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Laboratory Assessment of Nyamplung Seeds (*Calophyllum Inophyllum Linn*) Base Cosmetic Products

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Abstract: The development of the cosmetics industry in Indonesia is currently very rapid with average market growth reaching 9.67 % per year. The high market potential gives rise to tight business competition in the cosmetics industry, thus encouraging manufacturers to continue to innovate to create new product variations to meet society's demands for cosmetics as a complement to an attractive everyday appearance. This study aims to evaluate the physical characteristics of facial masks, body scrubs and sunscreens from Nyamplung (Calophyllum inophyllum) seed extract at various concentrations (5%, 10%, 15%). The test results showed that the three preparations met the standard physical property test parameters (organoleptic, pH, viscosity, spreadability, etc.). The facial mask formula with 10% extract was most liked by the panelists. Body scrub and sunscreen formulas with 10-15% extract also provide the best physical test results. The SPF value of sunscreen increases with increasing extract concentration up to the ultra category (SPF 17.42 at 15%). This study concludes that Nyamplung seed extract has the potential to be used as a natural ingredient for facial masks, body scrubs and sunscreen with an optimum concentration of 10-15%. Further research is needed regarding antioxidant activity and product stability testing. Overall, the three cosmetic preparations from Nyamplung seed extract show good prospects for development by paying attention to the best extract concentration of each product.

Keywords: Body scrub; Facial mask; Nyamplung seed extract; Physical properties test; Sunscreen

Introduction

The development of the cosmetics industry in Indonesia is currently very good. The growing trend of using cosmetics, as well as the demand for everyone to look attractive in front of the general public, is one of the reasons the cosmetics industry is developing well in Indonesia. Progress in the beauty industry in Indonesia is currently showing an increase. Sales of personal care and cosmetic products have increased rapidly in recent years amid the massive development of e-commerce in Indonesia. From 2018 to 2022, personal care and cosmetics were the top 3 sales in the market place, with a transaction value of IDR 13,287.4 trillion and a transaction volume of 145.44 million (Kemenko Perekonomian, 2024).

Cosmetics, which are currently a basic need for appearance for all levels of society, both women and men, tend to be active consumers. The high potential for market share and income creates a lot of competition in the cosmetics industry (Triana Sari, 2017). The increasingly rapid business in the cosmetics sector means that business competition is currently very sharp, which is a challenge for companies to remain competitive in the industry.

For a long time, Indonesia has been a country that has very rich natural resource potential, there are around 300 species that have been identified and 950 of

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them have functions as medicinal, cosmetic and food plants. Because of its very strategic location, astronomically speaking, Indonesia is a country with a tropical climate. The tropical climate allows Indonesia to have a variety of plants as a source of medicines and cosmetics. This is what makes Indonesia have the potential as a producer of natural ingredients in the cosmetics industry (Batubara & Prastya, 2020; Wathoni et al., 2018).

One natural resource that has potential as a cosmetic ingredient is the Nyamplung plant (*calophyllum inophyllum*). The Nyamplung plant (*calophyllum inophyllum*) is a member of the *Clusiaceace family*. Nyamplung is a large to medium tree species, and grows in non-swamp and sandy beach habitats (Khery et al., 2022, 2023). Nyamplung seed oil contains vitamin E which has antioxidant properties and is able to protect against oxidative effects and DNA damage (Handayani et al., 2020). Nyamplung seed oil can be used as a raw material for sunscreen and body scrub (Rakhmawati et al., 2021; Rejeki & Wahyuningsih, 2015).

Nyamplung oil can make the skin smooth and soft and does not leave residue on the skin. Research conducted by Rejeki & Wahyuningsih, (2015)reported that *in vitro* , Nyamplung oil was able to produce *SPF* 6 and *SPF* 14. Nyamplung oil was also reported to have anti-bacterial activity and was also a raw material for cosmetics. Nyamplung oil at low concentrations (1/10,000 ml/ml) shows significant UV absorption, has antioxidant properties and is able to protect against DNA damage (Said et al., 2007).

The high oil content of up to 70% makes Nyamplung potential as a source of energy and raw materials for cosmetics. Cosmetic products that can be developed from processed Nyamplung seeds can include facial masks, sunscreen and body scrubs as well as other cosmetic products (Amelia et al., 2024). Sunscreen is a substance or material that can protect the skin against solar radiation (Khery et al., 2023; Rejeki & Wahyuningsih, 2015). Various of cosmtics products produced contain activated charcoal in their formula (Mora-Villalobos et al., 2023). For mask products made from activated charcoal, Nyamplung seeds can maintain elasticity, while minimizing enlarged facial pores, the jam can also remove acne and blackheads and make the face glow (Rakhmawati et al., 2021).

Nyamplung plant extract has the potential to be used as a sunscreen, while activated charcoal processed from Nyamplung seed shells has the potential to be used as a facial mask and body scrub. Of the three products to be processed, each has its own quality indicators. The SPF value for sunscreen preparations is 15, which provides the highest protection from *sunburn,* and does not result in *tanning*. The higher the SPF value, the better the quality of the sunscreen product which can protect the skin from UV radiation. The percentage of erythema/fragmentation transmission in sunscreen preparations with the total effectiveness at each wavelength in the erythema range is 292.5 - 337.5 nm and the pigmentation range is 332.5 - 372.5 nm (R. Sayre et al., 1979). Dermatologists say that the recommended SPF value for *sunscreen* to be worn is a minimum for the face of 30 and a maximum of 50. *Body scrub cosmetic products* have an average SPF value limit for black skin ranging from SPF 20 – 30 (Lestari & Farid, 2022; Rakhmawati et al., 2021; Rejeki & Wahyuningsih, 2015).

