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FORMULATION OF TEA TREE OIL (Melaleuca alternifolia) IN PEEL-OFF MASK GEL EXTRACT OF PLANT FLOWS

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ABSTRACT

Pandan wangi (Pandanus amaryllifolius) is one of the plants that has chemical content, alkaloids, flavonoids, saponins, tannins, vitamin C, vitamin E, polyphenols that function as natural antioxidants. Polyphenols are phenol-derived compounds that have antioxidant activity. Melaleuca Alternifolia or tea tree is a type of tree that has small leaves and is up to twenty feet tall, Tea tree oil also contains α-terpinene, α-terpinolene and γ-terpinene compounds as antioxidants that function to capture free radicals The purpose of this study was to obtain the physical quality of the peel-off gel mask preparation of the best pandan leaf extract tea tree oil formulation, by varying the concentration of pandan leaf extract 1%; 3%, 5% and 7% with tea tree oil concentrations of 2%, 4%, 6% and 8% The peel-off gel mask formulation of tea tree oil pandan leaf extract organoleptically has a distinctive odor of pandan leaf extract, gel shape and brownish green color. The best product was obtained in the 16th product with product code d4, this product has a gel texture, intense green color, and a distinctive aroma of pandan leaves, the pH of this product is 7.93 and the drying time is 21:47 minutes, able to increase moisture up to 8% more moist than the initial skin condition. The antioxidant activity obtained in the wolffia extract peel-off gel mask product is 3.254 μg/mL categorized in the classification of very strong antioxidant activity.

Keywords: Antioxidant, Peel-Off Gel Mask, Pandan Leaf, Tea Tree Oil.

INTRODUCTION

Environmental pollution due to air pollution such as incomplete combustion from motor vehicles, cigarette smoke, and sun radiation can cause skin dullness and premature aging. Various treatments are carried out in order to maintain healthy facial skin such as using face masks. Currently, many face masks are found on the market in various types, one of which is a peel-off gel face mask. Peel-off gel face mask is one type of mask that has several advantages in its use, including that it can be easily lifted or removed like an elastic membrane (Rahmawanty et al., 2015).

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Pandanus amaryllifolius (Pandanus amaryllifolius) grows in the tropics and is an annual shrub with a height of 1-2 m. The properties of this plant are as a spice, flavoring material, fragrance and green color giver in cooking or confectionery and raw material for making perfume. The efficacy of this plant is as a spice, flavoring material, fragrance and green color giver in cooking or confectionery and raw material for making perfume oil. In addition, pandanus is also used as a traditional medicine to prevent hair loss, blacken hair, eliminate dandruff, treat weak nerves (neurasthenia), no appetite, rheumatism, pain accompanied by anxiety.The color obtained from pandanus leaves is dark green. Green leaves contain chlorophyll, the function of chlorophyll in plants is to absorb energy from sunlight to be used in the photosynthetic process, which is a biochemical process of plants in synthesizing carbohydrates (sugar into starch), from carbon dioxide gas and water with the help of sunlight. Pandan wangi (Pandanus amaryllifolius) is one of the plants that has chemical content, alkaloids, flavonoids, saponins, tannins, vitamin C, vitamin E, polyphenols which function as natural antioxidants. Polyphenols are phenol-derived compounds that have antioxidant activity. (Rauyani, 2019)

One of the factors that cause damage to the skin is free radicals. Free radicals are molecules that lose electrons so that the molecule becomes unstable (unpaired) and tries to take electrons from other molecules, so that if two free radicals meet, they will form a covalent bond (Ramadhan, 2015). One alternative to overcome the adverse effects of free radicals is with the help of antioxidant compounds.

Sun exposure causes the skin to become dull because it contains UV radiation that can damage the skin layer. The use of cosmetics containing antioxidant compounds such as ceramide and tea tree oil can protect the skin from sun exposure. Ceramide can strengthen the skin barrier and prevent the loss of skin moisture that functions as an antiaging and provides a repairing effect on the skin by inhibiting some of the unwanted effects related to aging. Tea tree oil is an antioxidant agent that works to capture free radicals, free radical capture ingredients include α-terpinene, α-terpinolene and γ-terpinene.

