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Formulation and Evaluation of Sun Block Lotion Made From Virgin Coconut Oil (VCO) with the Addition of Extract of Telang Flowers (*Clitoria Ternatea*, L) and Pandan Leaves (*Pandanumusa Paradisiaca*, L)

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A B S T R A C T

Telang flowers (*Clitoriaternatea,* L) and pandan leaves (*Pandanusparadisiaca*) are plants that contain phytochemical components that are able to block sunlight from exposing the skin. While Virgina Coconut Oil (VCO) is able to moisturize and soften the skin. This study aims to determine the best formulation in protecting sunlight in application to the skin, as well as knowing the physical and chemical characteristics of skin lotion. This research uses an exploratory method with 2 treatments and 3 replications. The treatment is the addition of telang flower extract and pandan leaf extract to the VCO skin lotion. Evaluation is carried out on the physical and chemical properties and the level of panelist preference. The results showed different results from the two formulations, the highest protection value to the sun was the addition of telang flower extracts expressed by SPF 20.64, the antioxidant activity of 81.66%, pH of 6, 0.012% free fatty acids, a specific gravity of 0.94, 34880 cP viscosity, 65.25% stability, 6.0 cm dispersibility, total plate count of 1.3 x 10^{-10}cfu / ml.

1. INTRODUCTION

1.1. Research Background

Skin lotion is one of the skin moisturizing cosmetics consisting of various vegetable oils, animal or synthetic synthesis which can form the surface fat of artificial skin that functions to flex the layers of dry and rough skin and reduce water evaporation from skin cells, but it cannot replace all functions and the use of the original skin. Skin moisturizing cosmetics generally take the form of a mixture of oil in water that can be added with certain substances for special purposes [1].

Skin Lotion can maintain skin moisture and water resistance in the skin layer so that it can soften and maintain the smoothness of the skin [2]. The final results obtained depend on the ability to mix raw materials with other materials to obtain moisture, softness and protection from drought [3].

Natural substances extracted from plants can act as a potential source of sunscreen because they are photoprotective. This is related to the fact that plants cannot avoid sun exposure because plants need sunlight for their photosynthesis. Even so, the plant has a self-protection mechanism so that the plant is not damaged. This gives a little picture of the ability of plants to protect the skin through compounds contained in plants in the form of bioactive compounds such as phenolic compounds and is supported by the presence of antioxidant compounds. Phenolic compounds, especially the flavonoid group, have potential as a sunscreen due to the chromophore group, which is a single conjugated double bond that is able to absorb UV rays both UV A and UV B, thereby reducing its intensity on the skin [4].

Fragrant pandan (Pandanus amaryllifolius Roxb.) Or simply called pandanus is a type of monocot plant of the Pandanaceae family. The leaves are an important component in the cooking traditions of Indonesia and other Southeast Asian countries. Pandanus amaryllifolius Roxb. is the only Pandanus species that has fragrant leaves. This plant is known for its distinctive fragrance, so it is called fragrant screw pine [5]. The content of fragrant pandanus leaves, including flavonoids, alkaloids, saponins, tannins, polyphenols, and dyes, is thought to have contributed to antibacterial activity [6].

The telang flower (*Clitoria ternatea*, L) is a compound flower, formed on the armpit of the leaf, has a cylindrical stalk, approximately 1.5 cm long, has a funnel-shaped petals, a

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butterfly-shaped crown and is blue, the stalks are attached to form a tube, round anthers, cylindrical pistil stems, round pistil heads (Figure 3). Pod-shaped fruit, 7-14 cm long, short-stemmed, young fruits that turn green after dark turn black [7].

According to Ref. [8], the blue color of telang flowers indicates the presence of anthocyanin. Crude extracts from telang flowers can be used as an alternative dye for coloring animal blood cell preparations. Seeing the benefits, the nature of telang flowers which are easy to grow in Indonesia, and safe for consumption, the anthocyanin from telang flowers has the potential to be a natural coloring agent in food. The blue color of telang flowers has been used as a blue dye in sticky rice in Malaysia. Telang flowers can also be consumed as a vegetable in India and the Philippines [9].

Anthocyanin pigments are more stable in acidic solutions than neutral or basic solutions because in acidic conditions anthocyanins will be in the form of cavities flavilium to quinodal bases so that color degradation does not occur [10]. Anthocyanins from flowers can be extracted by maceration. Maceration is a type of liquid solid extraction, namely by soaking plant tissue that has been blended in the appropriate solvent for 24 hours then filtered with a Buchner funnel and finally evaporated to obtain a pigment extract [6].

