIOMA: Berkala Ilmiah Biologi*, 28(1): 99-113

ketoconazole, and salicylic acid. One anti-dandruff product on the market is Makarizo Advisor Hair and Scalp Tonic. However, long-term use of anti-dandruff active ingredients with high concentrations of chemicals can cause side effects such as irritation of the skin, eyes, and nose. In addition to anti-dandruff products on the market, there are several natural ingredients that are known to effectively eliminate dandruff and are safe for long-term use. The secondary metabolites in mushrooms, such as flavonoids, tannins, saponins, and phenols, are natural ingredients that inhibit the growth of M. furfur, the fungus that causes dandruff. The chemical compounds saponins and flavonoids function as anti-inflammatory, antioxidant, antibacterial, and antifungal agents (Astriani et al., 2023:96). Oyster mushrooms are fungi that contain secondary metabolites such as flavonoids, phenols, saponins, and tannins (Fadly et al., 2021:164). The area where oyster mushrooms are abundant is the village of Sungkai.

Sungkai Village is located in Bajubang Subdistrict, Batanghari Regency, Jambi Province. Geographically, it is located between 103030'59.3“ East Longitude and 01085'62.8” South Latitude with an area of 1,303.01 hectares. The majority of the population of Sungkai Village work as rubber and palm oil farmers, numbering 292 people. Oil palm farmers in Sungkai Village usually use empty oil palm bunches as fertilizer. These empty bunches become a medium for growing straw mushrooms, which usually grow well during the rainy season. Observations and interviews with Mr. Wendra, an oil palm farmer, revealed that straw mushrooms are commonly consumed. However, the people of Sungkai Village rarely use these mushrooms for consumption or to make other products. The lack of knowledge about the use of straw mushrooms in this area provides an opportunity for research as a new source of information.

2. MATERIAL AND METHODS

This study used quantitative research with an experimental method, and the results were obtained from observation and documentation. Observation was useful in directly observing the conditions of the research object. This study directly observed the diameter of the inhibition zone in each treatment. The observation of the diameter of the inhibition zone was carried out to see and measure the antifungal activity of the mushroom extract hair tonic in inhibiting the fungus M. furfur. Furthermore, an evaluation test of the hair tonic preparation will also be carried out to ensure the safety and quality of the hair tonic produced. The evaluation tests to be carried out include organoleptic tests, pH tests, viscosity tests, and skin irritation tests. Data collection will be carried out using observation sheets.

2.1 Study area

Research on the activity of hair tonic extract from straw mushrooms (*V. volvacea*) against the growth of *M. furfur* fungus as enrichment material for mycology practicums was conducted at the FKIP Biology Education Laboratory, the Faculty of Animal Husbandry Laboratory, and the Basic and Integrated Laboratory (UPT-LTD) of the University of Jambi. The research was conducted from January to March 2025.

2.2 Materials

This study used the necessary tools and materials obtained from the laboratory or other places. The tools used were digital scales, ovens, stirring rods, beakers, blenders, measuring cups, autoclaves, rotary evaporators, pH meters, Petri dishes, Bunsen burners, Erlenmeyer flasks, test tube racks, laminar air flow, vortex, tweezers, analytical balance, spray container, incubator, refrigerator, electric stove, microscope, rotary shaker, caliper, magnetic stirrer, and funnel. The materials used were straw mushroom extract, *M. furfur* mushroom culture, Makarizo advisor hair and scalp tonic, PDA media, PDB media, 70% ethanol, 96% ethanol, menthol, sodium metabisulfate, methyl paraben, propylene glycol, disodium EDTA (Na_2EDTA), distilled water, 0.9% NaCl, and 0.85% NaCl.

2.3 Antifungal activity of hair tonic extracted from straw mushrooms

The study of the antifungal activity of hair tonic extracted from straw mushrooms (*V. volvacea*) against the growth of *M. furfur* as enrichment material for mycology practicums is a quantitative study using experimental methods. The design used was a completely randomized design (CRD), which is the simplest experimental design, where CRD is appropriate when the materials, objects, and research media are homogeneous, the experiments are

completed at the same time, and are carried out in the same room (Fernandes, 2018: 210). The oyster mushroom (*V. volvacea*) extract used in the study was 10%, 30%, 50%, and 70% formulated in hair tonic. These extract concentrations were selected based on research by Syarifah 2019, which showed that *V. volvacea* had antibacterial activity against S. aureus, B. cereus, E. coli, and P. auregtinosa bacteria, with a high bacterial growth inhibition value at a concentration of 10%. Concentrations of 30%, 50%, and 70% were selected to evaluate the effectiveness of antifungal activity at higher concentrations. This study used extracts at the specified concentrations to further examine the antifungal activity of oyster mushroom extract in hair tonic.

The hair tonic formulation was developed based on research by Hindun et al. (2023:69), modified using ingredients such as 96% ethanol, menthol, methyl paraben, propylene glycol, Na_2EDTA, sodium metabisulfite, and distilled water. The selection of propylene glycol refers to research conducted by Aztriana et al. (2023:247), which can be used as a solubility and viscosity enhancer for hair tonic preparations so that the contact time of the preparation with the skin will be longer, thus increasing the chance of the preparation penetrating the skin. 96% ethanol was chosen because it can increase the penetration of the preparation into the skin. Disodium EDTA (Na_2EDTA) was used to stabilize the mixture of ingredients in the preparation so that it was homogeneous. In addition, Na_2EDTA can prevent unpleasant odors from fat-based preparations (Rizkuloh et al., 2023:50).

Methyl paraben is used as a preservative because the high water content in the hair tonic preparation can become a medium for microbial growth, while menthol provides a cooling sensation on the scalp, gives a fresh scent, and enhances penetration into the skin (Indriyani & Endrawati, 2021:22). Sodium metabisulfite is used as an antioxidant and to prevent oxidation that may occur in the preparation (Hindun et al., 2023:71). The mixture of several ingredients used in the manufacture of hair tonic is expected to produce a preparation that is not sticky and easy to apply to the hair.

This study involved 24 experimental units. The experiments were divided into 6 treatment groups and 4 repetitions. The following are the six types of treatments in this study:

P0: Makarizo advisor hair and scalp tonic (positive control)
P1: Formulation without extract (negative control)
P2: 10% straw mushroom extract + hair tonic formula
P3: 30% straw mushroom extract + hair tonic formula
P4: 50% straw mushroom extract + hair tonic formula
P5: 70% straw mushroom extract + hair tonic formula

2.5 Data analysis

The research data consists of the inhibition zone area and evaluation of hair tonic preparations, namely irritation tests, organoleptic tests, pH measurements, and viscosity tests. The inhibition zone and pH data were statistically analyzed using a completely randomized design (CRD). The results of the pH measurements and inhibition zone observations were analyzed using analysis of variance (ANOVA) with SPSS software. When there was activity from the treatment, a further test was conducted, namely the Duncan New Multiple Range Test (DNMRT) at a 95% confidence level. Viscosity tests were analyzed using the Kruskal-Wallis test, and when there were differences, they were followed up with the Mann-Whitney test. Meanwhile, descriptive analysis was used for organoleptic and irritation tests.

3. Results and Discussion

3.1 Hair tonic evaluation test

Measurements of the inhibition zone conducted in the antifungal activity test showed that the mushroom extract hair tonic had activity in inhibiting the growth of *M. furfur* fungus. The results of observations conducted over 3 days were then tested for normality and homogeneity, followed by ANOVA and DNMRT tests. The results of the ANOVA statistical analysis showed that Fcount>Ftable (12.865>3.10), so the null hypothesis was rejected, while the alternative hypothesis stating that there was activity of the hair tonic extract of the straw mushroom (*V. volvacea*) against the growth of the fungus *M. furfur* was accepted. This was followed by a further test using the

DNMRT test at a 95% confidence level (α=0.05) to determine significant differences in treatment. The results of the analysis of the diameter of the inhibition zone formed can be seen in Table.