The physical quality of mask and *body scrub preparations* is influenced by the composition of the ingredients used. To obtain good quality and meet standards, an evaluation must be carried out on mask and body scrub preparations which include organoleptic evaluation, viscosity evaluation, pH evaluation, spreadability evaluation and evaluation of the effectiveness of mask and *bosy scrub formulations*. Based on the background of the problem above, it is necessary to study the cosmetic quality of facial masks, *body scrubs* and sunscreen from processed Nyamplung seeds. So in this research, researchers conducted a study on quality testing of cosmetic products from processed Nyamplung seeds.

Method

Tools and Materials

The equipment used in this research includes a UV-Vis spectrophotometer, pH meter, analytical balance, oven, desiccator, Erlenmeyer, spatula, measuring cup, beaker glass, dropper pipette, burner, stopwatch, object *glass* , *Wattman* paper , stir bar, porcelain cup, sieve, filter paper, water bath, mixer stirrer, graph paper, transparent glass, tube container. The materials that will be used in this research are nyamplung seed extract, activated carbon, distilled water, glycerin, PVA (*polyvinyl alcohol*), TEA (*trietanolimine*), perfume, methyl paraben, cetyl alcohol, strearic acid, prophylen glycol, prophylen paraben, silica gel.

Research Procedure

1. *Making Facial Mask Cream*

Making facial mask cream begins by preparing the tools and materials then dissolving the PVA in hot distilled water at 80 ^{0} C. In another place, dissolve glycerine, methyl paraben, perfume and TEA. Next, dissolve it in PVA, then stir until homogeneous. The next step is to add activated carbon little by little while stirring until homogeneous. After adding activated carbon, add Nyamplung seed extract with 3 different concentrations for each sample. In sample 1 the

concentration of Nyamplung extract is 5%, sample 2 is 10%, and sample 3 is 15%, then the preparation is put into a container and heated in an oven at a temperature of 40 0 C (Lestari et al., 2018; Rejeki & Wahyuningsih, 2015).

2. *Test the Physical Properties of Face Masks*

Tests of the physical properties of masks include organoleptic examination, homogeneity, pH, viscosity, spreadability, dry time, adhesion, irritation test, density test, water content test and face mask effectiveness test (Ansel, 1988; Kamagi & Tanggasari, 2022; Lestari et al., 2018).

3. *Making Body Scrub Cream*

Making body scrub cream begins with preparing tools and materials. The prepared ingredients are weighed. Then dissolve the oil phase (cetyl alcohol, stearic acid) in a water bath at a temperature of 70 ^{0}C, while the water phase (propylene glycol, glycerin, and TEA) dissolve in water at a temperature of 80 ^{0}C and stir until homogeneous. The oil phase and water phase are mixed while stirring gently to form a body scrub base. Next, add activated charcoal, silica gel, and add Nyamplung seed extract with 3 different concentrations for each sample. In sample 1, the concentration of Nyamplung extract was 5%, sample 2 was 10%, and sample 3 was 15%, into the scrub base and stirred until homogeneous. Let it cool and put it in a container (Rakhmawati et al., 2021).

4. *Test the Physical Properties of Body Scrub Cream*

The evaluation stage of the physical properties of the body scrub cream was carried out using several tests including organoleptical test, homogeneity test, pH test, spreadability test, stickiness test, and irritation test, density test and water content test.

5. *Making Sunscreen*

The first step in making sunscreen is to weigh all the ingredients. After drawing, an oil phase and a water phase are made. The oil phase (stereic acid, cetyl alcohol and propyl paraben) was melted successively into a porcelain cup over a water bath. The water phase was made by mixing propylene glycol, glycerin, triethanolamine (TEA), methyl paraben, and distilled water in a beaker, then heating in a water bath. Both were left until the temperature reached 70 ^{0} C. After reaching this temperature, add the water phase little by little to the oil phase while stirring with a mixer for 2 minutes with a rest interval of 20 seconds. When the cream is 45-50 ^{0}C, add nyamplung seed extract while stirring until homogeneous. Next, put it into the *tube container* (Usman & Muin, 2022).

6. *Evaluation of Physical Stability of Sunscreen*

Evaluation of the physical stability of sunscreen is carried out using several tests including organoleptic tests, homogeneity, pH, and SPF value tests, percent erythema and pigmentation, density tests and water content tests.

Results and Discussion

Results of Physical Properties Test Analysis of Face Masks from Nyamplung (Calophylum Inophylum Linn) Extract

1. Organoleptic

In this study, the organoleptic test carried out was a preference test or hedonic test. This organoleptic test includes testing the panelists' preferences for the aroma, color and texture felt on the skin after using the mask.