The human body is the most easily exposed place to microorganisms, especially the skin as the outermost part of the human body. Groups of microorganisms that cause infections in the human body such as: bacteria, viruses, and fungi (Nabilla & Advinda, 2022). Bacteria that often cause skin infections to cause acne include Propionibacterium acnes, Staphylococcus aureus, and Staphylococcus epidermidis. Staphylococcus aureus, which is round or oval (0.8 to 0.9 μ), immobile, non-sporing, and arranged in grape-like clusters, is a gram-positive bacterium (Utama et al., 2022). Microbial contamination can occur during the production process and increase due to use by consumers (Cahyani & Purwanto, 2020). The safety level of cosmetics must be free from microbial contamination such as bacteria and fungi.

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According to the Regulation of the Head of the Food and Drug Administration of the Republic of Indonesia Number 12 of 2019, microbial contamination in cosmetics must meet the requirements of ALT (Total Plate Count) not to exceed 103 Colonies/g, and the bacteria Staphylococcus aureus, and Pseudomonas aeruginosa must be negative per 0.1 g or 0.1 ml of test sample (Rachman et al., 2021). (Indriyati et al., 2021).

Table 1 Chemical Content of Fragrant Pandan Leaves

Substance	Percentage (%)	Uses
Flavonoid	0.512	1) Acts as an antioxidant 2) Protects cell structure 3) Enhances the effectiveness of vitamin C 4) Anti-inflammatory 5) Prevents bone loss 6) Acts as an antibiotic 7) Acts as an antiviral 8) Inhibits glucose absorption in the intestine
Polyphenol	2.170	1) Antioxidant 2) Strengthens the immune system 3) Improves blood circulation and heart health 4) Inhibits cancer growth 5) Slows down bone loss
Tannin	0.379	1) Antibacterial 2) Antidote 3) Anti-diarrheal 4) Antioxidant 5) Inhibits tumor growth
Saponin	0.115	1) Antiseptic 2) Inhibits the Na+/D-glucose cotransport system (SGLUT) in the intestinal brush border
Alkaloid	-	Minimizes toxins in the body
Glycoside	-	A compound that absorbs and retains moisture in the skin

METHOD

1. Tools And Material

The tools and equipment used include measuring cylinders, drop pipettes, spatulas, beaker glasses, pH meters, mortar and pestle, blenders, filter paper, containers, glass slides, UV-VIS spectrophotometers, analytical balances, skin analyzers, incubators, and colony counters. The materials used include pandan leaf extract, tea tree oil, 96% ethanol, PVA, HPMC, glycerin, tea, methylparaben, propylparaben, DPPH

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(2,2-diphenyl-l-picylhydrazyl), distilled water, nutrient agar, aluminum foil, and cotton.

2. Preparation of Pandan leaf extract

Pandan leaves, weighing 2 kg, are finely sliced and sun-dried for one week before being ground into a smooth powder using a blender. The resulting pandan leaf powder, weighing 200 grams, is then extracted through maceration using 1.5 liters of 96% ethanol. The maceration container is sealed and stored for seven days in a location protected from direct sunlight, with occasional stirring. Afterward, the mixture is separated into pulp and filtrate, yielding approximately 1 liter of pandan leaf extract. The extract is then evaporated using a rotary vacuum evaporator to reduce alcohol content and produce a thicker consistency. The evaporation process results in 40 ml of thick pandan leaf extract.

3. Preparation of Gel Base

A total of 3 g of PVA is placed into a beaker glass, and 10 mL of distilled water is gradually added. The mixture is heated in a water bath at 80°C with continuous stirring until it fully expands (mass 1). In another container, 0.5 g of HPMC is dispersed in 5 mL of distilled water and stirred until it fully expands. Separately, 5 mL of glycerin, 0.1 g of methylparaben, and 0.025 g of propylparaben are dissolved in 5 mL of hot distilled water (mass 2). Mass 1 and mass 2 are combined in a clean mortar, and HPMC and 0.8 mL of TEA are added sequentially. The remaining distilled water is gradually added while stirring until the mixture becomes homogeneous. If needed, a magnetic stirrer is used to ensure better mixing. This procedure is repeated for each gel mask base preparation based on its specific concentration.