1.2. Research Objective

This study aimed to study the effect of natural ingredients extract in the production of sunscreen skin lotion which provides a protective effect against the sun, with a relatively high SPF value and determine the best formulation in protecting sunlight in application to the skin, as well as knowing the physical and chemical characteristics of skin lotion.

2. MATERIALS AND METHODS

2.1. Materials

The raw materials used in this study are VCO, telang flowers, pandanus leaves, green tea, black tea, and secang wood. The chemicals used in this study were stearic acid, glycerin, triethanolamine (TEA), methyl parabens, aquades, deodorizers, buffer solutions, NaOH, KOH, neutral alcohol, ethanol, HCL physiological salts, PCA, acetone, methanol, aquades, DPPH, and PCA (Plate Count Agar) media.

The tools used are scales, basins, knives, blenders, petri dishes, autoclaves, aluminum spoons, aluminum foil, hot plates, magnetic stirers. The tools for analysis are analytical balance, stopwatch, aluminum cup, oven, desiccator, pH meter, chalice, measuring flask, erlenmeyer, funnel, vortex, spectrophotometer, upright cooler, filter paper, micro pipette and drop pipette.

2.2. Working Procedure

2.2.1. Telang Flower Extraction

Fresh telang flowers are cut with a size of 1 cm and then mashed with blander and macerated with distilled water (1:5) for 15 minutes while stirring with a magnetic stirer at 25 °C. Then filtered and obtained liquid extracts of telang flowers.

2.2.2. Pandan Leaf Extraction

Fresh pandan leaves are cut to the size of 1 cm and then mashed with blander and macerated with distilled water (1: 5) for 15 minutes while stirring with a magnetic stirer at a temperature of 25 °C. Then filtered and obtained liquid extract of pandan leaves

2.2.3. Skin Lotion Preparation

The principle of making skin lotion is the mixing of several ingredients with perfect stirring and heating. Following the process of making skin lotion: Material is separated into two parts, namely oil-soluble material and water-soluble material. Ingredients included in the oil phase include: VCO, glycerin and stearic acid. Ingredients included in the water phase include: triethanolamine, and natural coloring water extracts namely telang flower extract and pandan leaf). The oil phase is mixed until homogeneous with heating 70-75 ºC to form dosage A. The water phase is mixed until homogeneous with heating 70-75 ºC to form B. to 40 ºC, a C preparation is formed. At 37 ºC, the methyl paraben is inserted into the C preparation, then add the fragrance.

2.2.4. Pandan Leaf Extraction Observation

Observation of raw materials, namely free fatty acids. Observation of skin lotions are as follows: Chemical analysis of pH, free fatty acids, antioxidant activity and SPF values. Physical observations are viscosity, emulsion stability, specific gravity, and spreadability. Microbiological analysis is the analysis of total plate numbers. Organoleptic testing which includes color, aroma, absorption and adhesiveness.

3. RESULT AND DISCUSSION

3.1. The value of pH

3.1.1. Evaluation of Natural Ingredients

Based on the results of research that has been done on the formulation and evaluation of sunscreen skin lotion made from VCO by adding a variety of natural extracts made from pandan leaves and telang flowers. Following are the results of the analysis conducted on the extracts of these natural ingredients can be seen in Table 1.

Extra flower of telang flower has antioxidant activity that is equal to 86.30% this result is categorized as high antioxidant. This is caused by a number of phenols and flavonoids showing significant inhibition compared to gallic acid and quercetin standards. This shows that the leaves and flowers of telang have antioxidant activity against free radicals such as DPPH, hydroxyl radicals, and hydrogen peroxide. This result is a potential source of antioxidants from biological substances [11]. The results of the antioxidant activity test of pandan leaf water extract were 83.60%. Compounds that are known to be contained in fragrant pandanus are phenolic compounds, alkaloids, flavonoids, saponins, tannins, essential oils, terpenoids, and steroids. Flavonoids are known as one of the powerful antioxidant substances that can eliminate the damaging effects that occur on oxygen in the human body. This compound consists of more than 15 carbon atoms, most of which can be found in plant contents [12].

Based on the data obtained from the natural extract test, it can be seen that the higher the antioxidant activity of the ingredients, the SPF value is also increasing, this is caused by the compounds contained in these natural ingredients besides being antioxidants it is also able to withstand sunlight so it is not

directly exposed to skin through the double bonds that the material has.