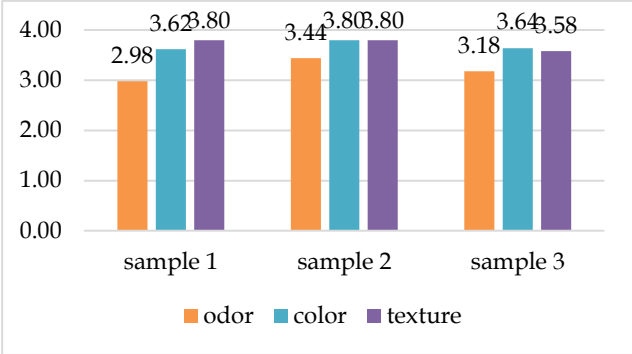

Figure 1. Average gravity of organoleptic tests

Information:
Sample 1 : *Nyamplung* extract concentration 5%
Sample 2 : *Nyamplung* extract concentration 10%
Sample 3 : *Nyamplung* extract concentration 15%

The assessment is carried out with a value range of 0 to 5. The value range consists of:

- Very good : 4.6 - 5
- Good : 3.6 – 4.5
- Fairly good : 2.6 – 3.5
- Bad : 0 – 2.5

Based on research testing the success of respondents regarding the aroma, texture and color of nyamplung extract mask preparations, it was found that samples with a nyamplung extract concentration of 10% had the highest average value compared to samples of 5% and 15%. This shows that masks containing 10 % nyamplung extract provide the most preferred aroma, texture and color by respondents. At a concentration of 5% the aroma and color of the mask are not strong enough, while at 15% the aroma and color are too strong so it is not liked.

In terms of texture, a mask with 10% nyamplung extract has the most appropriate and comfortable

consistency when applied to facial skin. The consistency is neither too runny nor too thick, making it the most preferred texture. Thus, it can be concluded that the optimal concentration of nyamplung extract for preparing facial masks is 10%. At this level the aroma, texture and color can be well received by the panelists. Extract concentrations lower or higher than that are less preferable for various reasons that have been explained.

2. Homogenity

Based on the homogenity test results of the three facial mask formulas with varying concentrations of nyamplung extract of 5%, 10% and 15%, the results showed that all mask formulas were homogeneous. Homogeneity shows that all the ingredients that make up the mask are evenly mixed without any lumps or phase separation between the solute and the solvent (Kuncari & Praptiwi, 2014).

The homogeneity of the three mask formulas with varying concentrations of nyamplung extract of 5%, 10% and 15% indicates that the addition of extracts with various levels of concentration does not interfere with the perfect mixing of the ingredients that make up the mask. It is important for topical preparations such as facial masks to have homogeneous properties so that they can spread evenly when applied to facial skin. Thus it can be concluded that the use of nyamplung extract up to a concentration of 15% is still able to produce a homogeneous facial mask preparation.

3. pH

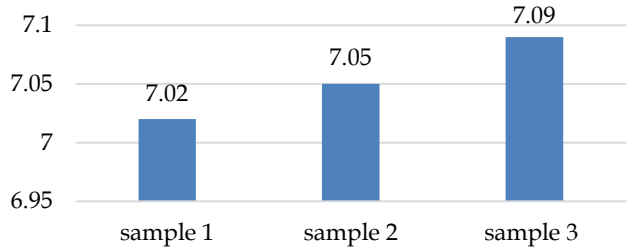

Figure 2. Gravity pH value

Based on pH value data for facial mask formulas with varying nyamplung extract concentrations of 5%, 10% and 15%, it is known that the three mask formulas have a neutral pH value, which is around 7. The pH value for the formula with a 5% nyamplung extract concentration is 7.02. The formula with a concentration of 10% has a pH value of 7.05, and the formula with a concentration of 15% has a pH value of 7.09.

Judging from the pH values of the three formulas, facial masks with nyamplung extract at various concentration levels are proven to be safe for use on facial skin. A neutral pH value indicates that the mask is not irritating or irritates facial skin. Thus, it can be concluded that the addition of nyamplung extract with a concentration of up to 15% does not cause significant changes in pH so it is safe and comfortable to use as a facial mask. This facial mask formula made from nyamplung extract is worthy of further testing.

4. Spread Power

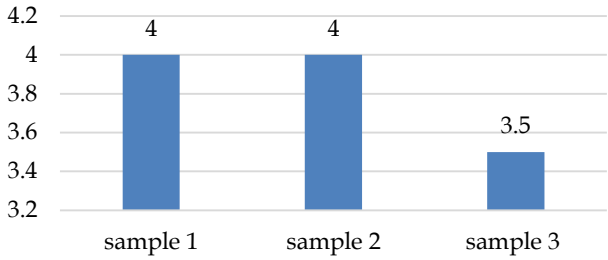

Figure 3. Gravity spreadability value (cm)

Based on data from spreadability test results for facial mask formulas with varying concentrations of nyamplung extract, it is known that the higher the concentration of nyamplung extract used, the lower the spreadability. At extract concentrations of 5% and 10%, the spreadability of the mask is 4 cm. However, when the concentration of nyamplung extract was increased to 15%, the spreadability of the mask decreased slightly to 3.5 cm.

Decrease in spreadability was caused by an increase in the concentration of the active ingredient of Nyamplung extract which had caused an increase in the viscosity or viscosity of the mask preparation. The thicker the texture of the mask, the less spreadable it is because it is difficult to spread on facial skin. Even though there is a decrease in the spreadability of the formula with 15% extract, the spreadability value of the mask still meets the requirements, namely above 3 cm. Thus, it can be said that the use of nyamplung extract up to a concentration of 15% still produces a facial mask with good spreadability.

