

FORMULATION AND EVALUATION OF LIP BALM CONTAINING RED BEET (Beta vulgaris L) USING VARIATIONS OF BEESWAX CONCENTRATION AS SUNSCREEN

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Abstract

Lips are a body part that plays an important role in communication, facial expression, and eating. The skin on the lips is thinner than other parts of the skin, making it more susceptible to dryness and damage from environmental factors such as sunlight, wind, and pollution. Lip health is greatly influenced by hydration, nutrition, and proper care, such as using lip balm to maintain moisture. Sunscreen is a cosmetic product that can physically or chemically inhibit the penetration of UV rays into the skin. The potential or strength of a sunscreen is stated based on the SPF (Sun Protecting Factor) value. Beetroot extract is known to contain flavonoid compounds so that it has the potential as a sunscreen. The purpose of this study was to formulate and evaluate lip balm preparations of 96% ethanol extract of red beetroot (*Beta vulgaris L.*) with variations in beeswax concentration as sunscreen.

The method used in this study was experimental. We extracted red beetroot using the maceration method with 96% ethanol. The lip balm preparation was made into 3 formulas with a *cera alba* base, namely F1 5%, F2 7.5%, and F3 10%. Testing of lip balm preparations includes organoleptic tests, homogeneity tests, pH measurements, irritation tests, adhesion tests, spreadability tests, moisture tests, preference tests, smear tests, viscosity tests, and SPF tests. Testing of the sunscreen activity of red beetroot extract lip balm was carried out using the UV-Vis spectrophotometry Mansur

Keywords: red beetroot, lip balm, sunscreen

INTRODUCTION

Indonesia is a tropical country and is located on the equator, so the exposure to sunlight entering the area is high intensity. SPF (Sun Protection Factor) is a global value used to determine the effectiveness of sunscreen protection (Avianka, 2021). Exposure to incoming sunlight can cause harm, namely damage to the skin due to ultraviolet (UV) radiation (Rahmawati et al., 2021). The higher the SPF value, the greater the protective effect of sunscreen from exposure to ultraviolet rays on the skin (PERKINS et al., 2023). Protection against sun exposure can be done physically, such as with clothing, hats, umbrellas, and glasses, but often there are parts of the body that cannot be protected physically, so sunscreen can be used (Donglikar & Deore, 2016). Sunlight has various benefits, such as helping to prevent vitamin D deficiency, psoriasis, sarcoidosis, mycosis fungoides, and various skin diseases (Wilson et al., 2012). UV radiation in high enough levels can cause a burning sensation on the skin, redness of the skin (erythema), darkening of the skin (sunburn), and even skin cancer (Dampati & Veronica, 2020). Lips are a part of the face that affects a person's perception and aesthetic expression. Lips are different from normal skin and therefore very sensitive. Lips have a thinner layer of skin cells, making them clearer and appear (Madans et al., 2011). Common problems with lips that are often encountered are dryness, chapping, peeling, and dark color due to exposure to ultraviolet B (UVB) rays (Trookman et al., 2009). Dark lip color becomes unsightly (Mulyani et al., 2015). So lip cosmetics or moisturizers are needed that contain sunscreen as protection from UV rays. The effectiveness of sunscreen formulations is based on the Sun Protection Factor (SPF) value, which indicates the preparation's ability to protect the skin from the effects of UVB rays (Stanfield, 2003). Lip balm is a cosmetic preparation with main components such as wax, fat, and oil from natural or synthesized extracts with the aim of preventing dryness of the lips by increasing lip moisture and protecting the lips from adverse environmental influences (Kwunsiriwong, 2016). The content contained in lip balm preparations is a moisturizer and vitamins for lip care (Mulyawan, 2013). Lip balm with SPF can overcome dryness of the lips and at the same time can protect the skin of the lips from sunlight, especially UVA and UVB rays. With this background, other alternatives are needed,