4. Preparation of gel mask preparation

A small amount of gel base is placed into a clean and dry mortar and crushed evenly, followed by the addition of pandan leaf extract, which is also crushed. Gradually, the remaining gel base is added and crushed until homogeneous. The mixture is then transferred to a glass beaker and stirred until homogeneous using a magnetic stirrer. Finally, the pandan leaf extract peel-off gel mask is placed into an appropriate container and labeled according to its concentration.

5. Addition

Tea tree oil is added according to the respective concentration and stirred until evenly distributed using a stirring rod.

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RESULTS AND DISCUSSION

Research result

Tea Tree Oil Formulation *Peel-Off Gel* Mask Product Pandan Leaf Extract was produced on November 28, 2024 to December 16, 2024. Making a *peel-off gel mask* with Tea Tree Oil Formulation Pandan Leaf extract was conducted in the Process Unit Laboratory, Lhokseumawe State Polytechnic. For testing of Antioxidants in Pandan Leaf Extract was conducted in the Basic Chemistry and Analytical Chemistry Laboratory, and for homogeneity testing, Microbial Contamination was conducted in the Biotechnology and Food Technology Laboratory.

Test data organoleptic

Organoleptic tests were carried out with the observed parameters that is observation shape , color , and smell .

Table 2 Test Results Organoleptic Peel-Off Gel Mask Formulated with Tea Tree Oil and Pandan Leaf Extract

Concentration extra leaf Pandanus (%)	Tea Tree Oil Concentration (%)	Peel-Off Gel Mask Products	Panelists	Average Value of Organoleptic Test		
				Texture	Color	Aroma
1	2	1	1-30	2.1	4.3	4.4
	4	2	1-30	2.7	4.5	3.4
	6	3	1-30	2.5	4.1	2.9
	8	4	1-30	1.8	4.8	3.1
3	2	5	1-30	2.3	4.6	4.5
	4	6	1-30	2.8	4.4	4.1
	6	7	1-30	1.9	4.9	2.8
	8	8	1-30	2.2	4.7	3.2
5	2	9	1-30	2.3	2.6	3.3
	4	10	1-30	1.7	2.4	3.7
	6	11	1-30	2.7	2.7	3.4
	8	12	1-30	2.6	2.8	3.1
7	2	13	1-30	1.7	3	1.5
	4	14	1-30	1.8	3	1.9
	6	15	1-30	2.4	2.9	1.8
	8	16	1-30	2.3	3	1.7
Total				35.8	72.3	52.9
Average				1.9	2.4	1.7

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Irritation test observation data

Table 3 Test Results Irritation Peel-Off Gel Mask Skin Formulation Tea Tree Oil Pandan Leaf Extract

Concentration extra leaf Pandanus (%)	Tea Tree Oil Concentration (%)	Peel-Off Gel Mask Products	Panelists	Irritation Skin		
				Redness	Itchy rash	Stings
1	2	1	1-30	There isn't any	There isn't any	There isn't any
	4	2	1-30	There isn't any	There isn't any	There isn't any
	6	3	1-30	There isn't any	There isn't any	There isn't any
	8	4	1-30	There isn't any	There isn't any	There isn't any
3	2	5	1-30	There isn't any	There isn't any	There isn't any
	4	6	1-30	There isn't any	There isn't any	There isn't any
	6	7	1-30	There isn't any	There isn't any	There isn't any
	8	8	1-30	There isn't any	There isn't any	There isn't any
5	2	9	1-30	There isn't any	There isn't any	There isn't any
	4	10	1-30	There isn't any	There isn't any	There isn't any
	6	11	1-30	There isn't any	There isn't any	There isn't any
	8	12	1-30	There isn't any	There isn't any	There isn't any
7	2	13	1-30	There isn't any	There isn't any	There isn't any
	4	14	1-30	There isn't any	1 Panelist	1 Panelist
	6	15	1-30	There isn't any	There isn't any	There isn't any
	8	16	1-30	There isn't any	There isn't any	There isn't any