5. Stickiness

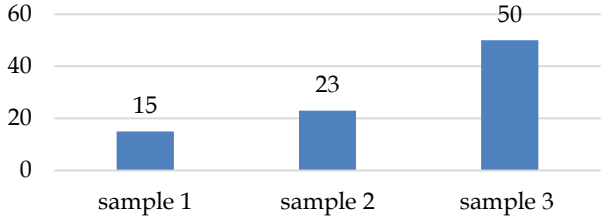

Figure 4. Gravity value of adhesion force (second)

Based on data from adhesion test results for facial mask formulas with varying concentrations of nyamplung extract of 5%, 10% and 15%, it can be seen that the higher the concentration of the extract used, the more adhesion the mask tends to increase. Masks with an extract concentration of 5% have the fastest

adhesive power, namely 15 seconds. Then, successively, the mask with an extract concentration of 10% had an adhesion of 20 seconds, and a concentration of 15% had the longest adhesion, namely 30 seconds. This increase in adhesive power is thought to be related to the increase in viscosity or viscosity of the preparation as the concentration of the active substance used in the nyamplung extract increases. However, this increase in adhesion is still within the limits that meet the requirements for facial mask preparations, namely a maximum of 30 seconds (Lestari et al., 2021). Thus, it can be concluded that the facial mask formula with varying concentrations of nyamplung extract shows good adhesion up to a concentration of 15%.

6. Drying Time

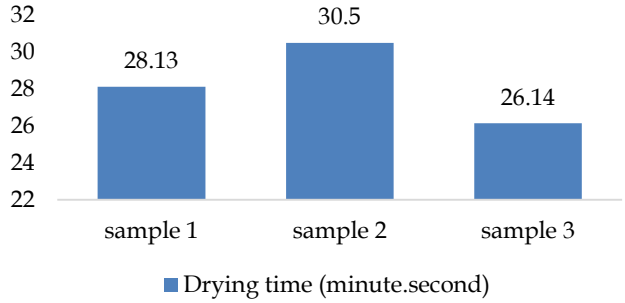

Figure 5. Graphic the drying time value

Based on data from the drying time test results of the three facial mask formulas with varying concentrations of nyamplung extract, it can be seen that masks with all concentration levels show a relatively fast drying time, namely less than 30 minutes. The formula with a 5% nyamplung extract concentration had a drying time of 28 minutes 13 seconds, the 10% formula took 30 minutes 5 seconds, and the 15% formula had the shortest drying time, namely 26 minutes 14 seconds.

The short drying time of less than half an hour for the three mask formulas shows that the use of nyamplung extract at various concentration levels is able to produce facial mask preparations that dry easily when applied to the face. This is a practical use advantage for consumers. Based on the drying time test , it can be concluded that the nyamplung extract mask has good performance and dries easily when applied to the face.

7. Irritation from Facial Mask Preparations

Based on the results of irritation tests on the three facial mask formulas with varying concentrations of nyamplung extract of 5%, 10% and 15%, the results showed that none of the mask formulas caused a positive irritation reaction when applied to the skin. The absence of an irritating reaction is indicated by the absence of red, swollen, hot or sore effects on the skin area where the mask is applied.

Test results show that using nyamplung extract in a concentration range of 5-15% is safe to use because it does not irritate the skin. The bioactive content in nyamplung extract at this concentration level is not irritating. Thus, it can be concluded that the three mask formulas are safe to apply to facial skin and are worthy of further research as potential herbal facial masks.

8. Water content

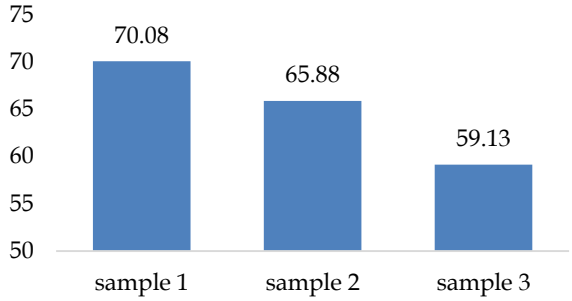

Figure 6. Water content (%)

Content test results of the three facial mask formulas with varying concentrations of nyamplung extract of 5%, 10% and 15%, a tendency was seen to decrease the water content along with increasing concentrations of the nyamplung extract used. The formula with an extract concentration of 5% had the highest water content, namely 70.08 % , then the 10% formula had a water content of 65.88%, and the 15% formula had the lowest water content, namely 59.13%. This decrease in water content is thought to be because the more nyamplung extract that is added, the free water content in the mask preparation decreases. Even though there is a decrease in water content in formulas with higher extract concentrations, the water content value of the mask is still in a good range to support the desired performance and texture of the mask. It can be concluded that variations in the concentration of nyamplung extract have an influence on water content but the value is still within optimal limits for facial mask formulas.

9. Density

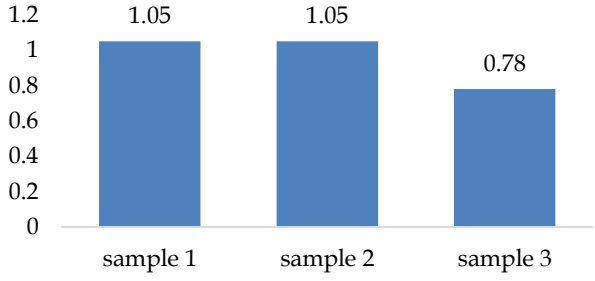

Figure 7. Density gravity (gr/mL)

Based on data from the density test results of the three facial mask formulas with varying concentrations of nyamplung extract, it can be seen that the formulas with concentrations of 5% and 10% have the same density value, namely 1.05 gr/ml. However, there was a significant decrease in the density value in the formula with an extract concentration of 15%, namely to 0.78 gr/ml.