Table 1. Diameter of the inhibition zone for each treatment of hair tonic formulated with straw mushroom extract

Treatment	Type of treatment	Average inhibition zone diameter (mm)
P0	Hair tonic "A"	9,08[a]
P1	Formulation without extract (negative control)	31,48[b]
P2	10% straw mushroom extract + hair tonic formula	34.73[bc]
P3	30% straw mushroom extract + hair tonic formula	36.49[cde]
P4	50% straw mushroom extract + hair tonic formula	39.07[de]
P5	70% straw mushroom extract + hair tonic formula	42.02[e]

Note: Numbers with the same lowercase letters indicate that there is no significant difference between treatments at the 95% confidence level based on the DNMRT test.

The DNMRT test analysis in Table 1 shows that there are variations in the letter notation for each treatment. The average diameter of the inhibition zone ranges from 19.08 mm to 42.02 mm. The largest diameter was produced by treatment P5 (70% straw mushroom extract + hair tonic formula) with a diameter of 42.02 mm. The diameter of P5 with the letter notation "e" shows a significant difference from treatments P0 and P1. In P0 or positive control with the letter notation "a", there is a significant difference from P1, P2, P3, P4, and P5, with a diameter of P0 being 19.08 mm. In P1 (formulation without extract) with the letter notation "b," the diameter of the inhibition zone formed was 31.48 mm. In the treatment of 10% straw mushroom extract + hair tonic formula (P2) with the letter notation "bc," the diameter of the inhibition zone formed was 34.73 mm. The treatment of 30% straw mushroom extract + hair tonic formula (P3) with the letter notation "cde" had an inhibition zone diameter of 36.49 mm. Meanwhile, the treatment of 50% straw mushroom extract + hair tonic formula (P4) with the letter notation "de" had an inhibition zone diameter of 39.07 mm. Figure 1 shows the results of observations of the inhibition zone of *M. furfur* fungal growth for positive control, negative control, and various concentrations of oyster mushroom extract hair tonic.

The organoleptic test results showed variations in aroma, color, and texture. The test was conducted in two observations, on the first and seventh days of storage, observing aroma, color, and texture. The results of the organoleptic test are presented in Table 2. The positive control treatment using Makarizo advisor hair and scalp tonic (P0) has a non-sticky texture, mint aroma, and clear color. Treatment P1 (formula without extract) has a non-sticky texture, mint aroma, and clear color. Treatment P2 (10% straw mushroom extract + hair tonic formula) has a non-sticky texture, distinctive mushroom aroma, and light brown color. Treatment P3 (30% straw mushroom extract + hair tonic formula) has a non-sticky texture, a distinctive mushroom aroma, and a dark brown color. Treatment P4 (50% straw mushroom extract + hair tonic formula) has a non-sticky texture, a distinctive mushroom aroma, and a dark brown color. Treatment P5 (70% oyster mushroom extract + hair tonic formula) has a non-sticky texture, a distinctive mushroom aroma, and a dark brown color. The results of the organoleptic test observations can be seen in Figure 2.

Based on the viscosity test using a viscometer, as well as the viscosity test conducted using the Kruskal-Wallis test, it was found that the Asymp. Sig value of 0.000 < 0.05, indicating a difference, so a further test was conducted, namely the Mann-Whitney test, which showed that there was a difference in viscosity between P1 and P0, P2, P3, P4, and P5. The viscosity test was conducted to determine the viscosity of each treatment of the hair tonic produced. The viscosity test results can be seen in Table 3.

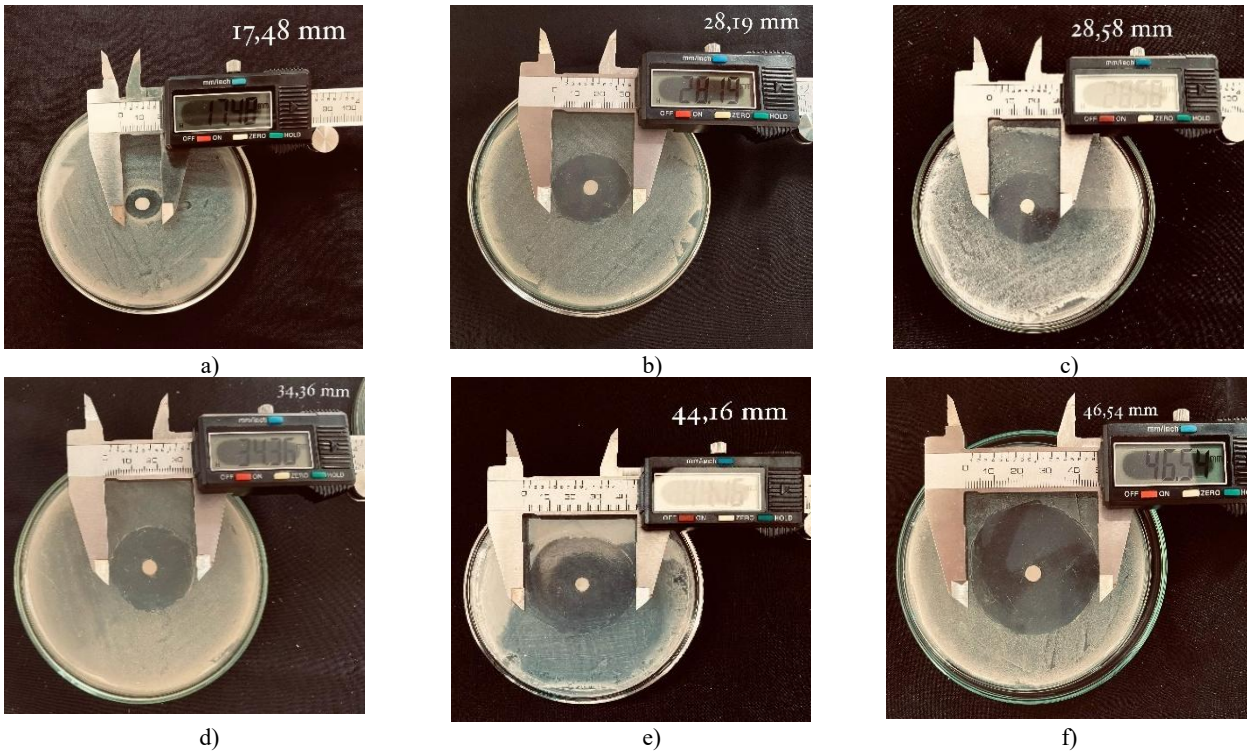


Figure 1. The inhibition zone between six treatments of hair tonic formulated with straw mushroom extract
Note: (a) Makarizo advisor hair and scalp tonic (P0), (b) Formulation without extract (P1), (c) 10% straw mushroom extract + hair tonic formula (P2), (d) 30% straw mushroom extract + hair tonic formula (P3), (e) 50% straw mushroom extract + hair tonic formula (P4), (f) 70% straw mushroom extract + hair tonic formula (P5)

Table 2. Organoleptic characteristics of six hair tonic formulations containing straw mushroom extract

Treatment	Aroma	Color	Texture
P0	Mint (fresh and cool)	Clear	Non-sticky
P1	Mint (fresh and cool)	Clear	Non-sticky
P2	Distinctive mushroom aroma	Light brown	Non-sticky
P3	Distinctive mushroom aroma	Dark brown	Non-sticky
P4	Characteristic mushroom aroma	Dark brown	Non-sticky
P5	Characteristic mushroom aroma	Dark brown	Non-sticky

