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ANTIOXIDANT ACTIVITY OF FACIAL MOISTURIZING FORMULATIONS FROM VARIOUS PLANTS

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Abstract

Indonesia, with its rich biodiversity, has great potential in medicinal plants that can be utilized in cosmetic products. The use of natural ingredients in cosmetics, such as moisturizers, is increasingly in demand because of its ability to improve skin health at a relatively lower cost. Moisturizers function to overcome dry skin problems and maintain skin moisture by reducing water loss and protecting it from environmental impacts. This study aims to identify plants with potential antioxidant activity for use in facial moisturizer formulations. The method used is a literature review from various sources, including journals and publications related to antioxidant activity. The results showed that Purple Sweet Potato Leaves (Ipomoea batatas) and Celery (Apium graveolens) have very strong antioxidant activity with IC50 values of 3.68 ppm and 19.66 ppm, respectively. Sonneratia caseolaris leaves also showed strong antioxidant activity with an IC50 value of 14.503 ppm. Other plants such as Virgin Coconut Oil (Cocos Nucifera), Malacca Fruit (Phyllanthus emblica), and Carrot Root (Daucus Carota) also have significant antioxidant activity, although with higher IC50 values. In conclusion, these plants show great potential for use in cosmetic formulations that can combat oxidative stress and maintain skin health.

Keywords: Antioxidants, Free Radicals, Facial Moisturizer, IC50, Medicinal Plants

Introduction

Indonesia is one of the countries with very rich global biodiversity, having great potential in medicinal plants with around 9,600 plant species (Nugroho, 2017). The use of natural ingredients in cosmetics is currently growing rapidly and is increasingly attracting market interest (Kuntorini et al., 2013). The use of natural ingredients is important to improve the quality of public health at a relatively more affordable cost (Berawi et al., 2018). One form of cosmetic preparation that is rampant in the market is moisturizer.

Moisturizer is a type of skin care cosmetic designed to overcome dry, scaly, and rough skin problems, and to make rough skin smoother and softer. This product works by helping the skin retain moisture in the stratum corneum layer, reducing transepidermal water loss, and protecting healthy skin from environmental effects that can cause dryness (Dewi, 2010). Endogenous free radicals, which are produced through aerobic respiration and various metabolic processes in the body, are different from exogenous free radicals that come from external sources such as air pollution and UV radiation. Free radical compounds are highly reactive and tend to seek out their electron pairs. When free radicals form in the body, they can trigger a chain reaction that produces more free radicals, so that their numbers continue to increase.

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These free radicals can later trigger several degenerative diseases such as cancer, aging, rheumatoid arthritis, autoimmune, and neurodegenerative disorders. (Maigona et al, 2022) (Nurcholis et al, 2021). According to Ozil (2014), free radicals produced in the body can usually be neutralized by natural antioxidants under normal conditions. However, if the level of free radicals is too high and exceeds the body's system's ability to neutralize them, additional antioxidants from outside the body are needed. Antioxidants are compounds that can bind to free radicals and stop chain reactions that have the potential to damage important macromolecules in the body (Noviarni et al, 2020). Several exogenous synthetic compounds, such as vitamin E and BHA (Butylated Hydroxylanisole), are used as antioxidants. However, long-term use of synthetic antioxidants and inappropriate doses can cause toxic effects. Therefore, alternative natural antioxidants are sought to reduce the risk of these toxic effects (Wandita et al, 2021).

Therefore, protection against air pollution and UV rays is considered crucial for all cosmetic categories. Around 67% of global consumers believe that reducing sun exposure and protecting the skin from pollutants with the right products can help maintain a youthful appearance. UV rays can damage collagen and elastin, causing hyperpigmentation, inflammation, and dehydration of the skin. In addition, UV rays can also worsen fine lines, wrinkles, and brown spots, as well as trigger premature aging. As a result, consumers tend to look for moisturizing formulations that can neutralize the negative effects of smoke, gas, heavy metal particles, ozone, free radicals, and UV rays (Morganti et al., 2019). The solution to protect the skin from free radicals is to use antioxidants, so proper care is very important to maintain healthy and beautiful skin (Isfianti, 2018; Lestari et al., 2020).

Previous research conducted by (Hidayah et al, 2021) aimed to assess the potential of various plants as sources of antioxidants in facial serum formulations. The results of the literature review show that there are 11 relevant journals discussing various plants with antioxidant activity, including green coffee extract (Coffea canephora Var. robusta), ginger rhizome extract (Curcuma heyneana), tamarind seeds (Tamarindus indica L.), cocoa fruit skin (Theobroma cacao L.), red dragon fruit skin (Hylocereus polyrhizus), red algae (E. cottonii), lychee fruit skin (Litchi chinensis Sonn.), wangon leaves (Olax psittacorum (Willd.) Vahl.), green coffee beans (Coffea robusta L), turmeric rhizome (Curcuma domestica), and banana (Musa X paradisiaca) Based on this background, the author conducted this journal review with the aim of providing information to readers about which plants have the potential as antioxidants in facial moisturizer formulations.

