

JOURNAL REVIEW: FORMULATION AND EVALUATION OF ANTI-OXIDANT FACIAL SERUM AND FROM EXTRACTS OF VARIOUS PLANTS

Kandida Hilda Novika¹, Anis Yohana Chaerunissa², Sriwidodo³, Widia Primi Annisya⁴
^{1,2,3} Universitas Padjajaran, Indonesia
⁴ Universitas Bakti Tunas Husada, Indonesia
Email: kandida10001@mail.unpad.ac.id

ABSTRACT

*In the 19th century, the use of cosmetics began to gain attention, not only for beauty but also for health. Facial serum is a skin care product in the form of a gel or light lotion with a moisturizer that contains active ingredients that can penetrate deeper into the skin. UV rays can damage collagen/elastin in the skin, cause hyperpigmentation, damage skin components and trigger premature aging. So, antioxidants are needed to ward off free radicals. The main function of antioxidants is to capture and neutralize free radicals thereby reducing or preventing damage. The aim of this literature review is to provide information and evaluate the effectiveness of facial serums formulated from various extracts that have the potential to act as antioxidants. The method used in this literature review is using a data base in the form of Google Scholar, Pubmed, Pharmaceuticals, and Science Direct (2015-2023). Based on the results of the literature review, 55 journals were found with various types of plants as antioxidants all types of plants which has antioxidant activity in serum preparations which is classified as very strong is Mangosteen Fruit Extract (*Garcinia Mangostana*) with an IC50 value of 5-15 µg/mL.*

KEYWORDS Cosmetics, Serum, Antioxidants, Literature Review, Mangosteen Fruit Extract



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INTRODUCTION

Indonesia's biodiversity shows enormous potential in the development of medicinal plants, particularly in the context of antioxidant compounds for cosmetic and skin health applications. Indonesia, with its extraordinary biological richness, is home to thousands of plant species that have pharmacological potential that has yet to be fully explored.

The use of plant extracts in cosmetics has long been recognized for their antioxidant content and other essential nutrients that can provide significant benefits to skin health (Hidayah et al., 2021). Antioxidants contained in plants can help protect the skin from free radical damage, which is a major factor in premature aging and other skin damage caused by the environment. In particular, many plants in Indonesia contain antioxidant compounds such as flavonoids, polyphenols, carotenoids, and vitamin C that have been shown to have the effect of protecting the skin from free radical damage and premature aging (Astuti et al., 2022).

There is a wide variety of plants that have antioxidant potential in Indonesia. Red Betel Leaf Extract (*Piper Crocatum Ruiz & Pav.*), White temu essential oil (*Curcuma zedoaria*), Mangosteen Fruit Extract (*Garcinia Mangostana*), Licorice Extract (*Glycyrrhiza glabra*), Kurkuma Extract (*Curcuma longa*), Ginger Extract (*Zingiber officinale*), Rosemary Extract (*Rosmarinus officinalis*), Lavender Extract (*Lavandula angustifolia*), Chamomile Extract (*Matricaria chamomilla*), Green Coffee Extract (*Coffea arabica*), Cinnamon Extract (*Cinnamomum verum*), Garlic Extract (*Allium sativum*), Red Onion Extract (*Allium cepa*), Olive Leaf Extract (*Olea Europaea*), Aloe Vera Extract (*Aloe vera*), Grapefruit Seed Extract (*Citrus paradisi*), Licorice Root Extract (*Glycyrrhiza glabra*), Cucumber Extract (*Cucumis sativus*), Carrot Extract (*Daucus carota*), Avocado Extract (*Persea americana*), Papaya Extract (*Carica papaya*), Green Tea Extract (*Camellia sinensis*).

A facial serum is a skincare product in the form of a light, moisturizing gel or lotion that contains active ingredients that can penetrate deeper into the skin. Serums often have a light and absorbent texture, created to deliver targeted benefits such as intensive hydration, skin rejuvenation or antioxidant protection. Typically, serums are used as an additional step in the skincare routine after cleansing and before moisturizer application (Indrayati, 2019).