one of which is using natural materials. One of the natural ingredients that can be used as an active ingredient in lip balm preparations is red beetroot (*Beta vulgaris* L.), also known as beetroot, which is a plant from the Amaranthaceae family. The main component found in beetroot is the purplish-red betacyanin pigment, which has the potential as a natural dye (Wibawanto et al., 2014). The antioxidant compound content in red beetroot consists of flavonoid compounds (350-2760 mg/kg) (Ananda, 2008). Flavonoid compounds also have the potential as sunscreens because they have a chromophore group (conjugated single-double bonds) that can absorb UV-A and UV-B rays, thereby reducing the intensity on the skin (Rahmawati et al., 2021). Choosing the right base can determine the quality of the consistency of the preparation so that it can be accepted and used well by the public, because the base is the main former of the lip balm preparation. One of the base components that functions as a texture former in making lip balm is beeswax.

Beeswax is a natural wax produced by honeybees; it is brittle and soft at low temperatures and can be formed at high temperatures (Rowe et al., 2009). The advantages of beeswax are is a good oil binder, provides shine, and can maintain color stability (Kuswana et al., 2017). Beeswax is also known to have natural antibacterial activity and contains vitamin A, which can improve wound healing and protect the skin from UV radiation (Kasparaviciene et al., 2016). The usefulness of beeswax is as a good oil and wax binder so that it can produce a homogeneous preparation mass. In addition, beeswax is also used as an emulsifier that stabilizes the dispersion of the oil phase and water phase in the emulsion system. Beeswax is also used in lip balm because it can maintain the consistency of the preparation and color stability.

METHOD

Tool

The tools used in this study were a UV-Vis spectrophotometer (Shimadzu), an analytical balance (Ohaus), an adhesiveness tester, a spreadability tester, a viscometer (VT-04 Rion), glassware (Pyrex®), a pH meter (Lutron PH-220SS), object glass (Sail Brand), a dropper, a water bath (Memmert), a stirring rod (Iwaki), a petri dish (Anumbra), a porcelain dish (Pyrex®), a mortar and stamper (Pyrex®), a rotary evaporator (Boeco®), a maceration jar, Whatman No. 1 filter paper (Cytiva), and a 100 mL pot.

Material

The main ingredients used in this study were extract 96 of red beetroot (were collected from Pemalang, Central Java), beeswax (Gracefruit Ltd.), propyl paraben (Golden Era), BHT (Sigma Aldrich), 96% alcohol (Merck), olive oil (Borges), and Cera alba (Icon Arrow Night).

Formulation Lip Balm

Formulation of red beetroot extract lip balm

The formulation of red beetroot extract lip balm was made as many as 3 formulas and each formula was replicated 3 times. The formulation of the lip balm preparation can be seen in Table 2. Beetroot extract has activity as a sunscreen in vitro. Sunscreen with a concentration of 5000 ppm produces the highest SPF value of 28.938 ± 0.164 (Sari & Endriyatno, 2024).

Table 1. Lip Balm Formulation

Material	F1 (%)	F2 (%)	F3 (%)	Function
Red Beetroot	0.5	0.5	0.5	Active Substance
Propilen glikol	15	15	15	Humectant
Beeswax	5	7.5	10	Stiffening agent
Nipasol	0.02	0.02	0.02	Preservatives
BHT	0.05	0.05	0.05	Antioxidant
Olive oil	15	15	15	Emolient
Vaseline album	Ad 100	Ad 100	Ad 100	Basis

Based on research (Setiawan, 2022) and (Cholis Endriyatno et al., 2024) and modifications from the author, the initial steps taken in the process of making lip balm formulations are melting beeswax at a temperature of 62-64 °C, the base is melted in a water bath. Then BHT is added to the melted base, and nipasol is added. Then olive oil is added, and then the red beetroot extract that has been dissolved in propylene glycol is added last after the temperature is not too

hot while stirring. After that, the melt is put into a mold and left at room temperature until it solidifies. Each formula was replicated three times. Evaluation was carried out on the lip balm in the form of organoleptic, homogeneity, pH, adhesion, spreadability, moisture, smear test

RESULT AND DISCUSSION

Evaluation of lip balm preparations aims to determine the preparations that have been made in accordance with the criteria of good and safe lip balm to use. The evaluations carried out include organoleptic tests, pH, homogeneity, adhesiveness, spreadability, moisture, and smearability, each of which is carried out 3 times.