Note: P0 = Makarizo advisor hair and scalp tonic, P1 = Formulation without extract, P2 = 10% straw mushroom extract + hair tonic formula, P3 = 30% straw mushroom extract + hair tonic formula, P4 = 50% straw mushroom extract + hair tonic formula, P5 = 70% straw mushroom extract + hair tonic formula

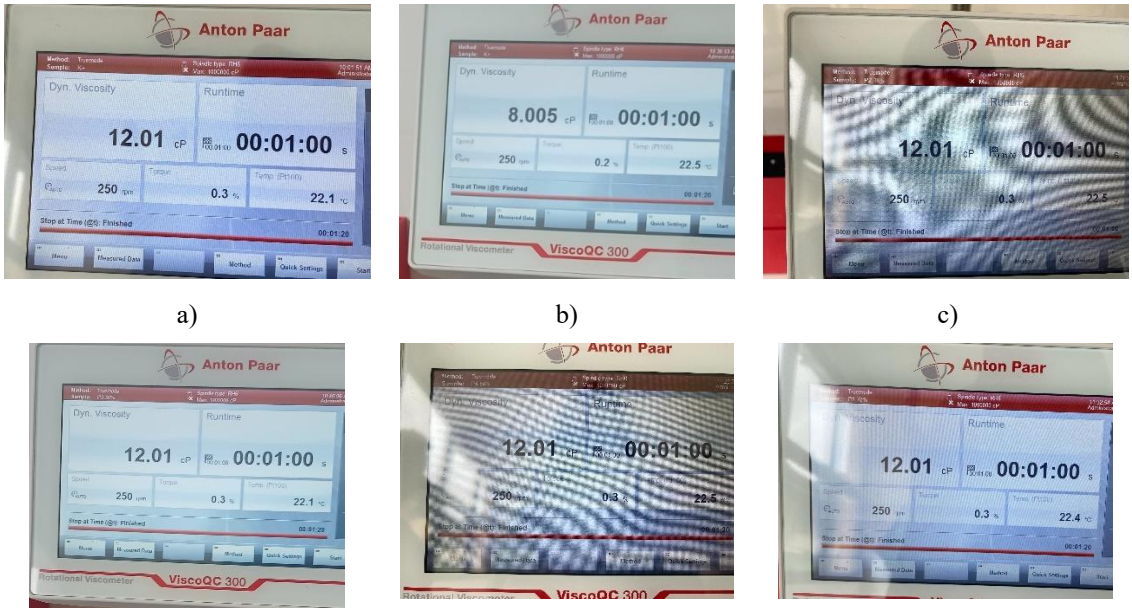
Table 3. Viscosity test results

Treatment	**Type of treatment**	**Viscosity (cP)**
P0	Hair tonic "A"	12.01a
P1	Formulation without extract (negative control)	8.005b
P2	10% straw mushroom extract + hair tonic formula	12.01a
P3	30% straw mushroom extract + hair tonic formula	12.01a
P4	50% straw mushroom extract + hair tonic formula	12.01a
P5	70% straw mushroom extract + hair tonic formula	12.01a

Note: a,b= similar letter notation means there is no significant difference according to the Mann-Whitney test.

a) b) c) d) e) f)

Figure 2. Organoleptic visualization of hair tonic formulated with straw mushroom extract
Note: (a) Makarizo advisor hair and scalp tonic (P0), (b) Formulation without extract (P1), (c) 10% straw mushroom extract + hair tonic formula (P2), (d) 30% straw mushroom extract + hair tonic formula (P3), (e) 50% straw mushroom extract + hair tonic formula (P4), (f) 70% straw mushroom extract + hair tonic formula (P5)



a) b) c)

d) e) f)

Figure 3. Viscosity observations: (a) makarizo advisor hair and scalp tonic (p0), (b) formulation without extract (p1), (c) 10% straw mushroom extract + hair tonic formula (p2), (d) 30% straw mushroom extract + hair tonic formula (p3), (e) 50% straw mushroom extract + hair tonic formula (p4), (f) 70% straw

The viscosity observations in Table 3 show that the viscosity of treatment P0 (Makarizo advisor hair and scalp tonic), which is 12.01 cP, is similar to P2 (10% straw mushroom extract + hair tonic formula), P3 (30% straw mushroom extract + hair tonic formula), P4 (50% straw mushroom extract + hair tonic formula), and P5 (70% straw mushroom extract + hair tonic formula). Meanwhile, there is a difference in viscosity in treatment P1 (formula without extract), which is 8.005 cP. The viscosity observation results can be seen in Figure 3.

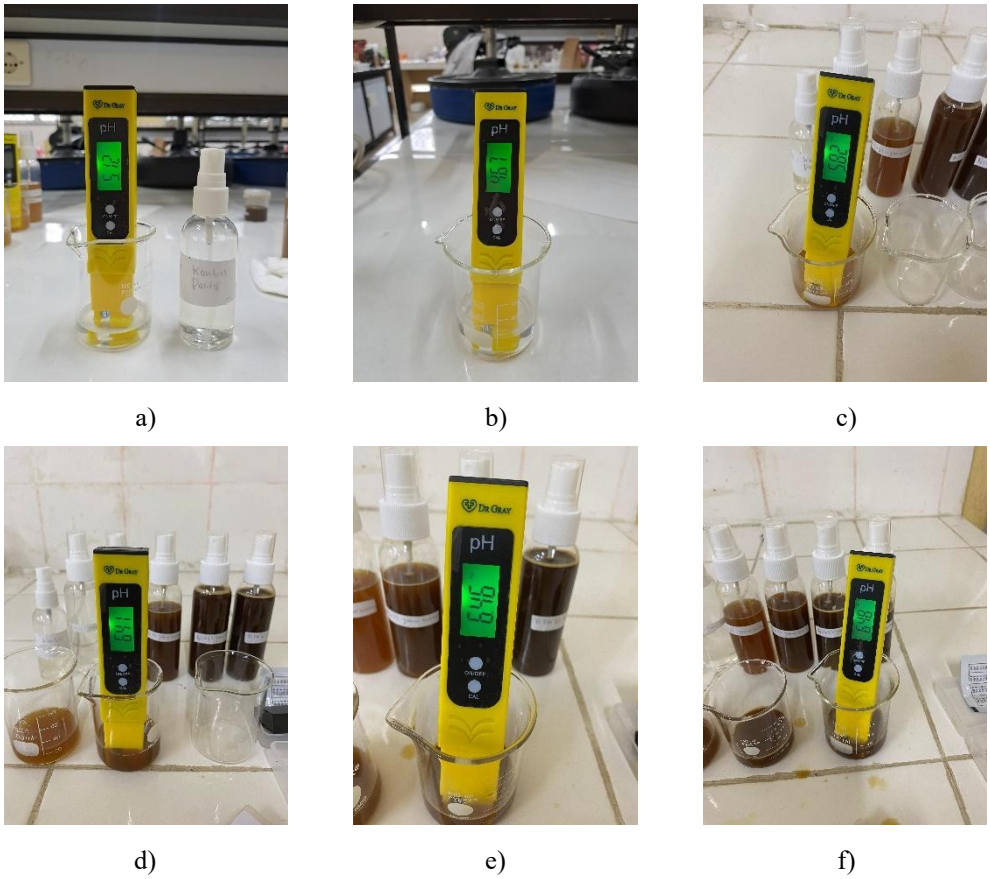
The pH test conducted on the hair tonic showed that all treatments had an effect on the pH value produced. The ANOVA test results showed that Fcount>Ftable (3,524.028>3.10), indicating that there was a significant difference in the mushroom extract hair tonic treatments. Furthermore, a follow-up test was conducted using the

DNMRT test to determine the significant difference between extract groups with a 95% confidence level (0.05). Table 4 shows the pH results of the straw mushroom extract hair tonic with various types of extracts.