Method

The research method used in this study is a literature review. A literature review involves examining various sources, such as journals, and other publications relevant to the research topic, to understand the research conducted and answer the existing problems. The literature sources in this study were searched through Google Scholar using the keywords "antioxidant activity of moisturizing preparation formulations" and "antioxidant value in plants". The search was conducted from August 22, 2024 to August 29, 2024, with a focus on antioxidant activity.

Results

Cosmetics are not intended to treat or prevent disease. So they are not categorized as drugs. However, if a cosmetic product claims to heal wounds, reduce inflammation, treat infections, or other diseases, or if a product is designed to be injected into the human body, then the product is categorized as a drug, not a cosmetic. (BPOM) RI No. 23 of 2019.)

Antioxidants are compounds that provide electrons to reduce the negative effects of oxidants, such as enzymes and metal-binding proteins (Irianti et al., 2018). Antioxidant activity testing can be done using the DPPH (2,2-diphenyl-1-picrylhydrazyl) method. This method involves measuring the decrease in DPPH absorption at the maximum wavelength after the addition of a DPPH reagent solution, which is related to the concentration of free radical inhibitors. Antioxidant activity is expressed by the IC50 value (inhibition concentration) (Amelia, 2011). IC50 indicates the concentration of extract that can reduce DPPH activity by 50%. A smaller IC50 value indicates higher antioxidant activity, while a larger IC50 value indicates lower antioxidant activity. According to Blois (1958), there are four categories of IC50 values: a compound is categorized as a very strong antioxidant if the IC50 value is less than 50 ppm, strong if the IC50 value is between 50-100 ppm, moderate if between 100-150 ppm, and weak if the IC50 value is more than 151 ppm.

Table 1

No	Plant Name	IC_{50} Extract (ppm)	IC_{50} Preparation (ppm)	Reference
1	*Cocos Nucifera*		30.3	Purnamasari (2020)
2	*Anredera Cordifolia*	100,333		Alifa (2024)
3	*Panax ginseng*	181,15		Yuhara (2024)
4	Psidium guajava L.	23,29	953,87	Sosalia et al (2021)
5	*Persea Gratissima Gaertn*	159,85		Darmirani et al (2021)
6	*Phyllanthus emblica L*	27,69		Febriani et al (2024)
7	A*pium graveolens L*	19,66		Rosaini et al (2019)
8	*Cocos Nucifera*		44,39	Aulifa et al (2020)
9	*Oryza nivara L.*		74,52	Marliyanti et al (2023)
10	*Daucus Carota L.*	28,80		Marlina et al (2023)
11	*E. cottonii*	105,04		Endah et al (2020)
12	*Ipomoea batatas L. Lamk*	3,68		Dipahayu et al (2014)
13	*Pyrus Bretschneideri*	84,58		Suryani et al (2024)
14	*Sonneratia caseolaris*	14,503		Guseyvona et al (2024)
15	*Moringa oleifera L.*	256,89		Amanah et al (2021)

Discussion

Purple Sweet Potato Leaves (Ipomoea batatas (L.) Lamk) have a very low IC50 value of 3.68 ppm. This very low IC50 value indicates that purple sweet potato leaf extract is very effective in inhibiting free radical activity. This very strong antioxidant activity makes purple sweet potato leaves an attractive candidate for use in the formulation of health and cosmetic products that aim to combat oxidative stress. The success of this extract in reducing free radicals can be attributed to its high content of active compounds that can capture and neutralize free radicals efficiently. Celery (Apium graveolens L.) showed an IC50 value of 19.66 ppm. This value indicates that celery extract has strong antioxidant activity and is able to reduce free radicals efficiently. Celery extract not only provides benefits in fighting free radicals, but also has the potential to be used in skin care products and health

supplements. Celery is known to contain various phytochemicals that contribute to its antioxidant activity, making it a good choice for improving skin conditions and improving overall health.

Sonneratia caseolaris leaves also showed a low IC50 value of 14.503 ppm, indicating very strong antioxidant activity. Sonneratia caseolaris leaf extract has high potential in inhibiting free radicals and protecting cells from oxidative damage. Its ability to reduce free radicals very efficiently indicates the presence of a high concentration of active compounds that work as antioxidants. This potential makes it a promising ingredient for further development in health and cosmetic products.