Table 1. Evaluation Natural Material Extract

Parameter	Telang Flower Extract	Pandan Leaves Extract
SPF	19.65	16.74
Antioxidant (%)	86.53	83.60

The results of the test extract of this material certainly differ according to the material used, the SPF value of the extract of telang flower is 19.65 and pandan leaf extract is 16.74. The SPF value of the extract material needs to be known so that the handling of the ingredients can be done properly and can be synchronized with the SPF value of the skin lotion product.

Telang flower water extract has antioxidant activity that is equal to 86.30%. This result is categorized as high antioxidant. This is caused by a number of phenols and flavonoids showing significant inhibition compared to gallic acid and quercetin standards. This shows that the leaves and flowers of telang have antioxidant activity against free radicals such as DPPH, hydroxyl radicals, and hydrogen peroxide. This result is a potential source of antioxidants from biological substances [11].

The results of the antioxidant activity test of pandan leaf water extract were 83.60%. Compounds that are known to be contained in fragrant pandanus are phenolic compounds, alkaloids, flavonoids, saponins, tannins, essential oils, terpenoids, and steroids. Flavonoids are known as one of the powerful antioxidant substances that can eliminate the damaging effects that occur on oxygen in the human body. This compound consists of more than 15 carbon atoms, most of which can be found in plant contents [12].

3.2. Characteristic of Skin Lotion

3.2.1. Chemical Evaluation

Table 2. Evaluation of Chemical *Skin Lotion*

Parameter	*Skin Lotion* Telang Flower Extract	*Skin lotion*, Pandan Leaves Extract
SPF	20.64	19.21
Antioxidant activity (%)	81.66	80.40
pH	6.0	6.5
FFA (%)	0.012	0.022

The UV spectrophotometry method is a simple, fast, low cost method and can be used to determine SPF values in vitro on several cosmetic formulations. From the results obtained in each formulation with the lowest value of 19.21 in the formulation of the addition of pandan leaf extract, the highest SPF value is produced in the formulation of the addition of extracts of telang flowers) ie 20.64 this value is classified into a high SPF because based on SNI 16-4399-1996. The SPF contained in the lotion sedan is 4. The high SPF value of a cosmetic sedan is influenced by the active components contained in it, and this is closely related to the antioxidant compounds in the ingredients. Sunscreen functions to absorb or spread sunlight so that the intensity of light that is able to reach the skin is much less [1]. Active sunscreen compounds absorb at least 85% of UV radiation over a range of wavelengths from 290 to 320 nm, and possibly to wavelengths in excess of 320 nm. By absorbing UVR, the chemical sunscreen will block UVR transmission to the epidermis physically reflecting UV radiation.

Sun Lotion is mainly composed of sunscreen active ingredients, as well as a base consisting of components of the oil phase and water phase, emulsifying agents, humectants, and preservatives. Emulsifying agents are distinguished as anionic, cationic and nonionic surfactants [2]. The purpose of making sunscreen preparations is to formulate products that are rubbed on the skin to leave residues that are not detected in the eye and are not tacky or greasy. Hard paste may be difficult to rub on the skin, difficult to put into a flat layer; and application to damaged skin may be painful. Usually the consistency of the emulsion is controlled by varying the ratio of the waxy component (wax) as a structural matrix material to the liquid fraction [13].

Based on the research results obtained, it can be seen that formulas that have high antioxidant activity values produce high SPF values as well. This shows a positive correlation as an antioxidant as well as sunscreen.

The value of antioxidant activity of skin lotions ranging from 80.40 to 87.24% is a high enough value compared to skin lotion products on the market with an antioxidant activity value of 57.65%. This high antioxidant activity comes from the ingredients used in making skin lotions, VCO also contains phenolic compounds which provide high antioxidant activity [14]. Besides that it turns out that the antioxidant content in VCO is very high, such as tocopherol and beta-carotene.

Chemical compounds that have been successfully investigated in telang flower crowns contain 14 types of flavonol glycosides and 19 types of anthocyanins. Phenol and delfinidin compounds in telang flowers are effective against Staphylococcus aureus, which causes inflammation of the eyes. Aside from being an antioxidant that functions to capture free radicals, anthocyanins also play a role in maintaining eye tissue, antidiabetic, anti-inflammatory, maintaining the immune system and preventing platelet aggregation. Anthocyanins can be inhibitors of the cyclooxygenase (COX) enzyme and prevent prostaglandin synthesis which is one of the inflammatory mediators [15].