Table 4. pH test results

Treatment	Type of treatment	Average pH
P1	Formulation without extract (negative control)	4,67a
P0	Hair tonic "A"	5,09b
P2	10% straw mushroom extract + hair tonic formula	5,82c
P3	30% straw mushroom extract + hair tonic formula	6,41d
P4	50% straw mushroom extract + hair tonic formula	6,42de
P5	70% straw mushroom extract + hair tonic formula	6,46e

Note: Different lowercase letters indicate significant differences between treatments at the 95% confidence level based on the DNMRT test.



a) b) c)

d) e) f)

Figure 4. pH measurement results: (a) makarizo advisor hair and scalp tonic (p0), (b) formulation without extract (p1), (c) 10% straw mushroom extract + hair tonic formula (p2), (d) 30% straw mushroom extract + hair tonic formula (p3), (e) 50% straw mushroom extract + hair tonic formula (p4), (f) 70% straw mushroom extract + hair tonic formula (p5)

The results of the pH test data analysis in Table 4 show that there are different pH variations for each treatment. The pH range of the straw mushroom extract hair tonic was between 4.67 and 6.46. The analysis results showed that the highest pH was found in treatment P5 (70% straw mushroom extract + hair tonic formula) and was significantly different from treatments P0, P1, and P2, but was similar to P3 and P4. Treatment group P(1) (formula without extract) had an average pH of 4.67, which was significantly different from treatment P0 Hair tonic "A" at 5.09 and treatment P2 (10% oyster mushroom extract + hair tonic formula) at 5.82, and was highly

significantly different from treatments P3 (6.41), P4 (6.42), and P5 (6.46). The pH test results can be observed in Figure 4.

The results of irritation testing on 10 panelists who met the inclusion criteria showed no skin irritation in all treatments. This test used a closed irritation test method by spraying hair tonic onto gauze, placing it on the inner arm after covering it with a plaster, and leaving it for 24 hours. Then, the presence or absence of erythema and edema on the skin of the panelists who had been given the treatment was observed. The observation results showed that each treatment was safe for use on the panelists and mushroom extract hair tonic has the potential to be developed as a safe antifungal product. Based on Table 5, it is known that no skin irritation was found in the 10 panelists who were tested with mushroom extract hair tonic, positive control, and negative control.

Table 5. Irritation test observation results

Treatment	Type of Treatment	Indications of irritation	
		Erythema (Redness)	Edema (Swelling)
P0	Hair tonic "A"	-	-
P1	Formulation without extract (negative control)	-	-
P2	10% straw mushroom extract + hair tonic formula	-	-
P3	30% straw mushroom extract + hair tonic formula	-	-
P4	50% straw mushroom extract + hair tonic formula	-	-
P5	70% straw mushroom extract + hair tonic formula	-	-

Description: (-) no reaction occurs, (+) reaction occurs

3.2 Inhibition zone of hair tonic from *Volvariella volvacea* extract

A hair tonic formulated with *Volvariella volvacea* extract demonstrated potent antifungal activity against *Malassezia furfur* based on the inhibition zone formed in this study. These results are consistent with previous findings that higher concentrations of straw mushroom extract enhance microbial inhibition (Misa, 2023). This antifungal effect is attributed to the synergistic action of flavonoids, saponins, alkaloids, and tannins identified in the extract (Fadly et al., 2021:164). Flavonoids inhibit microbial protein synthesis (Hardani et al., 2020; Ardiansah et al., 2025:150), saponins disrupt cytoplasmic membranes (Suharto et al., 2012:93), alkaloids damage fungal membranes by binding to ergosterol (Sadiah et al., 2022; Maisarah & Chatri, 2023:232), and tannins inhibit ergosterol biosynthesis (Agustina et al., 2021:145). According to the antifungal activity classification of Simanjuntak & Butar-Butar (2019:95), all extract-based formulations demonstrated very strong antifungal activity, outperforming commercial positive controls.

A straw mushroom-based hair tonic demonstrated stronger antifungal activity against *M. furfur* than a commercial product that primarily relies on piroctone olamine as the active antifungal agent (Dewi et al., 2025:15). This straw mushroom-based hair tonic formulation utilizes natural bioactive compounds from V. volvacea, offering a promising alternative with lower chemical exposure. The high antifungal efficacy was further supported by optimized extraction and testing protocols, including 70% ethanol maceration to maximize secondary metabolite recovery (Pradana et al., 2023:375; Yulianti et al., 2020:42), standardized fungal inoculum using 0.5 McFarland standard (Rosmania & Yanti, 2020:77), incubation at optimal growth temperature of M. furfur (Alawiyah et al., 2016), and PDA medium to ensure reliable fungal growth (Mardiah & Fatmawati, 2020).

3.3 Physicochemical characteristics and safety of hair tonic made from *V. volvacea*

The organoleptic test provide information that the concentration of extract added in the manufacture of hair tonic affects the organoleptic characteristics in terms of color and aroma. The higher the concentration of extract used, the more intense the color of the hair tonic and the stronger the aroma of the hair tonic produced. This is in line with research conducted by Putri (2021), which shows that an increase in the concentration of extract will affect the organoleptic properties of the preparation, especially the intensity of the color and aroma, which become more distinctive.

Different concentrations of extract in the manufacture of straw mushroom extract hair tonic have no effect on the resulting texture. Treatment of each hair tonic with the addition of straw mushroom extract, negative control, and positive control shows that the texture is the same, i.e., non-sticky. The non-sticky texture makes the hair tonic easy to spray and does not leave a sticky feeling, which is also in accordance with the SNI regarding the non-sticky texture of hair tonic (SNI 16-4955-1998). The hair tonic formulation in liquid form with non-sticky characteristics, similar to a semisolid formulation, prevents residue buildup and reduces dandruff formation (Candani et al., 2024).

The viscosity test conducted on each treatment showed that there were variations in viscosity. This could be due to differences in the components of the materials used. The viscosity of hair tonic is influenced by the particle content in the solution, the amount of thickening agent, and the content of the fungus used. A large number of particles and thickening agents in the material will experience friction in the solution, thereby increasing viscosity (Dwiloka et al., 2024). Ingredients such as propylene glycol can increase the viscosity of hair tonic. Propylene glycol is a thickener that has the ability to increase the viscosity of a preparation (Daradasih & Devi, 2023:50).

The Indonesian National Standard (SNI) for the viscosity range of a good hair tonic is less than 5 cPs. Based on viscosity observations conducted using a rotational viscometer, each treatment had a viscosity value above 5 cPs, indicating that none of the treatments met the SNI criteria for a good hair tonic. The positive control (P0) used in this study was a hair tonic available on the market. The observation results showed that Makarizo advisor hair and scalp tonic had a viscosity value of 12.01 cP, which was similar to treatments P2, P3, P4, and P5, which are mushroom extract hair tonics with concentrations of 10%, 50%, and 70%, respectively. Meanwhile, treatment P1 had the lowest viscosity value of 8.005 cP; in this treatment, mushroom extract was not added (negative control). Hair tonic viscosity values above 5 cPs are safe for use on the scalp, as the ideal viscosity for hair tonic preparations is close to 15,733 cPs (Datulamban et al., 2024:115).

High viscosity will affect the spreadability of the preparation. The higher the viscosity of a preparation, the lower its spreadability. Conversely, if the viscosity is low, the spreadability will be faster. Different viscosities in hair tonics can be caused by the composition of the hair tonic itself, as well as the temperature and duration of storage. These factors can affect the physical stability of the active ingredients in the preparation (Dwiloka et al., 2024:3).

