PHYTOSOME FORMULATION OF RED DRAGON FRUIT EXTRACT

Novi Febrianti[1], Lina Widiyastuti[2], Agung Dwi Nugroho[2], Aulia Nugrahaningtyas[1], Natasya Dwi Karina[1]

[1] Biology Education Study Program, Faculty of Teacher Training & Education, Universitas Ahmad Dahlan, Indonesia. [2] Pharmacy Study Program, Faculty of Pharmacy,
Corresponding author: novifebrianti@pbio.uad.ac.id

Background: Red dragon fruit (*Hylocereus polyrhizus*) can be used as a base for anti-aging creams, but this fruit has low bioavailability. An appropriate delivery medium needs to be applied to a face cream. One of the widely used media is phytosomes. This study aims to develop a phytosome of red dragon fruit flesh extract. **Methods**: Red dragon fruit flesh was extracted using a blender and then reduced the water content using a water bath. The extract was tested for moisture and then tested for phenol and flavonoid content. Phytosomes were prepared with a combination of dragon fruit extract and lecithin ratio of 1:1, 1:2, and 1:5. **Results**: The results showed that red dragon fruit flesh extract has a moisture content of 30.31%. The phenolic and flavonoid content of dragon fruit extract is 10,767 mgGAE/g and 19,606 mgGAE/g, respectively**.** Phytosomes with the ratio of dragon fruit extract and lecithin 1:5 produced the optimum formula. **Discussion**: The water content of red dragon fruit extract is 30.31%, so another extraction method is needed so that the water content is below 10%. Phytosomes with a ratio of red dragon fruit extract and lecithin 1:5, which is a formula with the largest lecithin content, to produce phytosome particles that are smaller in size and more moist in consistency.

1 Introduction

Skin is an important body part directly exposed to ultraviolet (UV) light [1]. The types of UV light that most damage the skin come from exposure to UVA (315-400 nm) and UVB (280-325 nm) radiation. UVB radiation has the most dangerous effect because it can penetrate the epidermis and dermis layers of the skin so that it can induce oxidative stress, inflammatory responses, DNA damage, and suppression of immune reactions in the skin [2-4]. DNA damage to cells and the generation of reactive oxygen species (ROS) in the skin due to UV radiation are the initial triggers of molecular pathology events, which can then cause tissue changes and damage to the skin layer, which leads to premature aging [5-6]. To overcome this, additional antioxidants are needed to counteract free radicals caused by UV rays.

Red dragon fruit (*Hylocereus polyrhizus*) is one type of tropical fruit with pulp rich in antioxidants such as phenols, ascorbic acid, flavonoids, and betasianin [7][8][9]. Red dragon fruit can be used for antidiabetic treatment [10] and complementary therapy to reduce some symptoms of metabolic syndrome [11]. It has also been studied the cytoprotective effect of red dragon fruit on fibroblast cells exposed to hydrogen peroxide [12]. Red dragon fruit flesh extract is safe for normal fibroblast cells compared to the fruit skin [13]. Red dragon fruit flesh extract has a protective effect on fibroblast cell cultures exposed to UVB and can also increase collagen synthesis so that it can be used as a base for antiaging creams [13].

Several studies have utilized red dragon fruit for treatment, skin protection against UVB, and as an anti-aging ingredient (10-12). In vivo, the application of red dragon fruit meat extract is water soluble so its bioavailability is low [7][8]. An appropriate delivery medium is needed so that it can be applied to a face cream. One of the widely used media is phytosomes. Phytosomes are chemical interactions between water-soluble herbal ingredients with pho Collection of red dragon fruit samples phospholipid compounds so that they can be applied for oral and topical delivery. The purpose of this study was to formulate red dragon fruit phytosomes and analyze the phenol and flavonoid content of the phytosomes.

2 Methode

2.1 Collection of red dragon fruit samples

Samples of red dragon fruit were collected from a dragon fruit plantation in Hargobinangun, Pakem, Sleman DIY which is 38 km from UAD campus 4. The collected red dragon fruits are ripe, not deformed, and ready to be harvested.