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Homogeneity Test Observation Data

Table 4 Test results homogeneity of the Peel-Off Gel Mask Formulation Tea Tree Oil Extract leaf Pandanus

Concentration Extra Leaves Pandanus (%)	Tea Tree Oil Concentration (%)	Homogeneity		
		On	Middle	Lower
1	2	+	+	+
	4	+	+	+
	6	+	+	+
	8	+	+	+
3	2	+	+	+
	4	+	+	+
	6	+	+	+
	8	+	+	+
5	2	+	+	+
	4	+	+	+
	6	+	+	+
	8	+	+	+
7	2	+	+	+
	4	+	+	+
	6	+	+	+
	8	+	+	+

Information :

+ : Homogeneous

- : Not Homogeneous

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Speed test observation data time dry up

Table 5 Test results speed time Dries on Peel -Off Gel Mask Formulated with Tea Tree Oil and Pandan Leaf Extract

Concentration Pandan Leaf Extract (%)	Tea Tree Oil Concentration (%)	Drying Time
1	2	20:00
	4	20:20
	6	21:10
	8	21:40
3	2	20:05
	4	20:18
	6	20:59
	8	21:44
5	2	20:25
	4	20:21
	6	20:54
	8	21:52
7	2	20:08
	4	20:23
	6	20:50
	8	21:47

Data observation test pH

Table 6 Results testing pH on Face mask *Gel Peel-Off* Tea Tree Oil Formulation Extract Leaf Pandanus.

Concentration Pandan Leaf Extract (%)	Tea Tree Oil Concentration (%)	pH
1	2	7.11
	4	7.37
	6	7.58
	8	7.89
3	2	7.10
	4	7.40
	6	7.60
	8	7.90
5	2	7.20
	4	7.35
	6	7.59
	8	7.92

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7	2	7.19
	4	7.32
	6	7.61
	8	7.93

Humidity Test Observation Data

Table 7 Moisture Test Results on Peel-Off Gel Mask Formulated with Tea Tree Oil and Pandan Leaf Extract

Concentration Pandan Leaf Extract (%)	Tea Tree Oil Concentration (%)	Panelists	Humidity	
			Before	After
1	2	Panelist 1	37%	40%
	4	Panelist 2	35%	39%
	6	Panelist 3	40%	41%
	8	Panelist 4	33%	38%
3	2	Panelist 5	38%	41%
	4	Panelist 6	32%	43%
	6	Panelist 7	41%	42%
	8	Panelist 8	31%	37%
5	2	Panelist 9	33%	37%
	4	Panelist 10	36%	39%
	6	Panelist 11	42%	44%
	8	Panelist 12	40%	43%
7	2	Panelist 13	36%	39%
	4	Panelist 14	32%	42%
	6	Panelist 15	35%	45%
	8	Panelist 16	38%	46%

Information:

≤33% =dry
34-37% = little dry
38%-42% = normal
43%-46% = slightly damp
≥47% = humid

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Antioxidant Test Observation Data

Table 8 Test results Antioxidants in Peel-Off Gel Mask Formulated with Tea Tree Oil Extract leaf Pandanus

Peel-Off Gel Mask Products	Concentration Pandan Leaf Extract (%)	Absorbance	% Inhibition	Equality Regression	Antioxidant Activity Value µ g/mL
Blank	0	0.5207	0	y = 18.067x – 8.803 R^2 = 0.8318	3.254 µg/mL
a 4	1	0.3903	25.04		
b 4	3	0.1812	65.20		
c 4	5	0.1677	67.79		
d 4	7	1,1616	68.96		

Contamination Test Observation Data Microbes

Table 9 Calculation results pollution microbes on the peel-off gel mask formulated with tea tree oil extract leaf Pandanus