. Fragrant pandanus has the chemical content of alkaloids, flavonoids, saponins, tannins polyphenols which function as natural antioxidant substances. Phenolic antioxidants are usually used to prevent damage due to oxidation reactions in food, cosmetics, pharmaceuticals and plastics. [16].

pH is an important parameter in cosmetic products. The measurement of pH aims to determine whether the resulting lotion is acceptable to the skin or not. Skin lotion must be close to the skin's pH of 6.0 to 6.5 so as not to irritate. Too alkaline pH causes dry and scaly skin, if too acidic can cause skin irritation.

Free fatty acids are acids that are released in the process of fat hydrolysis by enzymes. This hydrolysis process is catalyzed by the lipase enzyme which is also present in the fruit, but is inside the oil-containing cell. If the cell wall is broken or damaged due to the decay process, the enzyme will undergo a hydrolysis reaction that will take place quickly to form glycerol and free fatty acids. Determination of free fatty acid levels related to free fatty acid content in VCO

3.3. Evaluation of Physical Characteristic

Table 3. Physical Characteristic of *Skin Lotion*

Parameter	*Skin Lotion* Telang Flower Extract	*Skin Lotion* Pandan Leaves Extract
Density	0.94	0.96
Viscosity (cP)	34880	35000
Stability (%)	65.25	67.39
Dispersibility (cm)	6.0	6.5
Total Plate Count (cfu/ml)	1.3×10^{-1}	1.7×10^{-1}

Specific gravity is the ratio of the weight of the sample volume to the weight of water with the same volume at a certain temperature. Measurement of this specific gravity is one indicator of the stability of an emulsion product. If the ratio between the dispersing phase and the dispersed phase is not appropriate, the lower the stability level of an emulsion preparation [17].

In this study the measurement of the specific gravity of the product using a pycnometer, the principle of this measurement is to insert the sample into the pignometer that has known the weight and volume, then measure the pycnometer that has been filled with the sample again until there are no visible air bubbles in the volume in the pignometer, then convert into weight type by dividing the amount of weight difference between the pycnometer that already contains the sample and the empty pignometer by the volume occupied by the sample.

The viscosity of each skin lotion tested in each formulation illustrates that skin lotion has the same tendency, which is the longer it is in the range of 34750-35300 cP. The existence of a strong stirring during mixing causes the droplet particles to move freely and collide with each other so that the tendency to join is even greater. Joining droplet particles will result in contact area between droplet particles becoming weaker. There will be a decrease in consistency in the system which will result in a decrease in viscosity in the system during storage [18].

The purpose of the spread test is to determine the extent of skin spread when applied to the skin. Based on Table 2. shows the differences in the spread area between the five formulas, ranging from 6.0 - 6.5 cm. High-viscosity preparations are more difficult to flow due to the large cohesion forces between the base molecule of the preparation so that skin lotions are difficult to spread and tend to accumulate. Conversely, skin lotions that have low viscosity will be easier to flow so it is easier to spread. This is related to viscosity, where the decrease in viscosity causes the spreadability to increase because the preparation is easier to flow.

The results of the total plate test numbers on the skin lotion in each formulation showed that there were 1.0×10^{-1} to 1.3×10^{-1}cfu / ml, the figures obtained were relatively small compared to the skin lotion products on the market, i.e. at 1.0×10^{-1}cfu / ml. Contamination of microorganisms can cause phase separation, product shrinkage, and unpleasant odors. Although the contamination is not caused by pathogenic microorganisms, this is still undesirable in cosmetic sedans because it can cause deterioration in product quality over time will cause skin irritation [2]..

Figure 1. Skin lotion from telang flower and pandan leaves

4. CONCLUSION

The best formulation in this study is the addition of telang flower extract and has been proven safe for normal skin types. The addition of natural ingredients extract in the production of sunscreen skin lotion which provides a protective effect against the sun, with a relatively high SPF value. The highest SPF value was produced by the formulation with the addition of telang flower extract which is 20.64, the specific gravity value was 0.94, the viscosity of 34880 cP of emulsion stability was 65.25%, the spreadability was 6.0 cm, the pH value was 6.0, the free fatty acid was 0.012 %, antioxidant activity 81.66%, total plate count 1.0x10-1 cfu / ml. Based on all evaluations that have been carried out on sunscreen skin lotions made from VCO with the addition of various extracts of natural ingredients, it is stated that they have fulfilled the SNI 16-4399-1996 requirements [19].

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