2.2 Preparation and extraction of red dragon fruit samples

Red dragon fruit samples were washed in running water and then dried using a clean and dry cloth. The dried fruit was cut into four parts, then peeled and pulped by hand. The pulp was blended to obtain a paste-like preparation for 3-5 minutes. The red dragon fruit pulp paste was then freeze-dried using a freeze dryer to reduce its moisture [9].

2.3 Evaluation of red dragon fruit extract

Evaluation of extracts includes evaluation of physicochemical properties and phytochemical content, namely:

2.3.1 Evaluation of physicochemical properties

Observation of extract color, moisture measurement, and pH measurement of red dragon fruit extract were conducted.

2.3.2 Evaluation of phytochemicals

Total phenol content assay

Testing of phenol content was carried out referring to the method carried out [10]. Samples were made at a concentration variation of 100, 200, 300, 400, and 500ug/mL as much as 1mL, then put in a 25mL volumetric flask and added 9mL of distilled water. Furthermore, 1mL of Folin-Ciocalteu reagent and 10 mL of Na2CO3 were added. Added water until the limit mark then incubate for 30 minutes. Read at a wavelength of 550nm

Total flavonoid content assay

Total flavonoid content was determined based on the method [11]. 1 mL of sample solution with concentration variations (20, 40, 60, 80, 100 ug/mL) was put into a 10 mL volumetric flask containing 4 mL distilled water. Add 0.30ml AlCl3 NaNO2 5%, wait for 5 minutes then add 0.30ml AlCl3 10% and wait for 5 minutes. Then add 2ml NaOH 1M. Add distilled water until the limit mark.

2.4 Phytosome formulation of red dragon fruit extract

Phytosome preparation was carried out using the thin-layer hydration method. Phytosome complex formation was done by combining red dragon fruit extract and phosphatidylcholine in ethanol. The combination of red dragon fruit extract and phosphatidylcholine are 1:1, 1:2, and 1:5

2.5. Entrapment efficiency assay

Red dragon fruit flesh extract was dissolved in 96% ethanol to a concentration of 1000ppm as much as 10mL. The emulsion was centrifuged at 10 rpm for 5 minutes. The supernatant formed was taken and the absorbance was read at a wavelength of 522 nm. Calculation of sorption efficiency using the formula

$$E = \frac{Qt - Qs}{Qt}\ x\ 100\%$$

E = Entrapment efficiency
Qt = Absorbancy of detected extract
Qs = Absorbancy of detected phytosom

3 Results and Discussion

Red dragon fruit (Hylocereus polyrhizus) has bioactive compounds such as phenols, flavonoids, and betacyanin that can work as active ingredients for sunscreen (Zahra et al., 2025). In this study, red dragon fruit extract was made by smoothing 1400 grams of dragon fruit flesh, after it was smooth, it was thickened and reduced the water content using a water bath until the desired consistency was obtained and had a low water content. The results of making this dragon fruit extract obtained 85 grams of dragon fruit extract so the yield value was 6.071%.

Moisture testing of the extract was carried out using the Halogen Moisture Analyzer tool, dragon fruit extract weighed 1 gram and was then analyzed using a temperature of 105 C for 15 minutes. Three replications were done in this test. The test results obtained an average extract moisture of 30.31%.

Phytochemical Content of Red Dragon Fruit Extract

The phytochemical test of dragon fruit extract was carried out to test the content of secondary metabolites present in red dragon fruit extract. In this study, total phenol content and total flavonoid content were tested. Calculation of total phenol content of red dragon fruit extract by using the standard curve regression y = bx + a, namely y = 0.0662x + 0.0017. Based on the calculation results, the red dragon fruit extract has an average total phenol content of 10.767 mg GAE/g extract.

Total flavonoid content was calculated using the linear regression equation y=bx+a. With a value of y = 0.0055x-0.0578. The total flavonoid content was 19.606 mg GAE/g extract. The results of this phenol and flavonoid test are lower when compared to the research of Febrianti et al. (2019), which found that the blended red dragon fruit flesh contained phenols and