Sample	Test Time	Dilution	Number of Colonies (colonies/gram)
16	24 hours	10^{-1}	27

-

Discussion

Study This using Pandanus amarillyfolious as material base in Making Peel-Off Gel Mask for maintenance skin face . Pandan leaves the moreover formerly dried and ground before Then the extraction process is carried out in a way maceration . Extract leaf pandan obtained Then done evaporated For reduce level ethanol . In the study This added Tea Tree Oil to it peel off gel mask products , there are 16 products with variable freedom that is varied that is concentration of Pandan leaves (1%, 3%, 5% and 7%) and concentration of Tea Tree Oil (2%, 4%, 6% and 8%). The analysis was carried out For know quality This mask product that is with do testing organoleptic , homogeneity , speed drying , pH test, test humidity , irritation test to skin panelists , as well as analysis activity antioxidant For know the work of the mask in ward off radical free and contamination test microbes in products best peel-off gel mask for count amount pollution microbes found in peel-off gel mask products with ALT method or number total plate .

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Organoleptic test

Organoptic test on peel-off gel mask formulated with tea tree oil extract leaf Pandanus done with method observe texture , color , and smell with scoring test with the range that has been determined in this study obtained average values at concentrations of 1%, 3%, 5% and 7% extra leaf Pandanus namely at a value of 1-3 , namely textured little bit of gel thing This because of amount PVA contained in all mass mask product his The same namely 3 grams, at a concentration of 1% and 3% extra leaf Pandanus obtained average value 4-5 namely brownish while at concentrations of 5% and 7% were obtained average value on grades 1-3 This because of the more big concentration extra leaf Pandanus so color product the more green, on concentration of 1% and 3% tea tree oil aroma is more tend smell from the leaves pandan and at concentrations of 5% and 7% leaf aroma Pandanus more tend more than tea tree oil big concentration extra leaf pandan in mask products then the more the aroma of pandan can be smelled .

Irritation test

Testing irritation intended For know security from Peel- off gel mask preparation with tea tree oil extract formulation leaf pandan made . Testing done on the skin part behind ear in . This is because the skin area the has a pH that is almost The same with the pH of the skin face . testing irritation on this peel-off gel mask done against 30 panelists .

From Table 3 we can seen results testing irritation from all sample peel-off gel mask extract product leaf pandan . In the 14th product there was 1 panelist who experienced it irritation light in the form of itching and burning in the first hour in term 1 minute time matter This happen because of type skin panelists who are too sensitive and could also be caused because product No in accordance with skin so that cause reaction moment when irritation test is carried out , will but the irritation will is lost in a number of minute after released bandage and clean the mask from skin panelist . Irritation light only occurred in 1 panelist the rest peel-off gel product formulated with tea tree oil extract leaf Pandanus No happen irritation light matter This due to the pH of the product This revolves around value 7,Ph the categorized into the category neutral so that Lots skin that can accept without experience irritation light .

Homogeneity test

Homogeneity from a semisolid preparations can influence application preparation on the skin . Homogeneity test observation data shown in Table 4 From the table the can We Look that all sample homogeneous throughout part peel- off gel mask preparation This because of all materials at the time produce peel-off gel mask product mixed with perfect .

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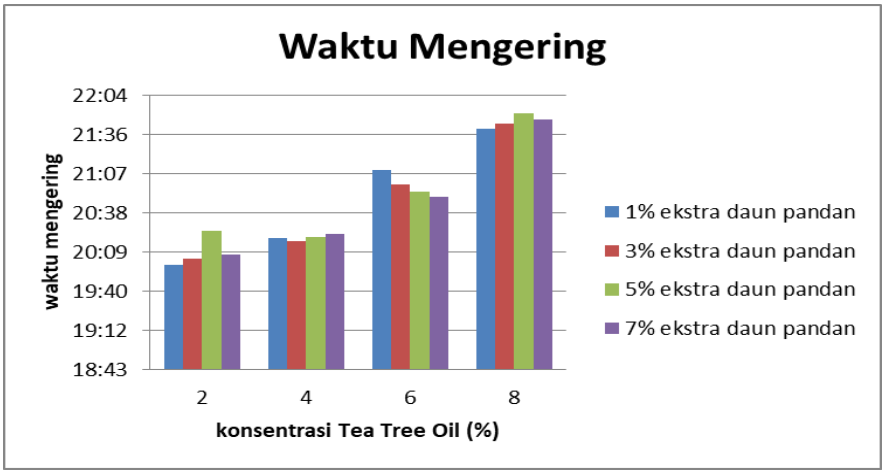
Speed test time dry up