Organoleptic Test

The purpose of organoleptic testing in making lip balm preparations is to determine the appearance produced; the appearance is in the form of color, odor, and texture (Rakhmawati et al., 2019). All formulas have the same color and aroma, only differing in texture. Formula 1 tends to have a more liquid texture, formula 2 tends to be thicker, and formula 3 is thick. The brownish-white color comes from black pomegranate skin extract. The resulting aroma comes from Vaseline because Vaseline in the red beetroot extract lip balm formulation is the highest concentration compared to other ingredients. The difference in lip balm texture is due to the different concentrations of beeswax base. The higher the concentration of beeswax, the thicker the consistency. The results obtained are in accordance with research (Ambari et al., 2020). Where the higher the concentration of beeswax, the denser the texture produced. The organoleptic test results are shown in Figure 1.

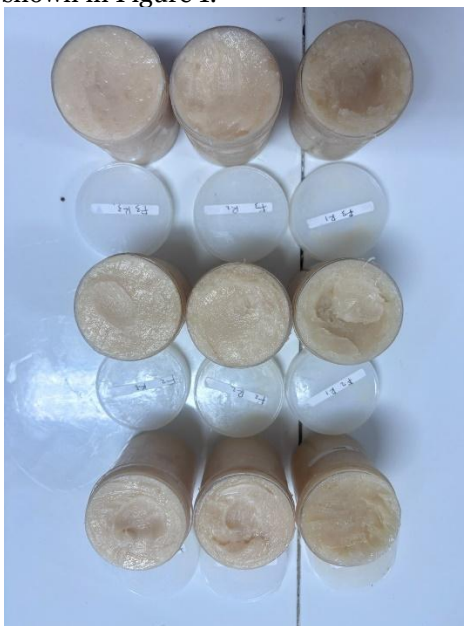


Figure 1. formulation lip balm

Homogeneity Test

The homogeneity test is a test that aims to determine whether all the ingredients are mixed homogeneously. All lip balm formulas have good homogeneity by showing an even color arrangement and mixed particles so that they have met the requirements for the homogeneity test of the preparation and are stable in storage. This is due to the consistent stirring process during the manufacture of lip balm so that all ingredients can be mixed evenly. Homogeneous preparation conditions mean that the active substance has the same opportunity to occupy the therapeutic site and vice versa; the therapeutic site has the same opportunity to come into contact with the active substance. The homogeneity test results are shown in Table 2.

Table 2. Homogeneity test

Formula	Results
F1 (5%)	Homogen
F2 (7,5%)	Homogen
F3 (10%)	Homogen

pH Test

The pH test aims to determine the safety of the preparation when applied to the skin or lips so as not to cause irritation. A pH that is too alkaline will make the skin dry, while a pH that is too acidic will irritate the skin. The results of the pH test show that all formulas have a good pH, which is between 4.5 and 6.5. This shows that the lip balm preparation made is safe and does not cause irritation to the lips. The more alkaline or acidic the ingredients that touch the skin, the drier and more chapped the skin becomes. If the pH is below standard, it will cause itching, and if the pH is above standard, it will cause hot lips. The pH test results are shown in Table 3.

Table 3. pH test

Formula	Results
F1 (5%)	4.94±0.00
F2 (7,5%)	5.88±0.02
F3 (10%)	6.10±0.01

Test Adhesion

The adhesion test aims to describe whether the preparation can stick or adhere to the skin. The requirement for good adhesion is more than 4 seconds (Ambari et al., 2020). The results of the three formulas show differences in the adhesive power values produced; the average for F1 is 4.94 seconds, F2 is 5.44 seconds, and F3 is 6.72 seconds. The higher the concentration of beeswax used, the higher the adhesive power value produced; the lower the concentration of beeswax used, the lower the adhesive power value produced. From the results of the examination of the adhesive strength of the preparation, the lip balm preparation that was made was said to be good. The adhesion test results are shown in Table 4.