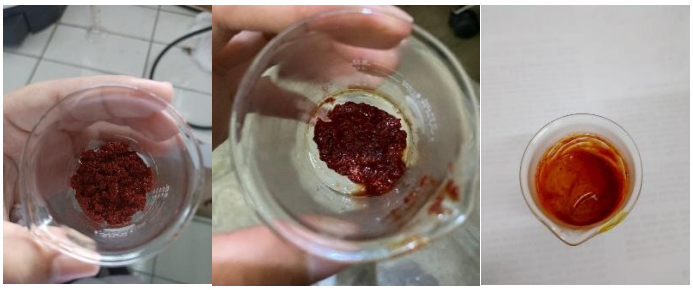
flavonoids, respectively, 22.43 ± 0.27 mgGAE/g and 36.07 ± 0.11 mgQE/g. This may be due to the red dragon fruit obtained from different locations. In this study, red dragon fruit was obtained from the Kaliurang area, which has an altitude of 700 - 1,325 meters above sea level (above sea level), while in Febrianti's research (2019) red dragon fruit was obtained from Sanden beach which has an altitude of 10 ml above sea level.

Red dragon fruit is a fruit that is usually consumed directly or made into juice. Research by Febrianti et al. (2019) found that blended flesh of fresh red dragon fruit at various concentrations has no significant effect on cell viability, but blended flesh of red dragon fruit has the potential to increase cell viability. Hor et al. (2012 reported that the methanolic extract of red dragon fruit flesh did not have acute or chronic toxicity to mice. No signs of damage to vital organs such as the liver, kidneys, and lungs were observed. The fruit flesh has been reported to be used for the treatment of diabetes, metabolic syndrome disease, preventing colitis and inflammation (Omidizadeh et al., 2014; Ramli et al., 2014).

Red dragon fruit extract phytosomes

The preparation of dragon fruit extract phytosomes was carried out by thin layer hydration method. The thin layer hydration method is widely used for the preparation of phytosomes (5). Dragon fruit extract phytosomes were prepared using a phospholipid agent in the form of lecithin derived from soybeans. Lecithin has lipophilic properties, so it can be used to form phytosomes that have lipophilic properties.

In the phytosomes of dragon fruit extract and lecithin in a 1:1 ratio, the results were obtained in the form of red-purple phytosomes. The extract-lecithin particles obtained were moist granules. The particle size is unknown but may be too large to be suitable for phytosomes. Phytosomes of dragon fruit extract and lecithin in the ratio of 1:2 produced dark purple extract phytosomes, with a smaller particle size compared to the 1:1 extract-lecithin combination. The phytosomes obtained were also more moist because more lecithin was used. The results of the phytosome formulation of dragon fruit extract and lecithin 1:5 obtained phytosomes with a dark brownish purple color (Fig. 1). The particle size of phytosomes was smaller and finer than the combination of 1:1 and 1:2 and had a more moist and fatty consistency.



a b c.

Fig. 1. Phytosomes with various combinations of red dragon extract and lecithin
a. 1:1 combination b. 1:2 combination c. 1:5 combination

In Fig. 1, it can be seen that phytosomes made with the ratio of dragon fruit extract and lecithin 1:5 produce phytosomes with better molecular characteristics. Lecithin functions in vesicle formation, increasing bioavailability, and increasing the stability of active ingredients [13] [14] [15]. Research by Ameri et al. (2024) who formulated phytosomes from Viola tricolor flower extract found that the ratio of extract and lecithin 3: 1 produced phytosomes

with the most optimum particle size and absorption efficiency. Das & Kalita (2014) found that formulations with higher phospholipid content produced thicker and stickier clumps. In this study, the formulation with dragon fruit extract and lecithin 1:5 produced phytosomes with better character, so the next step was to test the phytosomes with the ratio of extract and lecithin 1:5.

Entrapment efficiency

Sorption efficiency shows the ability of phytosomes to absorb or bind substances. In this study, the sorption efficiency test was carried out on phytosomes with a combination of dragon fruit extract and lecithin 1:5. The measurement results showed that the phytosomes had an absorption efficiency of 62.97% ± 0.025. This result is lower than the research of Permana et al (2020) who formulated propolis phytosomes coated with phosphatidylcholine and cholesterol which obtained a sorption efficiency of 80.83%.

Conclusion

The phenolic and flavonoid content of red dragon fruit extract is 10,767 mgGAE/g and 19,606 mgGAE/g, respectively**.** Phytosomes with the ratio of dragon fruit extract and lecithin 1:5 produced the optimum formula with 62,97% of entrapment efficiency

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