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Physical Quality and Sun Protection Factor Value of The Sunscreen Lotion Extract of Carrot (*Daucus carota* L.)

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Abstract: *Sunlight does not always have a beneficial effect, the content of ultraviolet rays contained in it can harm the skin. Sunscreen is a substance that can protect the skin from exposure to ultraviolet (UV) rays. Carotenoids, provitamin A is one of the many natural antioxidants found in carrots. The purpose of this study was to determine the physical quality and SPF value of carrot extract sunscreen lotion (Daucus carota L), with the amount of carrot extract added as much as 10%. The research method used is quantitative experimental. The stages of the research included making Simplicia and making carrot extract, formulation and making carrot extract lotion, and testing the physical quality and SPF value of carrot extract lotion preparations. The results of the physical quality test for carrot extract lotion preparations, organoleptic, were yellow, smelled of oranges, and had a soft texture; pH of 7.59; spreadability of 5.5 cm; adhesiveness of 1.38; viscosity of 9990 cps; and an SPF value of 6.67. The conclusion from this study is that the physical quality of the carrot extract sunscreen lotion meets the standards, with the SPF value obtained classified as extra protection sunscreen.*

INTRODUCTION

Sunlight is needed by humans as a source of energy. Sunlight does not always have a beneficial effect, the content of ultraviolet rays contained in it can harm the skin (Hapsah Isfardiyana et al., 2014); (Tahar et al., 2019). Excessive sun exposure makes the skin's epidermal tissue unable to fight these negative effects, causing erythema, sunburn, premature aging, and skin cancer (Sopian et al., 2021).

Sunscreen is a substance that can protect the skin from exposure to ultraviolet (UV) rays. Sunscreen can absorb at least 85% of sunlight, for UV-A with a wavelength of 320-400 nm, UV-C with a wavelength of 290-320 nm, and UV-C with a wavelength of 200-290 nm. UV-C is often filtered by the ozone layer so that only UV-A and UV-B reach the earth's surface (Widolaras & Ikhsanto, 2022). Free radicals are molecules that have unpaired electrons in their outermost orbitals, making them very reactive. These radicals tend to hold a chain reaction which when it occurs in the body can cause continuous and continuous damage (Fakriah et al., 2019).

The body has an endogenous defense system against free radical attack, mainly through normal cell metabolism and inflammation (Suryadinata, 2018). The number of free radicals can increase due to several factors, such as stress, radiation, cigarette smoke, and environmental pollution (Fakriah et al., 2019). This situation causes the body's existing defense system to be

inadequate to deal with it, so the body requires additional antioxidants from outside, including using antioxidants (Haerani et al., 2018). Antioxidants are compounds that can counteract or slow down the oxidation process. Antioxidants donate electrons to compounds that are oxidants, namely by binding and releasing hydrogen (Haerani et al., 2018).

Antioxidants are compounds that the skin needs to stay healthy. Carotenoids, provitamin A are natural antioxidant compounds that are abundant in carrots (*Daucus carota* L.) (Sari et al., 2023). Carotenoid content in carrots can be seen from the intensity of the color, the more orange the carrot color, the more carotenoid content (Hidayati et al., 2023). The carotenoids contained are not only beta-carotene but also alpha-carotene, gamma-carotene, beta-carotene, and lycopene. Research on the formulation of carrot extract lotion (*Daucus carota* L.) has been carried out and it produces physical quality that meets the requirements (Dewi & Wirahmi, 2019). Research on the effectiveness of sunscreen from β-carotene extract from carrot juice resulted in an SPF value of 1.34 (Malsawmtluangi dkk., 2013). Carrot extract can provide a protective effect on the skin (fibroblasts) and prevent apoptosis (Satriyasa et al., 2022).

Based on this background, a study was conducted on the physical quality and sun protection factor value of carrot extract (*Daucus carota* L.) sunscreen lotion. In this study, a type of carrot that comes from a place of origin where it grows is used, which is different from previous research (Dewi & Wirahmi, 2019). The carrots used in this study were obtained from Blumbang Village, Tawangmangu District, Karanganyar Regency. The selected preparation is in the form of a lotion because it can be spread thinly compared to cream or ointment preparations. This study aims to determine the physical quality of the lotion which includes organoleptic, homogeneity, pH, spreadability, adhesion, and viscosity, as well as the sun protection factor value.

METHOD

Materials

The ingredients used include carrots, ethanol (Merck), acidum oleicum (Merck), acidum stericum (Wilmar), aethanolum (ethanol), trieaethanolamine (Merck), lanolin, paraffin (Merck), methyl paraben, propyl paraben, olium citri (Merck), cetyl alcohol (Ecogreen), distilled water (Pure). The tools used include beaker glass (Pyrex), stir bar, analytical balance (Ohaus), porcelain cup, measuring cup (Pyrex), waterbath, oven (Binder), object glass (Slides), test tube (Pyrex), pH meter (Hanna HI 8010), viscometer (NDJ-82), transparent glass, stopwatch, round glass, caliper, dropping pipette, volume pipette (Iwaki), UV-Vis spectrophotometer (GD-752N).

Making Simplicia and Making Carrot Extract

Carrots are cleaned, then washed and chopped into small pieces. Then dried by aerated. Furthermore, dry sorting is carried out, to separate foreign objects that are not needed. Dried carrot Simplicia, weighed in an amount of 900 grams added with 3960 ml of 96% ethanol solvent, put in a bottle, closed, and left for five days protected from light. Stir regularly three to four times for about five minutes. After five days the mixture was filtered, then the macerate was thickened using a water bath at 70°C (Dewi & Wirahmi, 2019).