Virgin Coconut Oil (Cocos Nucifera) has two different IC50 values in different studies, namely 30.3 ppm and 44.39 ppm. Although there are differences in the results of the studies, in general, virgin coconut oil shows good antioxidant activity. This IC50 value indicates that virgin coconut oil can be an effective ingredient in fighting free radicals. Virgin coconut oil is known for its various health and cosmetic benefits, including its antioxidant properties that can help protect the skin from damage and premature aging.

Malacca fruit (Phyllanthus emblica L.) has an IC50 value of 27.69 ppm, indicating that malacca fruit extract has strong antioxidant activity. This extract is very effective in inhibiting free radicals, and the presence of active compounds in it plays a key role in its antioxidant activity. Malacca fruit is often used in various health and cosmetic products because of its good ability to fight oxidative stress and support skin health.

Carrot tuber (Daucus Carota L.) has an IC50 value of 28.80 ppm, indicating strong antioxidant activity. Carrot tuber extract gives quite good results in reducing free radicals, which is associated with the content of beta-carotene and other antioxidant compounds. This strong antioxidant activity makes it a potential ingredient for use in skin care products and health supplements to improve overall health and protect the skin from damage.

Red Binahong Leaf (Anredera Cordifolia) has an IC50 value of 100.333 ppm, indicating moderate to strong antioxidant activity. Although not as high as some other plants, red binahong leaf extract still has good effectiveness in inhibiting free radicals. The presence of active compounds in red binahong leaves provides additional benefits in health and cosmetic products, although it may require higher concentrations compared to plants with lower IC50 values.

Pear Peel (Pyrus Bretschneideri) showed an IC50 value of 84.58 ppm. This indicates that pear peel has moderate antioxidant activity, which is quite effective in reducing free radicals. Although not as strong as some plants with lower IC50 values, pear peel still offers beneficial antioxidant benefits in the formulation of health and cosmetic products.

Ginseng (Panax ginseng) had an IC50 value of 181.15 ppm, indicating lower antioxidant activity. Ginseng extract is less effective in inhibiting free radicals compared to plants with lower IC50 values. However, ginseng is still known for its various other health benefits, and the higher IC50 value may indicate that this extract requires higher concentrations to provide significant antioxidant effects.

Avocado Peel (Persea Gratissima Gaertn) has an IC50 value of 159.85 ppm, which indicates that avocado peel extract has lower antioxidant activity compared to several other plants. Although less effective in inhibiting free radicals, avocado skin has a variety of other health and cosmetic benefits, making it a valuable ingredient in skin care products.

Red Seaweed (E. cottonii) has an IC50 value of 105.04 ppm, indicating moderate antioxidant activity. Red seaweed extracts have shown moderate effectiveness in scavenging free radicals, making them suitable for use in a variety of health and cosmetic applications as a useful antioxidant supplement.

Moringa (Moringa oleifera L.) has the highest IC50 value among the listed plants, at 256.89 ppm. This indicates that the antioxidant activity of Moringa leaves is relatively lower compared to

other plants on this list. Although a higher IC50 value indicates less effectiveness in scavenging free radicals, Moringa leaves still have other health benefits and beneficial nutritional compounds.

Conclusion

From the literature review on the antioxidant activity of various plants, it can be concluded that Purple Sweet Potato Leaves (Ipomoea batatas (L.) Lamk) and Celery (Apium graveolens L.) have very strong antioxidant activity, with IC50 values of 3.68 ppm and 19.66 ppm, respectively. The extracts of these two plants are very effective in inhibiting free radicals, making them very potential ingredients for the formulation of cosmetic and health products that overcome oxidative stress. Sonneratia caseolaris leaves also showed very strong antioxidant activity with an IC50 value of 14.503 ppm, which adds to its potential application in health and cosmetic products. Meanwhile, Virgin Coconut Oil (Cocos Nucifera) showed varying IC50 values, but was generally effective in fighting free radicals, making it a useful ingredient in skin care. On the other hand, Malacca Fruit (Phyllanthus emblica L.), Carrot Tubers (Daucus Carota L.), and Red Binahong Leaves (Anredera Cordifolia) also showed significant antioxidant activity, although with higher IC50 values compared to the top plants. While Pear Peel (Pyrus Bretschneideri), Red Seaweed (E. cottonii), Ginseng (Panax ginseng), Avocado Peel (Persea Gratissima Gaertn), and Moringa Leaves (Moringa oleifera L.) showed lower antioxidant activity, but still have benefits in the fields of health and cosmetics, especially moisturizers.

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