The higher the viscosity, the greater the resistance. The viscosity value is greatly influenced by the thickening agent and particle size (Mutmainah et al., 2014:104). In addition, the content of straw mushrooms added to hair tonic also has an effect on viscosity. Straw mushrooms contain bioactive molecules, namely polysaccharides (Purwita et al., 2024:181). The main polysaccharide found in straw mushrooms is beta-glucan. Beta-glucan can cause straw mushroom extract hair tonic to have high viscosity, because this type of polysaccharide can form a gel, making the hair tonic thicker (Mardiah & Fatmawati, 2020:121).

The pH test results for all treatments showed that the concentration of straw mushroom (*V. volvacea*) extract affected the pH value of the hair tonic preparations. The higher the concentration, the higher the pH. This is in line with Mutmainah's (2014) study, which stated that the higher the extract concentration, the higher the pH. The different pH levels in each treatment in this study did not affect viscosity, as can be seen in Table 4, which shows that only one viscosity value was different, namely in P1, due to the absence of straw mushroom extract. The different pH levels in each treatment and the increase in pH with increasing extract concentration are consistent with the observation of the inhibition zone formed, which ranged from the smallest to the largest, starting from P0 to P5.

The pH measurement results show that mushroom extract hair tonic (*V. volvacea*) is safe to use. The pH of each concentration is in line with the ideal pH range for hair tonic, which is 4-7. In this study, the average pH of the hair tonic was 4.67-6.46. The pH of the hair tonic produced is comparable to the pH of the scalp, which ranges from 4.5-6.5. Hair tonic preparations that meet the pH level of normal skin are safe to use and do not irritate the user's skin.

The results of the skin irritation test conducted showed that no skin irritation occurred in any of the treatments. This indicates that the hair tonic formula is safe for use on the skin. The use of natural ingredients in the hair tonic

formulation, containing flavonoids, saponins, tannins, and alkaloids, such as those found in oyster mushrooms, was proven not to cause irritation in the 10 test subjects. The absence of erythema and edema in the panelists indicates that the hair tonic does not cause irritation (Sumarni, 2022).

This is in line with the research by Sari et al. 2023 that stable preparations cannot cause skin irritation. The criteria referred to here are the appearance of erythema (redness) and edema (swelling) on the skin. The right hair tonic formulation plays a role in effectively delivering the antifungal compounds contained in the extract into the skin without causing skin irritation. The selection of ingredients such as propylene glycol can be used as a solubility and viscosity enhancer for hair tonic formulations, thereby prolonging the contact time between the formulation and the skin (Aztriana et al., 2023:247).

4. CONCLUSION

Research conducted on the testing of hair tonic containing merang mushroom extract (*V. volvacea*) for antifungal activity has concluded that merang mushroom extract (*V. volvacea*) hair tonic has antifungal activity in inhibiting the growth of *M. furfur* fungus. The optimal concentration of hair tonic extract from the merang mushroom (*V. volvacea*) for inhibiting the growth of the fungus *M. furfur* is a hair tonic with a concentration of 30%.

ACKNOWLEDGMENT

The author would like to thank all those who have helped in the preparation of this journal.

REFERENCES

Agustina, E., Andiarna, F., Hidayati, I., & Kartika, V. F. 2021. Uji aktivitas antijamur ekstrak black garlic terhadap pertumbuhan jamur Candida albicans. Bioma: Jurnal Ilmiah Biologi, 10(2), 143–157. https://doi.org/10.26877/bioma.v10i2.6371.

Aisyah, S., Noor, R. M., & Muthmainnah, N. 2020. Hubungan Karakteristik Pemakaian Jilbab terhadap Kejadian Ketombe pada Mahasiswi PSPD Fakultas Kedoteran Universitas Lambung Mangkurat. Homeostasis, 1(1), 15–21. https://doi.org/10.20527/ht.v1i1.461

Alawiyah, T., Khotimah, S., & Mulyadi, A. 2016. Aktivitas antijamur ekstrak teripang darah (Holothuria atra jeager.) terhadap pertumbuhan jamur Malassezia furfur penyebab panu. Protobiont, 5(1). https://doi.org/10.26418/protobiont.v5i1.14897 .

Amalia, N. I., Yuniawatika, Y., & Murti, T. 2020. Pengembangan E-booklet Berbasis Karakter Kemandirian Dan Tanggung Jawab Melalui Aplikasi Edmodo Pada Materi Bangun Datar. Jurnal Kajian Teknologi Pendidikan, 3(3), 282–291. https://doi.org/10.17977/um038v3i32020p282.

Ardiansah, N., Ifaya, M., & Fauziah, R. 2025. Uji Aktivitas Antimikroba Ekstrak Etanol Daun Meistera chinensis Terhadap Bakteri Escherichia coli dan Jamur Candida albicans. Jurnal Pharmacia Mandala Waluya, 4(2), 142–155. https://doi.org/10.54883/jpmw.v4i2.313.

Astuti, I. I. P., & Dewi, I. K. 2023. Prevalensi dan Faktor Risiko Kejadian Ketombe pada Rambut Mahasiswa Laki-Laki Fakultas Kedokteran Yarsi Angkatan 2020-2022. Junior Medical Journal, 2(7), 796–803. https://doi.org/10.33476/jmj.v2i7.4367.

Astuti, S. T., Hardiyati, I., & Fajar, I. R. F. 2023. Formulasi Sediaan Hair tonic Kombinasi Fraksi Daun Binahong (Anredera cordifolia (Ten.) Steenis) dan Lendir Bekicot (Lissachatina fulica) sebagai Penumbuh Rambut. Jurnal Kesehatan Perintis, 11(1), 86–97. https://jurnal.upertis.ac.id/index.php/JKP.

Aztriana, A., Nurlina, N., Achmad, D. S., Purnamasari, V., & Hasrawati, A. 2023. Formulasi dan Uji Aktivitas Sediaan Hair tonic Kafein untuk Menstimulasi Pertumbuhan Rambut pada Hewan Uji Marmut. Journal of Pharmaceutical and Health Research, 4(2), 245–251. 10.47065/jharma.v4i2.3453.

Azzahra, S. 2023. Analisis Kandungan Fitokimia Makrofungi Jamur Kelapa Sawit (Volvariella volvaceae) Untuk Pencegahan Pertumbuhan Sel Kanker. Borneo Journal of Science and Mathematics Education, 4(1), 54–66. https://repository.unja.ac.id/.

Barus, B. R., & Meliala, L. 2022. The Formulation And Evaluation O Formulation And Evaluation Of The Preparation Of Hair tonic Ethanol Extract Of Patchouli Leaves (Pogostemon cablin Benth.) To Overcome Hair Loss. Jurnal Penelitian Farmasi & Herbal, 4(2), 45–51. http://ejournal.delihusada.ac.id/index.php/JPFH.

Bhakti, T. S., Porwanti, R., Pribadi, P., & Rahmawati, D. 2023. Total Plate Number Test at 0.5 McFarland Standard in Escherichia coli Culture. Bioma: Berkala Ilmiah Biologi, 25(2), 94–97. https://doi.org/10.14710/bioma.2023.52057.

Boekhout, T., Guého-Kellermann, E., Mayser, P., & Velegraki, A. 2010. Malassezia and the skin: science and clinical practice. Springer Science & Business Media.

Cahyaningrum, B. D. 2018. Uji Aktivitas Antijamur Kombinasi Ekstrak Etanol 70% Daun Kersen (Muntingia calabura L.) Dan Daun Sukun (Artocarpus communis Forst.) Terhadap Candida albicans. Skripsi.Stikes Karya Putra Bangsa..Tulungagung. http://repository.stikes-kartrasa.ac.id/id/eprint/18.