The formulation process involves combining selected ingredients in the right proportions to achieve the desired consistency, stability, and effectiveness. This includes the use of emulsifying agents, thickeners, preservatives, and other ingredients that support serum formulation (Nazilah, 2018).

In addition, research into the formulation of facial serums from plant extracts shows the potential to develop more effective and safe cosmetic products, utilizing widely available natural resources. It may also promote sustainability in the cosmetic industry by reducing reliance on synthetic ingredients that are potentially harmful to the environment. Thus, this journal *review* study aims to orient the reader into the scope and relevance of the research and provide a comprehensive understanding from the

various journals reviewed on the concepts and theories behind the use of plant extracts as active ingredients in antioxidant serums.

RESEARCH METHOD

The method used in this writing is literature *review article* (LRA) with library sources through data bases such as Google scholar, Pubmed, Pharmaceutics, and Science Direct published from 2015 to 2023 on the topic of Formulation and Evaluation of Antioxidant Facial Serums from Various Plant Extracts. In this literature review using keywords including facial serum formulation, serum formula evaluation, plants that have potential as antioxidants. The journal results from the search were 11,850 journals then only 55 journals were selected with the topic linkage.

RESULT AND DISCUSSION

The development of cosmetic preparations containing natural ingredients is currently increasing. The growing interest in natural skincare products is driving research to find ingredients that are more environmentally friendly and effective. Plants are known as rich sources of antioxidants, which can protect the skin from free radical damage. The development of facial serums using extracts of various plants has the potential to provide significant benefits in skin care.

Indonesia with its biodiversity has great potential in providing a source of natural active ingredients for the cosmetic industry. Many local plants have not been fully explored for their antioxidant potential. Great opportunities exist in the development of environmentally friendly and sustainable cosmetic products, given the increasing consumer awareness of natural and organic products (Farlina et al., 2023)

The method used was literature review article (LRA) with literature sources taken from various databases such as Google Scholar, PubMed, Pharmaceutics, and Science Direct. Articles published between 2015 and 2023 on the topic of "Formulation and Evaluation of Antioxidant Facial Serums from Extracts of Various Plants" were the main focus of this study. The keywords used in the literature search included "Formulation of facial serum", "Evaluation of serum formula", and "plants with antioxidant potential". From this search, 11,850 journals were obtained which were then filtered based on relevance to the topic of interest, resulting in 55 relevant journals for further analysis.

Extracts of Various Plants with Potential as Antioxidants

This research involves the selection of plants from various journals that have high antioxidant content, such as Red Betel Leaf Extract (*Piper Crocatum Ruiz & Pav.*), White temu essential oil (*Curcuma zedoaria*), *Mangosteen* Fruit Extract (*Garcinia Mangostana*), Licorice Extract (*Glycyrrhiza glabra*), Kurkuma Extract (*Curcuma longa*), Ginger Extract (*Zingiber officinale*), Rosemary Extract (*Rosmarinus officinalis*), Lavender Extract (*Lavandula angustifolia*), Chamomile Extract

(*Matricaria chamomilla*), Green Coffee Extract (*Coffea arabica*), Cinnamon Extract (*Cinnamomum verum*), Garlic Extract (*Allium sativum*), Red Onion Extract (*Allium cepa*), Olive Leaf Extract (*Olea Europaea*), Aloe Vera Extract (*Aloe vera*), Grapefruit Seed Extract (*Citrus paradisi*), Licorice Root Extract (*Glycyrrhiza glabra*), Cucumber Extract (*Cucumis sativus*), Carrot Extract (*Daucus carota*), Avocado Extract (*Persea americana*), Papaya Extract (*Carica papaya*), Green Tea Extract (*Camellia sinensis*) and tropical fruits. Extraction of the active compounds is done through efficient methods to ensure the quality and purity of the active ingredients. Serum formulations were made by combining plant extracts with additional ingredients to achieve the desired consistency and stability. The resulting product is then tested for dosage evaluation, stability, safety, and effectiveness (Handayani & Qa, 2023).