Testing time stock dry up aiming For know how long does it take for a peel-off gel mask to dry on the surface skin and shape film layer . Speed data time drying on the peel-off gel mask formulation of tea tree oil extract leaf Pandanus shown in Table 5.

Figure 1 Relationship Curve Speed of Drying Time for Pandan Leaf Extra Peel-



Off Gel Mask To Composition Pandan Leaf Extract And Tea Tree Oil

Measurement results speed time dry up shows a peel-off gel mask formulated with tea tree oil extract leaf Pandanus dry in the range time between 20:00 – 21:00 minutes . All Peel-off gel mask preparation produced in this study contain polyvinyl alcohol as much as 3 grams per sample his matter This make the peel-off gel mask dry A little more long time.On chart the can seen that the more tall The concentration of tea tree oil then the longer the time dry . From the data obtained , the 30 samples stock peel-off gel mask extract product leaf Pandanus fulfil time dry good peel-off gel mask that is between 5-30 minutes (Grace et al., 2015).

pH test

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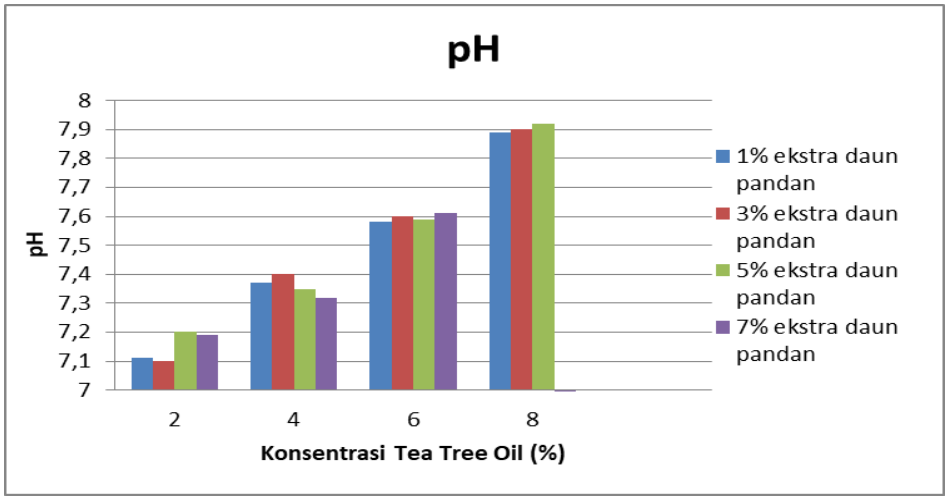
pH testing is intended For can know a number of mark acidity from a topical preparations made . pH testing of peel-off gel mask formulation of tea tree oil extract leaf Pandanus can seen in Figure 2 below This

Figure 2 pH Relationship Curve of Peel-Off Gel Mask with Pandan Leaf Extract



To Composition Pandan Leaf Extract And Tea Tree Oil

Results of pH measurements on the peel-off gel mask formulated with tea tree oil extract leaf Pandanus fulfil the standards that have been set by SNI16-6070-1999 are range between 4.5-8.0.pH is too language can cause skin become dry , while if the pH is too high sour will cause irritation skin . On the graph the can seen that the more tall tea tree oil concentration and extract leaf Pandanus so the more The pH value produced is also high . The pH value of the peel-off gel mask extract leaf pandan produced that is range between the numbers 7.1-7.9 which means has fulfil standard SNI. Values 7.1-7.9 are categorized into the neutral , thing This because of after the maceration process to be continued with the evaporation process use reduce more Lots the alcohol content and also the tea tree oil content Already formulated For face so that obtained a neutral pH and meets the requirements SNI standard and safe applied to the face .