The decrease in density in the 15% concentration formula is due to an increase in the viscosity of the preparation as the amount of thick extract added increases. Excessive viscosity can reduce the mass per volume of a preparation so that the density value is also reduced. Even though the formula density value is 15% lower than the other two formulas, this value is still in a good density range for facial mask preparations. Therefore, the use of up to 15% nyamplung extract is considered safe to use by considering the density test parameters.

Results of Physical Properties Test Analysis of Body Scrub from Nyamplung (Calophylum Inophylum Linn) Extract

1. Organoleptic

Body Scrub organoleptic testing of Nyamplung (Calophylum Inophylum Linn) seed extract includes color, odor and texture. This test was carried out with the aim of finding out whether the ingredients contained in the body scrub cream were homogeneous or not. Tests were carried out on 10 volunteers as respondents to determine the level of liking of the body scrub preparations that had been made.

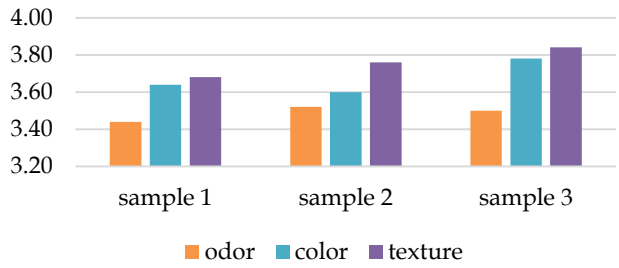

Figure 8. Average gravity of organoleptic tests

Information :
Sample1 : *Nyamplung* extract concentration 5%
Sample2 : *Nyamplung* extract concentration 10%
Sample3: *Nyamplung* extract concentration 15%

Based on test results of respondents' preferences for the aroma, color and texture *of body scrubs* with various concentrations of nyamplung extract, it can be said that for aroma, the highest average value was obtained at 10% nyamplung extract concentration, namely 3.52, followed by 15% concentration (3, 50) and 5% concentration (3.34). This shows that the higher the concentration of nyamplung extract, the more the panelists prefer the aroma *of the body scrub , up to an optimum concentration of 10%*. Furthermore, the color of the body scrub was also increasingly preferred by panelists as the concentration of nyamplung extract increased. The highest average color value was obtained at a concentration of 15% (3.78), followed by 10% (3.60) and 5% (3.64). Likewise for texture, the higher the concentration of nyamplung extract results in a greater average value of liking for texture, namely concentrations of 15% (3.84), 10% (3.76), and 5% (3.68).

In conclusion, the higher the concentration of nyamplung extract in *the body scrub* , the higher the level of panelist acceptance of the three parameters (aroma, color, texture). However, you must also pay attention to the optimum aroma at a concentration of 10%.

2. Homogenity

Based on the results of the homogeneity test with varying concentrations of nyamplung extract of 5%, 10% and 15%, data was obtained that all samples had good homogeneity. This is shown by the homogeneity test results which state that all samples are homogeneous. This good homogeneity indicates that the use of nyamplung extract at various concentration levels produces a *body scrub preparation* that has uniform physicochemical properties.

Thus, it can be concluded that the use of nyamplung extract in the range of 5-15% can produce *a body scrub* that is homogeneous and of good quality. The concentration of nyamplung extract can be further optimized to achieve the best characteristics of the desired *body scrub.*

3. pH

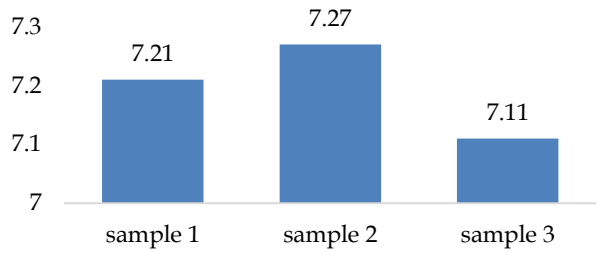

Figure 9. Gravity of pH values

The pH value indicates the acidity or alkalinity of a preparation. It is important to maintain a neutral pH in *body scrubs* so that they do not irritate the skin. The use of nyamplung extract at various concentration levels has been proven to produce a *body scrub pH* that is relatively the same and safe for the skin.

Looking in more detail, the pH value tends to increase slightly at a concentration of 10% compared to

5%, but then decreases at a concentration of 15%. This indicates that the optimum concentration for adding nyamplung extract in terms of pH parameters is 10-15%. Increasing the concentration beyond 15% has the potential to lower the pH beyond safe skin limits.

Thus, it can be concluded that the addition of nyamplung extract with a concentration of 5-15% to *body scrub preparations* produces a pH that is safe and suitable for use on the skin. pH stability is maintained in this concentration range.

4. Spread Power

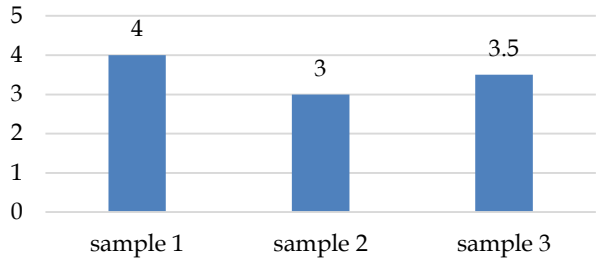

Figure 10. Gravity of spreadability (cm)

In general, spreadability shows the ability to spread a semi-solid preparation when applied to the skin. The greater the spreading power, the easier it is to rub and distribute evenly on the surface of the skin.