Candani, M., Gunawan, M., Tanjung, S. A., & Bagas, M. 2023. Formulasi Hair tonic Ekstrak Etanol Kulit Buah Pepaya (Carica Papaya L.) dan Uji Efektivitas Pertumbuhan Rambut pada Marmut Jantan (Cavia porcellus). AL-MIKRAJ Jurnal Studi Islam Dan Humaniora (E-ISSN 2745-4584), 5(01), 967–981. https://doi.org/10.37680/almikraj.v5i1.6198.

Cinta, A. P. 2023. Pengembangan Bahan Ajar Booklet Digital Materi Pola Lantai Tari Jaran Kepang. Joyful Learning Journal, 12(1), 25–29. https://journal.unnes.ac.id/sju/index.php/jlj.

Damayanti, S., Makkadafi, S. P., & Kusumawati, N. 2023. Identifikasi Jamur Malasezzia furfur Pada Mahasiswa D-Iii Teknologi Laboratorium Medis Yang Terinfeksi Ketombe. Jurnal Ilmu Kedokteran Dan Kesehatan, 11(1), 94–99. https://doi.org/10.33024/jikk.v11i1.12915.

Daradasih, E., & Devi, S. 2023. Pengaruh Perbedaan Konsentrasi Propilenglikol terhadap Karakteristik Fisik Hair tonic Ekstrak Daun Katuk (Sauropus androgynus (L). Merr). Sinteza, 3(2), 49–54. 10.29408/sinteza.v3i2.16825.

Darmawan, K. A., Wartini, N. M., & Wrasiati, L. P. 2019. Pengaruh konsentrasi natrium metabisulfit dan lama perendaman terhadap karakteristik bubuk bunga kenikir (Tagetes erecta L.). Jurnal Rekayasa Dan Manajemen Agroindustri ISSN, 2503, 488X. https://doi.org/10.24843/JRMA.2019.V07.I01.P09.

Dewi, R., Marniza, E., Anggraeni, W., & Kaliu, S. (n.d.). Kemampuan Daya Hambat Beberapa Produk Sampo Antiketombe Dengan Kandungan Bahan Aktif Berbeda Terhadap Jamur Candida albicans. Jurnal Pharmascience, 12(1), 9–18. http://dx.doi.org/10.20527/jps.v12i1.18749.

Fadly, D., Dhayan, R., Harsanti, B. R., Putri, D. M., & Saputri, N. E. 2021. Phytochemicals, Flavonoids, and Antioxidant Activity of Palm Mushrooms (Volvariella sp). Jurnal Ilmiah Kesehatan (JIKA), 3(3), 159–165. https://doi.org/10.36590/jika.v3i3.195 .

Farya, A. I., Budiarti, R. S., Mataniari, R., & Aswan, D. M. 2023. Pengaruh Ekstrak Buah Bintaro (Cerbera odollam Gaertn.) Terhadap Petumbuhan Jamur Microsporum canis: Pengaruh Ekstrak Buah Bintaro (Cerbera odollam Gaertn.) Terhadap Petumbuhan Jamur Microsporum canis. Biospecies, 16(2), 79–86. https://doi.org/10.22437/biospecies.v16i2.29711 .

Fernandes, A. A. R. 2018. Metodologi Penelitian Kuantitatif Perspektif Sistem: Mengungkap Novelty dan Memenuhi Validitas Penelitian. https://books.google.co.id/books?id=tv2EDwAAQBAJ

Fitriani, K., Slamet, S., Pambudi, D. B., & Waznah, U. 2021. Aktivitas Pertumbuhan Rambut Hair tonic Ekstrak Daun Bandotan (Ageratum conyzoides L.) Pada Kelinci Jantan (Oryctolagus Cuniculus). Prosiding Seminar Nasional Kesehatan, 1, 1194–1204. https://doi.org/10.48144/prosiding.v1i.811 .

Fraga-Corral, M., García-Oliveira, P., Pereira, A. G., Lourenço-Lopes, C., Jimenez-Lopez, C., Prieto, M. A., & Simal-Gandara, J. 2020. Technological application of tannin-based extracts. Molecules, 25(3), 614. https://doi.org/10.3390/molecules25030614.

Handayani, E. S., Handayani, D., Irdawati, I., & Violita, V. 2023. Potency of Yeast from Orange Peel's Ecoenzyme as Antimicrobe. Jurnal Serambi Biologi, 8(3), 274–279. https://e-journal.my.id/biogenerasi.

Hardani, R., Krisna, I. K. A., Hamzah, B., & Hardani, M. F. 2020. Uji Anti Jamur Ekstrak Buah Mengkudu (Morinda citrifolia L.). Jurnal IPA & Pembelajaran IPA, 4(1), 92–102. https://doi.org/10.24815/jipi.v4i1.16579.

Hasma, H., Panaungi, A. N., & Usman, Y. 2023. Uji Fitokimia dan Stabilitas Fisik Sediaan Hair tonic Ekstrak Jeruk Nipis (Citrus aurantifolia). Jurnal MIPA, 13(1), 7–12. https://doi.org/10.35799/jm.v13i1.48705 .

Heinrich, M., Mah, J., & Amirkia, V. 2021. Alkaloids used as medicines: Structural phytochemistry meets biodiversity—An update and forward look. Molecules, 26(7), 1836. 10.3390/molecules26071836.

Herdiana, N., Sugiharto, R., Winanti, D. D. T., & Sundari, U. Y. 2023. REMPAH DAN MINYAK ATSIRI DAUN. CV. Gita Lentera. https://books.google.co.id/books?id=g47xEAAAQBAJ

Hersila, N., MP, M. C., Si, V. M., & Si, I. M. 2023. Senyawa Metabolit Sekunder (Tanin) pada Tanaman sebagai Antifungi. Jurnal Embrio, 15(1), 16–22. https://doi.org/10.31317/embrio.v15i1.882.

Hidayah, R. N., Gozali, D., Hendriani, R., & Mustarichie, R. 2020. Formulasi dan Evaluasi Sediaan Hair tonic Anti Alopesia. Majalah Farmasetika, 5(5), 218–232. https://doi.org/10.24198/mfarmasetika.v5i5.27555.

Hidayati, N. N., Yulinda, R., & Putri, R. F. 2023. Pengembangan Media Pembelajaran E-booklet Sebagai Bahan Pengayaan Pada Materi Sistem Tata Surya Kelas Vii Smp. Eduproxima (Jurnal Ilmiah Pendidikan Ipa), 6(3), 942–952. https://doi.org/10.29100/.v6i3.4551.

Hindun, S., Akmal, A., Najihudin, A., & Sari, N. 2019. Formulasi Sediaan Hair tonic Kombinasi Dari Ekstrak Etanol Seledri (Apium graveolens L.) Dan Daun Teh Hijau (Camellia Sinensis (L) Kuntze) Sebagai Penumbuh Rambut Kelinci. Jurnal Ilmiah Farmako Bahari, 8(1), 21–33. https://doi.org/10.52434/jfb.v8i1.624.

Hindun, S., Rantika, N., Najihudin, A., & Indra, A. 2023. Formulasi Sediaan Hair tonic Ekstrak Etanol Daun Kelor (Moringa oleifera Lamk.) Dan Daun Rambutan (Nephelium lappaceaum L.) Terhadap Pertumbuhan Rambut. Pharma Xplore: Jurnal Sains Dan Ilmu Farmasi, 8(1), 65–76. https://doi.org/10.36805/jpx.v8i1.3008 .

Indrajaya, S. 2023. Komunikasi Digital Marketing. Kaizen Media Publishing. https://books.google.co.id/books?id=mYUXEQAAQBAJ

Jamilatun, M., Azzahra, N., & Aminah, A. 2020. Perbandingan pertumbuhan Aspergillus fumigatus pada media instan modifikasi carrot sucrose agar dan potato dextrose agar. Jurnal Mikologi Indonesia, 4(1). ttps://doi.org/10.35706/pc.v5i2.12333 .