Table 4. Adhesion test

Formula	Results (second)
F1 (5%)	4.94±0.03
F2 (7,5%)	5.45±0.03
F3 (10%)	6.73±0.03

Spreadability Test

The spreadability test aims to determine the ability of a preparation to spread when applied. Good lip balm spreading ability will provide ease of use on the lips (Mektildis, 2018). This test uses a petri dish that is given a load of 50, 100, 150, and 200 grams. The heavier the load given, the larger the diameter of the spread. The results of Formula 1 have good spreadability at weights of 50 grams, 100 grams, 150 grams, and 200 grams. Formulas 2 and 3 have poor spreadability; only formula 2, with a weight of 200 grams, reaches a value of 5 cm, where the spreadability results will increase as the weight increases. These results are influenced by the concentration of the beeswax base. The spreadability results for each formula are different, where the higher the concentration of beeswax used, the lower the spreadability value obtained because the texture of the lip balm preparation is solid and hard so that it cannot spread easily and evenly. The spreadability test results are shown in Table 5.

Table 5. Spreadability test

Formula	Results (cm)
F1 (5%)	50g: 5.10±0.00
	100g: 5.17±0.06
	150g: 5.30±0.00
	200g: 5.43±0.06
F2 (7,5%)	50g: 4.80±0.00
	100g: 4.83±0.06
	150g: 4.90±0.00
	200g: 5.00±0.00
F3 (10%)	50g: 4.50±0.00
	100g: 4.57±0.06
	150g: 4.67±0.06

	200g: 4.70±0.00
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Moisture Test

The moisture test is a test that aims to determine the moisture level of the lips before and after using lip balm. The measurement of moisture levels is carried out using a tool called a skin analyzer test with different retention times. The results of Formula 1 have a range of values from 48.3 to 48.7%, where this result is categorized as moist to very moist. This is because the concentration of beeswax in F1 is the smallest compared to F2 and F3. The higher the concentration of beeswax base used, the lower the humidity in the lip balm preparation. In addition, the concentration of Vaseline Album as a base can also affect the humidity of the lip balm preparation. The moisture test results are shown in Table 5.

Table 5. Moisture test

Formula	Results (%)
F1 (5%)	48.43±0.19
F2 (7,5%)	44.47±0.12
F3 (10%)	39.87±0.24

Smear Test

The smear test is a visual test conducted to determine the condition of the skin that has been smeared with a lip balm preparation. The requirements for a good smear test are that the applied lip balm preparation looks evenly attached to the skin and looks shiny (Risnawati & Purba, 2012). Preparations that are easy to apply evenly will be preferred by users. The results of all lip balm preparations have a qualified spreadability. The results of the spreadability test are related to the homogeneity test. If the resulting preparation is homogeneous, it will have good spreadability. This is because homogeneous preparations have an even composition so that the resulting spreadability will also be even (Limanda et al., 2019). The moisture test results are shown in Table 5.

Table 5. Smear test

Formula	Results
F1 (5%)	It adheres evenly to the skin and looks shiny.
F2 (7,5%)	It adheres evenly to the skin and looks shiny.
F3 (10%)	It adheres evenly to the skin and looks shiny.

Determination of the Best Formula for Red Beet Extract Lip Balm Preparation (Beta Vulgaris L.)

Formula 1 meets the physical properties of good lip balm preparations, such as organoleptic, homogeneity, pH, spreadability, smearability, adhesion, and moisture. Formulas 2 and 3 do not meet the physical requirements in the spreadability test. The ability to spread lip balm well will provide ease of use on the lips. So Formula 1 was chosen as the best formula with a beeswax concentration of 5% because it has physical properties that meet the requirements.

CONCLUSION

1. Ethanol extract of 96% red beetroot has activity as a sunscreen in vitro. Sunscreen with a concentration of 5000 ppm produces the highest SPF value of 28.938 ± 0.164.
2. Variation in beeswax base concentration affects the physical properties of red beetroot extract lip balm preparations, including organoleptic properties, homogeneity, pH, adhesion, spreadability, smearability, and moisture.
3. Formula 1 was chosen as the best formula with a beeswax concentration of 5% because it has physical properties that meet the requirements, such as organoleptic, homogeneity, pH, spreadability, smearability, adhesion, and moisture value.

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