From the data obtained, it can be seen that the spreadability tends to decrease with the higher concentration of nyamplung extract added. A 5% concentration provides the greatest spreading power, namely 4 cm, followed by 3.5 cm (15% concentration) and 3 cm (10% concentration). This is thought to be because the more nyamplung extract, the thicker the system becomes, so the dispersion power decreases. However, the spreadability values of the three formulas are still in the good range for *body scrub use.* A value of more than 3 cm is considered adequate so that *the body scrub* is easy to apply and spreads evenly when rubbed on the body. Therefore, it is necessary to choose the optimum concentration of nyamplung extract which does not reduce the spreadability value too much.

5. Stickiness

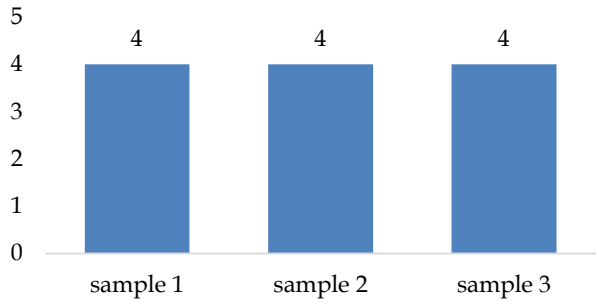

Figure 11. Gravity of adhesion (second)

Adhesion indicates the length of time a topical preparation sticks to the skin after application. The longer the adhesion, the better because it provides a longer contact time between the active ingredients of the formula and the skin to provide a therapeutic or treatment effect.

It is known that the adhesive power of the three *body scrub formulas* is the same, namely 4 seconds, and is not affected by changes in the concentration of nyamplung extract. This means that adding extracts in the range of 5-15% provides equally stable adhesion.

Thus, it can be concluded that using a nyamplung extract concentration of between 5-15% ensures that the adhesive power of the resulting *body scrub* is maintained well and long enough to be in contact with the skin, without causing an excessive sticky feeling after application.

6. Emulsion Type

Based on the test results, it is known that the three *body scrub formulas* with varying concentrations of nyamplung extract of 5%, 10% and 15% have the same type of emulsion, namely O/W or oil in water.

The type of emulsion determines the carrier system for the active ingredient in the preparation, whether it is dispersed in the oil phase (O/W) or the water phase (W/O). O/W emulsions are generally preferred because they provide a lighter feel and absorb easily into the skin.

Thus, it can be concluded that the addition of nyamplung extract with a concentration range of 5-15% in making *body scrubs* still allows the desired O/W emulsion to be formed without changing the emulsion type to W/O.

7. Water content

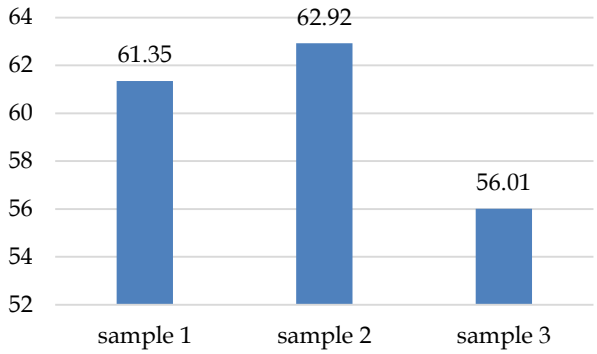

Figure 12. Water content gravity (%)

Water content is an important parameter that determines the physical stability and shelf life of semi-solid preparations such as *body scrubs.* The lower the water content , the more stable the preparation is from

microbial growth and chemical reactions that can reduce quality.

Based on the data produced, it can be seen that the water content tends to increase from an extract concentration of 5% to 10%, but then decreases drastically at a concentration of 15%. It is suspected that the more extract you add, the stronger the interactions between the components, thereby binding more water molecules. However, at high concentrations, it is suspected that there will be a decrease in water activity which actually maintains the physical stability of the preparation. Therefore, the optimum concentration of nyamplung extract needs to be considered between 10-15% in order to obtain a water content that is low enough but provides maximum therapeutic activity in *the body scrub.*

8. Density

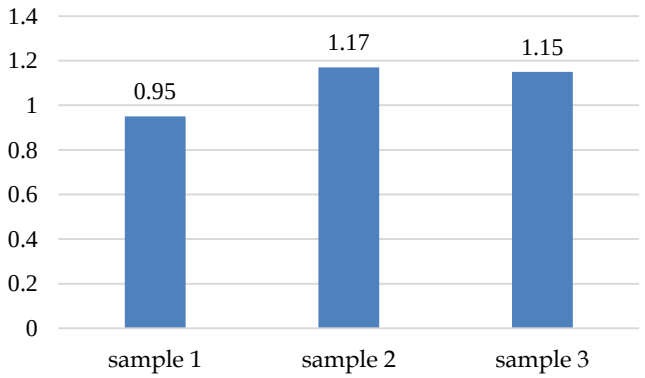

Figure 13. Density gravity (gr/mL)

The measured density represents the weight per unit volume of the preparation. The higher the density value indicates the denser and heavier the preparation. It can be seen that the density of *the body scrub* increases as the concentration of nyamplung extract increases. This is positively correlated with an increase in dissolved solids in the formula, so that the system density becomes greater. However, increasing the density in the range of 0.96 -1.17 gr/ml still gives *the body scrub* a good texture and is easy to apply to the skin. Therefore, a concentration of nyamplung extract of up to 15% still provides an optimum density value for the physical characteristics of the body scrub. Concentrations more than that need to be considered if they too affect the density and texture of the preparation.