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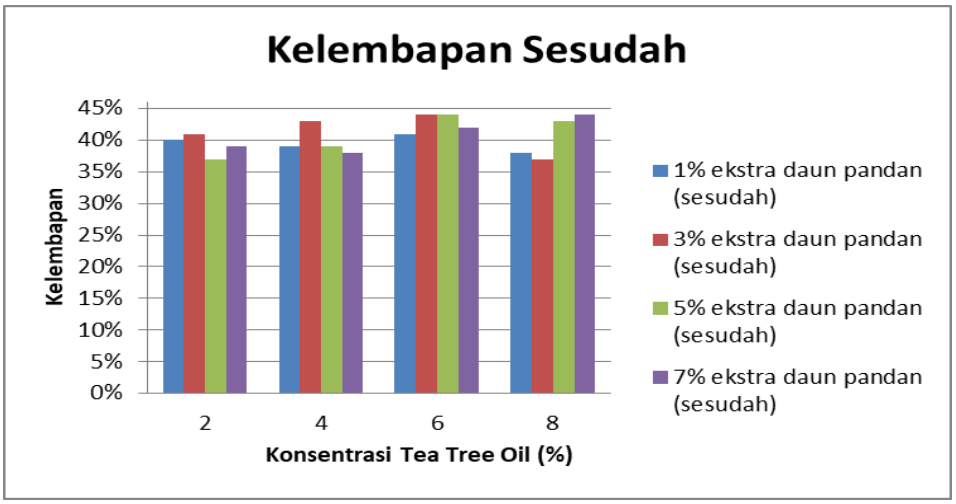
Humidity Test

Testing humidity done use skin analyzer tool ,testing with method measure moisture on the skin panelist part behind ear matter This because of the back part ear own aseptic condition and value moisture in the part behind almost The same with face before face applied various type moisturizer or such as the following chart humidity after using a peel-off gel mask formulated with extra tea tree oil leaf pandan .

Figure 3 Relationship Curve Humidity To Composition Pandan Leaf Extract And Tea Tree Oil



testing done with method measure level humidity before and after Use of peel-off gel mask formulated with tea tree oil extract leaf pandan , before using a peel-off gel mask formulated with extra tea tree oil leaf Pandanus mark humidity panelist can seen in table 4.6, the results from testing This Lots from panelists who are moisture on the skin increase up to 8% after use of peel-off gel mask, in graph 4.6 can be seen that the more big concentration extra leaf Pandanus so the more tall % humidity value from beginning humidity skin , thing This due to because leaf pandan and tea tree oil contain compound glycosides that can absorb and retain water in skin .

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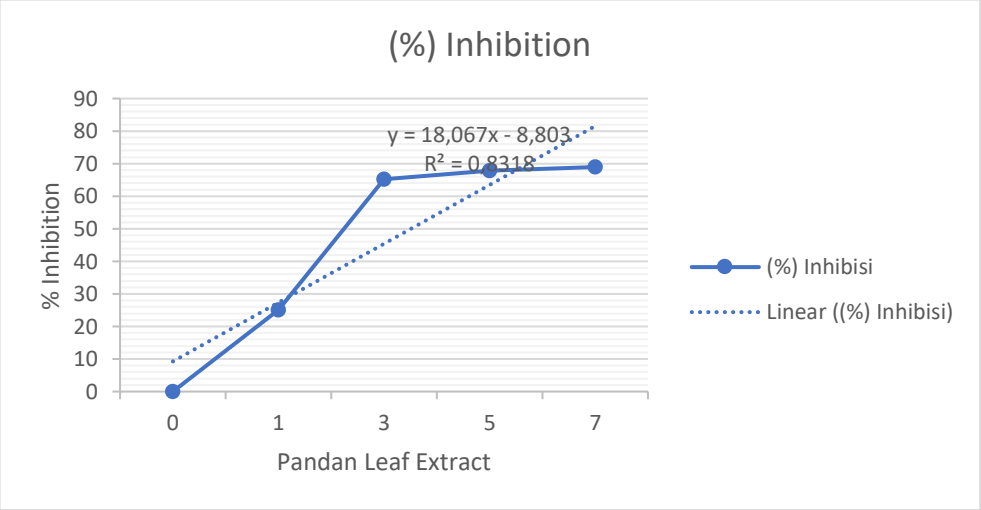
Activity test antioxidant