Formulation of Carrot Extract Lotion

Lotion preparations were made in 2 formulas, F0, which is a lotion preparation base that does not contain active ingredient components, and F1, which is a lotion preparation containing 10% carrot extract, each preparation was made with a weight of 300 mL. The composition of the carrot extract lotion (Dewi & Wirahmi, 2019), consists of acidum oleicum (6 g), acidum stericum (30 g),

aethanolum (15 g), triaethanolamine (15 g), lanolin (7.5 g), paraffin (15 g), nipagin (0.45 g), nipasol (0.45 g), olium citri (30 g), cetyl alcohol (15 g), distilled water (300 mL). The composition of F0 corresponds to this composition, while in F1 30 g of carrot extract was added.

Making Carrot Extract Lotion

Making carrot extract lotion refers to research (Dewi & Wirahmi, 2019). Beginning with mixing a similar solution as the oil phase, which includes oleic acid, stearic acid, lanolin, paraffin, cetyl alcohol, and nipasol in an evaporating cup, and heated over a water bath at 70°C. Followed by mixing a similar solution as the aqueous phase, which includes TEA, 96% ethanol, and nipagin. Nipagin had previously been dissolved in hot water. After the preparation of the oil phase and the water phase is complete, the oil phase is put into the hot mortar, then the water phase is added, and crushed quickly until a corpus is formed. Next, add the carrot extract and grind it until it is homogeneous. Then added citri olium, and crushed until homogeneous. The preparations that have been made are removed from the mortar, then put into the lotion container that has been prepared.

Physical Quality Test and SPF Value of Carrot Extract Lotion

Physical quality tests for carrot extract lotion preparations (Megantara, 2017), (Dewi & Wirahmi, 2019), (Syam & Marini, 2020), (Sopian et al., 2021), include organoleptic tests, homogeneity tests, pH tests, efficacy tests spread, adhesion tests, viscosity test. The determination of the SPF value was carried out using the UV-Vis spectrophotometry method at a wavelength of 290-320 nm, then the SPF was calculated using the Mansur formula (Malsawmtluangi et al., 2013).

RESULT AND DISCUSSION

Table 1. Physical Quality and Sun Protection Factor Value of Carrot (*Daucus carota* L.) Extract Sunscreen Lotion

Formulas	Organoleptic	Homogeneity	pH	Spread Power	Stickiness	Viscosity	SPF Value
F0	White color, orange smell, soft texture	Homogeneous	7,74	6,7 cm	1,52 second	9990	5,08
F1	Yellow color, orange smell, soft texture	Homogeneous	7,59	5,5 cm	1,38 second	9990	6,67

Note: F0 = lotion base that does not contain active ingredients. F1 = lotion preparation containing 10% carrot extract.

This research was conducted to know the physical quality and value of the sun protection factor of carrot extract (*Daucus carota* L.) sunscreen lotion. The results of the study are shown in Table 1. The results of the organoleptic test on carrot extract sunscreen lotion were yellow, and orange smell, soft texture. The organoleptic test results differ only in color from the formula without extract (F0), the yellow color of the lotion in F1 comes from carrot extract. The results of the homogeneity test for lotion preparations, either based on the addition of carrot extract, each showed homogeneous results. A good semi-solid preparation does not show any scattering of particles when the preparation is applied to transparent glass (Sopian et al., 2021). Homogeneous preparations will give good results because the ingredients are dispersed in the basic ingredients evenly so that each part of the preparation contains the same amount of material.

The pH test was carried out by weighing 1 gram of lotion and then diluting it with distilled water. Then a pH meter was used to measure the pH of the carrot extract lotion preparation. The

results of pH measurements were 7.74 on F0 and pH 7.59 on F1. This corresponds to the pH range that is acceptable to the skin, ranging from 4.5-8 (Iriani & Tukayo, 2021). The suitability of the skin pH with the pH of the topical preparation affects the skin's acceptance of the preparation. The ideal topical preparation is not irritating to the skin. The possibility of skin irritation will be very large if the preparation is too acidic or too alkaline. Thus, both formulas meet the pH requirements of topical preparations.

The spreadability test of the carrot extract lotion preparation shows the extent to which the lotion can spread evenly when applied to the skin. The results of the scatter test show that F0 has a spreading power of 6.7 cm and F1 has a spreading power of 5.5 cm. The spreadability of a good lotion preparation is between 5-7 cm. So that F1 meets the standard. The adhesion test of carrot extract lotion preparations was carried out to determine the strength of the lotion attached to the skin. The adhesive power of carrot extract lotion obtained was 1.52 on F0 and 1.38 on F1. The conditions for good adhesion are more than 1 second and no more than 4 seconds (Iriani & Tukayo, 2021). The adhesion of the two lotion preparation formulas meets the requirements.

The purpose of the viscosity test is to determine how much resistance a liquid or preparation has to flow. Viscosity is related to the ease of applying, the smaller the viscosity of the lotion, the easier it is to apply the lotion to the skin surface (Kadang et al., 2019). Viscosity measurements obtained results, both at F0 and F1, with a viscosity of 9990 cps. According to the literature, the viscosity of lotion preparations ranges from 3000 to 12000 cps (Wati et al., 2020). So that the two formulas are prepared with a viscosity that meets the standards. The results of the SPF value of the carrot extract lotion preparation were F0 having an SPF of 5.08 and F1 having an SPF of 6.67. According to the Food Drug Administration (FDA), the ability of sunscreen is divided into several levels as follows, SPF value: 2-4 (minimum); 4-6 (medium); 6-8 (extra); 8-15 (maximum); and >15 (ultra) (Damogalad et al., 2013). Based on these categories, the preparation of carrot extract sunscreen lotion as a result of this study is included in the extra category.

CONCLUSION

The results of the physical quality test of carrot extract lotion preparations met the standards of good lotion preparations, with the SPF value obtained classified as a sunscreen with extra protection ability.

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