Results of Physical Properties Test Analysis of Sunscreen from Nyamplung (Calophylum Inophylum Linn) Extract

1. Organoleptic

Organoleptic tests include examining color, aroma and texture. In this study, organoleptic tests were carried out with 10 random respondents.

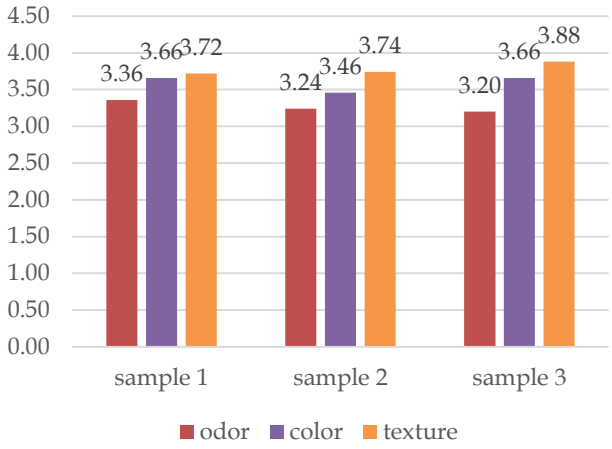

Figure 14. Average gravity of organoleptic tests

Information:

Sample 1 : *Nyamplung* extract concentration 5%

Sample 2 : *Nyamplung* extract concentration 10%

Sample 3 : *Nyamplung* extract concentration 15%

Based on data from the test results of respondents' preferences for sunscreen preparations with various concentrations of nyamplung extract, it can be analyzed that for aroma, sunscreen with a concentration of nyamplung extract of 5% has the highest average value, namely 3.36; followed by 10% concentration with a value of 3.24 and 15% concentration with a value of 3.2. This shows that the panelists preferred the aroma in sample 1.

For color, sunscreen preparations with 5% and 15% nyamplung extract concentrations had the highest average value, namely 3.88; while at concentration 10 it has a slightly lower value, namely 3.46. This means that the panelists most liked the color of sunscreen preparations with 5% and 15% nyamplung extract levels. Meanwhile, sample 3's texture had the highest average value, followed by sample 2 and sample 1. Thus, it can be said that the panelists liked the sunscreen texture at a higher extract concentration level, namely at a concentration of 15%.

2. Homogenity

Based on the results of the homogenity test on sunscreen samples with varying concentrations of nyamplung extract of 5%, 10% and 15%, it was found that all samples had the same or homogeneous variants. This indicates that the addition of nyamplung extract at various concentrations did not cause significant changes in the variability of the aroma, color and texture properties of sunscreen.

3. pH

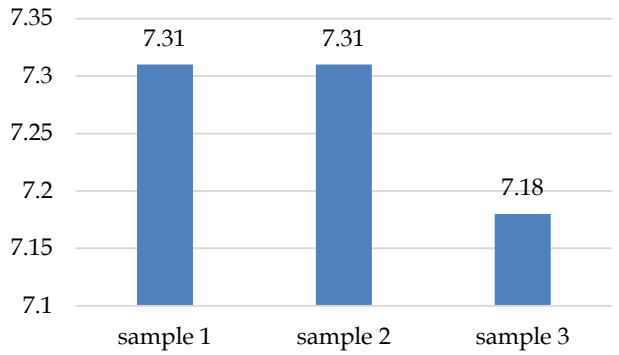

Figure 15. Gravity of pH values

Based on the test results, it is known that the pH value of sunscreen preparations with the addition of nyamplung extract at various concentration levels is relatively stable and meets pH standards that are safe for the skin. In detail, sunscreens with 5% and 10% nyamplung extract concentrations have identical pH values, namely 7.31. Meanwhile, at a concentration of 15%, the pH decreased to 7.18 , although the figure was still considered neutral. The decrease in pH value in the formula with the highest extract content is thought to be due to the increasing number of active compounds in the nyamplung extract which are acidic, although the shift is not drastic.

Overall, it can be concluded that the addition of up to 15% nyamplung extract has not changed the pH of the sunscreen preparation significantly, so it is still safe and suitable for application to the skin. pH monitoring still needs to be carried out when developing formulas with higher levels of nyamplung extract.

4. Water content

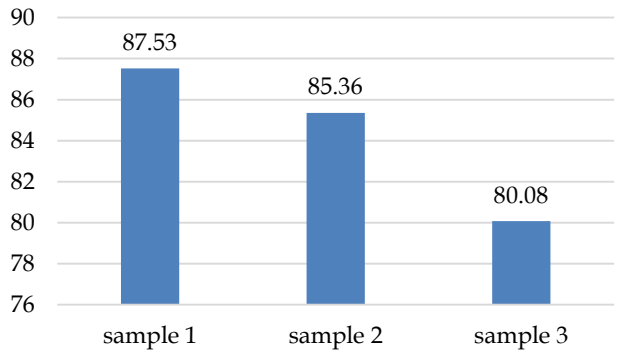

Figure 16. Water content gravity (%)

Based on the results of testing the water content of sunscreen preparations with varying concentrations of nyamplung extract, a tendency was seen to decrease the water content as the concentration of the added extract increased. In detail, the formula with an extract content of 5% has the highest water content, namely 87.53 % ; followed respectively by preparations with 10% (85.36%) and 15% (80.08%) extracts.