Komala, O., & Siwi, F. R. 2020. Aktivitas antijamur ekstrak etanol 50% dan etanol 96% daun pacar kuku lawsonia inermis l terhadap trichophyton mentagrophytes. Ekologia: Jurnal Ilmiah Ilmu Dasar Dan Lingkungan Hidup, 19(1), 12–19. 10.33751/ekol.v19i1.1657.

Kurniati, A., & Hartih, N. A. 2023. Uji Mutu Fisik Formula Shampo Ekstrak Sarang Semut (Myrmecodia Pendens) Sebagai Antiketombe. OBAT: Jurnal Riset Ilmu Farmasi Dan Kesehatan, 2(5), 103–110. https://doi.org/10.61132/obat.v2i5.651 .

Leny, L., Fitri, K., Lase, Y. K., Hafiz, I., & Iskandar, B. 2022. Formulation of Hair tonic from Ethanol Extract of Sea Hibiscus (Hibiscus tileaceus L.) Leaves in Promoting Hair Growth on Guinea Pig (Cavia porcellus). Journal of Drug Delivery and Therapeutics, 12(2), 1–5. 10.22270/jddt.v12i2.5364.

Lestari, A., Ulfa, A. M., & Saputri, G. A. R. 2023. Evaluasi Fisik Dan Uji Aktivitas Sediaan Hair tonic Ekstrak Bunga Telang (Clitoria ternatea L.) Terhadap Pertumbuhan Rambut Kelinci Jantan (Oryctolagus cuniculus). Jurnal Ilmiah Wahana Pendidikan, 10(22), 104–118. https://doi.org/10.5281/zenodo.14522835.

Lestari, S. M., Camelia, L., Rizki, W. T., Pratama, S., Khutami, C., Amelia, A., Rahmadevi, R., & Andriani, Y. 2023. Phytochemical Analysis and Determination of MIC and MFC of Cacao Leaves Extract (Theobroma cacao L.) against Malassezia furfur. Jurnal Jamu Indonesia, 9(2), 53–66. https://doi.org/10.29244/jji.v9i2.316.

Listyarini, A. D., & Fatmawati, Y. 2020. Edukasi gizi ibu hamil dengan media booklet tentang perilaku pencegahan balita stunting di Wilayah Puskesmas Undaan Kabupaten Kudus. Jurnal Ilmu Keperawatan Dan Kebidanan, 11(1), 100–105. https://doi.org/10.31596/jpk.v3i1.70.

Maisarah, M., & Chatri, M. 2023. Karakteristik dan fungsi senyawa alkaloid sebagai antifungi pada tumbuhan. Jurnal Serambi Biologi, 8(2), 231–236. https://doi.org/10.24036/srmb.v8i2.205 .

Manalu, K., Tambunan, E. P. S., & Ilmi, Z. 2022. Habitat Jamur Makroskopis Di Taman Hutan Raya Bukit Barisan Kabupaten Karo. SITek (Jurnal Sains, Informasi Dan Teknologi), 1(1), 1–6. https://doi.org/10.24127/bioedukasi.v17i1.13543 .

Mardiah, M., & Fatmawati, A. 2020. Penggunaan Serbuk Infus Bekatul Sebagai Bahan Baku Bekatul Dextrosa Agar Untuk Pertumbuhan Jamur. Jurnal Ilmu Alam Dan Lingkungan, 11(1). https://doi.org/10.70561/jal.v11i1.9310 .

Misa, M. R. 2023. Aktivitas Antibakteri Ekstrak Jamur Merang (Volvariella volvacea (Bulliard Ex Fries) Singer) Yang Bersimbiosis Pada Tandan Kosong Kelapa Sawit Terhadap Bakteri Salmonella Typhi. Jurnal Literasi Indonesia, 1(4), 154–168. https://jli.staiku.ac.id/index.php/st/index.

Muhasim, M. 2017. Pengaruh tehnologi digital terhadap motivasi belajar peserta didik. Palapa, 5(2), 53–77. 10.36088/palapa.v5i2.46.

Mustapa, M. A., Taupik, M., Suryadi, A. M. A., Makkulawu, A., & Paneo, M. A. 2023. Penentuan Kadar Flavonoid Daun Sembung (Blumea balsamifer) menggunakan Metode Spektrofotometri UV-Vis. Indonesian Journal of Pharmaceutical Education, 4(2). https://doi.org/10.37311/ijpe.v4i2.11284.

Mutmainah, M., Kusmita, L., & Puspitaningrum, I. (2014). Pengaruh Perbedaan Konsentrasi Ekstrak Etanol Kulit Buah Mangg1s (Garcinia Mangostana L.) Terhadap Karakteristik Fisik Sediaan Gel. Jurnal Ilmu Farmasi Dan Farmasi Klinik, 98–104. https://doi.org/10.31942/jiffk.v0i0.1209.

Novita, J., Sinaga, A. P. F., & Khu, A. 2020. Perbandingan Efektivitas Ekstrak Kulit Manggis (Garcinia mangostana L) Dan Buah Pare (Momordica charantia L) Terhadap Pertumbuhan Jamur Malassezia furfur Secara In Vitro Dengan Metode Difusi Cakram. Jurnal Ilmiah Mahasiswa Kesehatan Masyarakat, 5(4), 1–8. ISSN: 2502-731X. 10.37887/jimkesmas.v5i4.15299.

Plantamor. 2023. Volvariella volvacea. Diakses Pada 06 Oktober 2024 Dari,Https://Plantamor.Com/Species/Info/Volvariella/Volvacea#google_vignette&gsc.Tab=0.

Pradana, A. R., Wahyudi, H., & Lestari, D. 2023. Rendemen Ekstrak Etanol Herba Rumput Akar Wangi (Polygala paniculata L) Pada Perbandingan Konsentrasi Pelarut. Jurnal Riset Kefarmasian Indonesia, 5(3), 373–383. https://doi.org/10.33759/jrki.v5i3.418.

Prananda, A., Mahadi, I., & Suzanti, F. 2022. Pengembangan E-booklet Berbasis Discovery Learning Untuk Meningkatkan Minat Balajar Peserta Didik (Discovery Learning-Based E-booklet Development For Increase Students Interest Learning). Bio-Lectura: Jurnal Pendidikan Biologi, 9(2), 277–286. 10.31849/bl.v9i2.11688.

Putri, R. 2021. Formulasi Dan Evaluasi Fisik Sediaan Gel Antiseptik Tangan Dari Ekstrak Etanol 96% Daun Pandan Wangi (Pandanus Amaryllifolius Roxb). Journal Of Pharmaceutical and Healty Research, 2(1), 21–27. https://doi.org/10.47065/jharma.v2i1.837.

Ramli, T. O. R., & Fadhila, M. 2022. Uji Iritasi Gel Ekstrak Etanol Herba Pegagan (Centella Asiatica L) Dengan Gelling Agent Carbopol 940. Journal Pharma Saintika, 6(1), 8–15. 10.51225/jps.v6i1.16.

Rasyadi, Y. 2023. Aktivitas Penghambatan Pertumbuhan Jamur Malassezia furfur dari Sediaan Shampo Ekstrak Etanol Daun Kopi Arabika (Coffea arabica L.). Menara Ilmu: Jurnal Penelitian Dan Kajian Ilmiah, 18(2), 87–91. https://doi.org/10.31869/mi.v18i2.4956.

Rizkuloh, L. R., Adlina, S., & Yuliana, A. 2023. Pengaruh Variasi Konsentrasi Dinatrium EDTA Terhadap Stabilitas Fisika dan pH Sediaan Salep Ekstrak Etanol Daun Jambu Biji (Psidium guajava L.). MPI (Media Pharmaceutica Indonesiana), 5(1), 49–59. https://doi.org/10.24123/mpi.v5i1.5539.