Testing activity anti-radical free peel-off gel mask formulated with tea tree oil extract leaf Pandanus done with measure % inhibition against DPPH with use spectrophotometer uv -vis at length wave maximum 517 nm. Observation data testing activity antioxidant shown in Table 8 From the data obtained in Table 8 shows that the more big concentration extract leaf Pandanus so the more small DPPH absorbance so that improvement concentration resistor radical DPPH free increasingly big .

Figure 4 Regression Curve Between % Inhibition and Concentration Pandan Leaf Extract in Products Best Peel-Off Gel Mask Pandan Leaf Extract



From the graph on found equality the regression is y = 18.067 x – 8.803 and the R^2 value = 0.8318. From the equation the can counted activity antioxidants contained with y- axis as % inhibition and x- axis as concentration sample . For y axis inserted value 50 because IC50 value of each sample For show concentration extract required sample For catch DPPH radical is by 50 %. So activity antioxidants obtained from the peel-off gel mask product formulated with tea tree oil extract leaf Pandanus is 3.254 µg / mL. This value is categorized in the classification activity a very powerful antioxidant strong in ward off radical , other than in leaves Pandan in tea tree oil is also contained compound α-terpinene, α-terpinolene and γ-terpinene as antioxidants that function to capture free radicals (Zhang X 2018) . Antioxidants are also very useful for skin man function antioxidant is can donate electron For neutralize radical free or stop the occurrence damage skin , such as aging premature aging , hyperpigmentation , eczema , acne , and cancer skin .

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Contamination Test microbes

Testing This done with method count number total plate (ALT) on the peel-off gel mask product formulated with extra tea tree oil leaf Pandanus use colony counter tool for count amount the colonies that exist in the peel-off gel mask product on the day first incubation period bacteria Not yet visible in sight eye directly on the agar media after a 48-hour incubation period of the bacteria start visible and for count amount his used colony counter tool for count colonies in the sample obtained value in sample One there are 27 colonies / gram, there are many factors that make it growth bacteria the more many one among them because contamination air and temperature that makes bacteria grow with fast because That For stock cosmetics There is it would be good to be able to maintaining factors reason bacteria in cosmetics agar cosmetics still awake the quality so that still safe at the moment used . According to Regulation Head of the Food and Drug Supervisory Agency Republic of Indonesia Number 12 of 2019, pollution microbes in cosmetics must fulfil ALT (Total Plate Count) requirements are not may exceeding 103 Colonies/g, and Staphylococcus aureus, and Pseudomonas aeruginosa bacteria should be negative per 0.1 g or 0.1 ml of test sample (Rachman et al ., 2021).

CONCLUSION

From the results research that has been done , then can concluded that :

1. Based on the research, the best product composition is shown in the product with a higher concentration of pandan leaf extract, namely 7 %, with a pH value obtained ranging from 7; drying time reaches 20 - 21 minutes , and no irritation occurs in all panelists .

2. The drying speed test shows that the The lower the concentration of Tea Tree Oil contained in the product, the quicker it will dry.

3. Test the pH of the extra peel-off gel mask leaf Pandanus shows that the higher the concentration of Tea Tree Oil , the higher the pH value will be .

4. The antioxidant activity obtained in the peel-off gel mask product formulated with pandan leaf extract is 3.254 µg/mL. This value is categorized as a very strong antioxidant activity in counteracting free radicals.

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