Decrease in water content is thought to be due to the thicker extract being added, so that the total solids in the preparation becomes higher and the water content decreases. The difference in water content between formulas is still relatively small, namely less than 10%. Thus, it can be said that the effect of nyamplung extract concentration on the water content of sunscreen preparations is not significant. The overall water content of the formula is still adequate for the dosage form of sunscreen cream or lotion.

5. Density

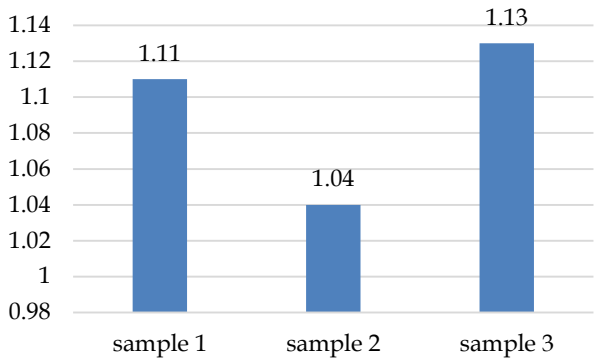

Figure 17. Density gravity (gr/mL)

Based on the results of density testing on sunscreen preparations with varying concentrations of nyamplung extract, it is known that the density value of the formula ranges from 1.04 to 1.13 gr/ml. In detail, the highest density was obtained in the preparation with the addition of 15% extract, namely 1.13 gr/ml, followed by the formula with 5% extract content (1.11 gr/ml). The lowest density value was produced by a preparation with 10% extract, namely 1.04 gr /ml.

Fluctuations in density values between formulas are thought to be influenced by the total amount of solids contained. The thicker extract added, the higher the density of the preparation. However, the difference in density between formulas is not too wide and is still within the normal range for topical/cosmetic preparations. In other words, variations in the concentration of nyamplung extract up to 15% have not had a significant effect on changes in density, so this parameter is relatively stable.

SPF, Erythema and Pigmentation

In determining the SPF value, erythema and pigmentation of Nyamplung extract *sunscreen* measured absorbance using a UV-Vis spectrophotometer at a wavelength of 290-320 nm and erythema transmittance at a wavelength of 292.5 - 317.5

nm and pigmentation transmittance at a wavelength of 322.5 - 372.5 nm with 5 nm of interval (Khery et al., 2023; R. Sayre et al., 1979; R. M. Sayre et al., 2013).

Table 1. SPF, Erythema and Pigmentation Test Results

Sample	Erythema (%Te)	Pigmentation (%Tp)	SPF	Category
5%	8.32	30.55	10	Extra sun protecting product
10%	1.14	12.58	14.14	Maximum sun protecting product
15%	1.30	9.34	17.42	Ultra sun protecting product

The results show that the SPF value of sunscreen increases significantly from 10 (extract concentration 5%) to 17.42 (15%), as the extract concentration increases. This indicates the role of Nyamplung extract as a natural sunscreen. Apart from that, formulas with higher extract levels also effectively reduce the risk of skin irritation (erythema) and hyperpigmentation due to UV rays. For example, the erythema rate decreased from 8.32 % (5% concentration) to 1.30% (15%). Likewise, pigmentation was reduced drastically from 30.55 % (5%) to 9.34% (15%). The mechanism is thought to be through the antioxidant activity of the extract which protects the skin from damage-inducing free radicals. Overall, (according to Khery et al., 2023; Rejeki & Wahyuningsih, 2015; R. Sayre et al., 1979; R. M. Sayre et al., 2013) the study results show that Nyamplung seed extract has the potential to increase the effectiveness and safety of sunscreen preparations, especially at higher concentrations (10-15%). Its use can be optimized to prevent side effects in the form of irritation and hyperpigmentation on the skin.

Conclusion

Based on the research results, it can be concluded that all cosmetic preparation samples produced meet the test standards. For facial mask cream preparations, the sample with the addition of 10% Naymplung extract was the best based on the results of the preference test for aroma, color and texture parameters. Body scrub preparations with the addition of 10% Naymplung extract are also the most preferred based on aroma parameters and produce scrub granules that are still coarse but safe for the skin. As for sunscreen preparations, the highest SPF value of 17.42 was obtained from the addition of 15% Naymplung extract in the ultra protection category. Overall, on average potential users gave a positive response to samples of cosmetic preparations based on organoleptic assessments including aroma, color and texture parameters. This shows that the product has the potential to be well received by consumers.

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Author Contributions

Conceptualization, Aliefman Hakim and Yusran Khery; methodology, Aliefman Hakim.; software, Husnul Hatimah.; validation, Aliefman Hakim, Joni Rokhmat. and AA Sukarso; formal analysis, Yusran Khery.; investigation, Febriana Lidiawati.; resources, Aliefman Hakim; data curation, Yusran Khery; writing—original draft preparation, Yusran Khery.; writing—review and editing, Aliefman Hakim; visualization, Yusran Khery; supervision, Aliefman Hakim and Yusran Khery; project administration, Husnul Hatimah; funding acquisition, Aliefman Hakim. All authors have read and agreed to the published version of the manuscript.

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