Roosheroe, I. G., Sjamsuridzal, W., & Oetari, A. 2018. Mikologi: Dasar dan Terapan. Yayasan Pustaka Obor Indonesia. https://books.google.co.id/books?id=n7NvDAAAQBAJ

Rosmania, R., & Yanti, F. (2020a). Perhitungan jumlah bakteri di Laboratorium Mikrobiologi menggunakan pengembangan metode Spektrofotometri. Jurnal Penelitian Sains, 22(2), 76–86. https://doi.org/10.56064/jps.v22i2.564.

Sadiah, H. H., Cahyadi, A. I., & Windria, S. 2022. Kajian Daun Sirih Hijau (Piper betle L) Sebagai Antibakteri. Jurnal Sain Veteriner, 40(2), 128–138. 10.22146/jsv.58745.

Sadli, S., Faradilla, M., & Nurhidayati, N. 2023. Formulation and evaluation of peel-off gel masks ethanol extract off straw mushrooms (Volvariella volvacea (Bull.) Singer). IOP Conference Series: Earth and Environmental Science, 1290(1), 012019. 10.1088/1755-1315/1290/1/012019.

Safitri, M., & Novelni, R. 2023. Kelayakan Hair tonic Daun Pare (Momordica Charantia L) Untuk Perawatan Rambut Rontok. Jurnal Tata Rias, 14(1), 33–45. 10.21009/jtr.14.1.04.

Salman, L. B., Sumantri, C., Noor, R. R., Saefuddin, A., & Talib, C. (2015). Kurva pertumbuhan sapi Friesian Holstein dari lahir sampai siap kawin berdasarkan tingkat kelahiran. Jurnal Veteriner, 16(1), 10–96. https://ojs.unud.ac.id/index.php/jvet/article/view/13328.

Sanjaya, W., Rialita, A., & Mahyarudin, M. 2021. Aktivitas Antijamur Ekstrak Etanol Daun Cengkodok (Melastoma malabathricum) Terhadap Pertumbuhan Malassezia furfur. Jurnal Fitofarmaka Indonesia, 8(1), 23–32. https://doi.org/10.33096/jffi.v8i1.614.

Sari, M., Chan, A., & Elvani, V. 2023. Formulasi dan Stabilitas Body Scrub dari Ekstrak Etanol Kulit Manggis (Garcinia mangostana L.) sebagai Pelembab Kulit. ULIL ALBAB: Jurnal Ilmiah Multidisiplin Vol. 2, No. 9, Agustus 2023, 2(9), 4314–4319. 10.56799/jim.v2i9.2157.

Sari, S. W., & Wilapangga, A. 2023. Uji Iritasi Sediaan Perona Pipi Dalam Bentuk Compact Powder Menggunakan Pewarna Alami Ekstrak Bit Merah (Beta vulgaris L.). Jurnal Bina Cipta Husada: Jurnal Kesehatan Dan Science, 19(1), 118–123. https;//jurnal.stikesbch.ac.id.

Sarmira, M., Purwanti, S., & Yuliati, F. N. 2021. Aktivitas antibakteri ekstrak daun oregano terhadap bakteri Escherichia coli dan Stapylococcus aureus sebagai alternatif feed additive unggas. Jurnal Ilmu Ternak Universitas Padjadjaran, 21(1), 40–49. 10.24198/jit.v21i1.33161.

Selvianti, I., Nopriyanti, M., & Azhari, A. 2022. Karakteristik kimia dan uji organoleptik beras (studi kasus di kecamatan benua kayong kabupaten ketapang). Jurnal Teknologi Pangan Dan Industri Perkebunan (LIPIDA), 2(1), 1–9. 10.58466/lipida.v2i1.1388.

Simanjuntak, H. A., & Butar-Butar, M. 2019. Uji Aktivittas Antifungi Ekstrak Etanol Umbi Bawang Merah (Allium Cepa L.) Terhadap Candida albicans Dan Pityrosporum Ovale. EKSAKTA: Jurnal Penelitian Dan Pembelajaran MIPA, 4(2), 79. 10.31604/eksakta.v4i2.91-98.

Sinaga, M. S. 2011. Budi Daya Jamur Merang. Penebar Swadaya. https://books.google.co.id/books?id=v_p5CgAAQBAJ

Suharto, M. A. P., Edy, H. J., & Dumanauw, J. M. (2012). Isolasi dan identifikasi senyawa saponin dari ekstrak metanol batang pisang ambon (Musa paradisiaca var. sapientum L.). Pharmacon, 1(2). https://doi.org/10.35799/pha.1.2012.914.

Suhery, W. N., Febrina, M., & Permatasari, I. 2018. Formulasi Mikroemulsi dari Kombinasi Minyak Kelapa Murni (Virgin Coconut Oil) dan Minyak Dedak Padi (Rice Bran Oil) Sebagai Penyubur Rambut Microemulsion Formulation of Combination of Virgin Coconut Oil and Rice Bran Oil for Hair Growth. Traditional Medicine Journal, 23(1), 40–46. 10.22146/tradmedj.29213.

Sumarni, N. K. 2022. -REVIEW ARTIKEL: Uji Iritasi Sediaan Topikal dari Tumbuhan Herbal:-. Jurnal Jejaring Matematika Dan Sains, 4(1), 13–24. http://isainsmedis.id/.

Suparti, S., Kartika, A. A., & Ernawati, D. 2016. Pengaruh Penambahan Leri dan Enceng Gondok, Klaras, Serta Kardus Terhadap Produktivitas Jamur Merang (Volvariella volvacea) pada Media Baglog. Bioeksperimen: Jurnal Penelitian Biologi, 2(2). https://doi.org/10.23917/bioeksperimen.v2i2.2491

Supriadi, D. (2014). Formulasi sediaan krim ekstrak etanol daun teh hijau (Camellia sinensis l.) sebagai pelindung sinar ultra violet. Jurnal Farmasi Galenika, 1(01). 10.70410/jfg.v1i01.12.

Syarifah, N. 2019. Aktivitas Antibakteri Dari Ekstrak Dan Fraksi Terpilih Dari Jamur Merang, Bawang Putih, Temu Putih Dan Temu Mangga Terhadap Beberapa Bakteri Patogen. Tesis.Institut Teknologi,Bandung.https;//digilib.itb.ac.id.

Utami, S. A., & Lubis, M. S. 2023. Irritation and Acceptability Test of Salicylic Acid Gel Preparations Using Karbopol-940 Base. Pharmauho: Jurnal Farmasi, Sains, Dan Kesehatan, 10(1), 1–9. DOI: 10.29303/jppipa.v11i12.13535.

Wulandari, S., Nisa, Y. S., Taryono, T., Indarti, S., & Sayekti, R. S. 2022. Sterilisasi peralatan dan media kultur jaringan. Agrotechnology Innovation (Agrinova), 4(2), 16–19. https://jurnal.ugm.ac.id/Agrinova.

Yang, X., Xiong, B., Yuan, Z., Liao, H., Liu, X., Wu, Y., Zhang, S., & Xiang, Q. 2022. Polygalaxanthone III, an Active Ingredient in Polygala japonica Houtt., Repaired Malassezia-Stimulated Skin Injury via STAT3 Phosphorylated Activation. Molecules, 27(21), 7520. https://doi.org/10.3390/molecules27217520.

Yulianti, W., Ayuningtyas, G., Martini, R., & Resmeiliana, I. 2020. Pengaruh metode ekstraksi dan polaritas pelarut terhadap kadar fenolik total daun kersen (muntingia calabura l). Jurnal Sains Terapan: Wahana Informasi Dan Alih Teknologi Pertanian, 10(2), 41–49. 10.29244/jstsv.