Frequently used extraction methods include solvent extraction, high-pressure extraction, and supercritical extraction. The choice of extraction method impacts the quality and purity of the active compounds obtained, which in turn affects the effectiveness of the serum (Indriaty et al., 2018).

The results showed that the plant extracts used had significant antioxidant content and could be formulated into a stable facial serum. The stability test is a series of evaluation tests that show that the serum remains effective and safe during shelf life. Clinical testing on human subjects showed improved skin hydration, wrinkle reduction, and protection against free radical damage (Andreani et al., 2022).

Some plants that frequently appear in the literature as sources of antioxidants for facial serums include green tea (*Camellia sinensis*), grapes (*Vitis vinifera*), turmeric (*Curcuma longa*), and aloe vera (*Aloe vera*). The extracts of these plants contain active compounds such as polyphenols, flavonoids, carotenoids, and vitamin C, which have high antioxidant capabilities.

The IC value₅₀ (*Inhibitory Concentration 50*) is a parameter of the potential antioxidant activity of a compound. IC₅₀ value is the concentration required of a compound to inhibit 50% of free radical activity. Lower IC₅₀ values indicate stronger antioxidant activity (Febriani et al., 2022).

Table 1. IC results₅₀ Of the various plants that have potential as antioxidants

Plant Extract	Scientific Name	IC50 value (µg/mL)
Red Betel Leaf Extract	<i>Piper crocatum</i>	25-50
White Temu Essential Oil	<i>Curcuma zedoaria</i>	20-40
Mangosteen Fruit Extract	<i>Garcinia mangostana</i>	5-15
Licorice Extract	<i>Glycyrrhiza glabra</i>	20-40
Kurkuma Extract	<i>Curcuma longa</i>	5-15
Ginger Extract	<i>Zingiber officinale</i>	10-30
Rosemary Extract	<i>Rosmarinus officinalis</i>	15-25
Lavender Extract	<i>Lavandula angustifolia</i>	20-50
Chamomile Extract	<i>Matricaria chamomilla</i>	30-60
Green Coffee Extract	<i>Coffea arabica</i>	10-25

Cinnamon Extract	<i>Cinnamomum verum</i>	20-40
Garlic Extract	<i>Allium sativum</i>	10-30
Red Onion Extract	<i>Allium cepa</i>	30-70
Olive Leaf Extract	<i>Olea europaea</i>	5-15
Aloe Vera Extract	<i>Aloe vera</i>	50-100
Grapefruit Seed Extract	<i>Citrus paradisi</i>	10-25
Licorice Root Extract	<i>Glycyrrhiza glabra</i>	20-40
Cucumber Extract	<i>Cucumis sativus</i>	30-50
Carrot Extract	<i>Daucus carota</i>	20-40
Avocado Extract	<i>Persea americana</i>	25-50
Papaya Extract	<i>Carica papaya</i>	15-30
Green Tea Extract	<i>Camellia sinensis</i>	10-20

Green tea (*Camellia sinensis*) is well known for its high polyphenol content, especially epigallocatechin gallate (EGCG). IC values₅₀ for green tea vary depending on the measurement and extraction method, but are generally in the range of 10-20 µg/mL for pure green tea extract (Dewi et al., 2013).

Grapes (*Vitis vinifera*) contain resveratrol, quercetin, and proanthocyanidins which are known to be powerful antioxidants. IC₅₀ values for grape skin extracts can vary, but are usually in the range of 25-50 µg/ml.

Turmeric (*Curcuma longa*) contains curcumin, which has strong antioxidant properties. IC₅₀ values for curcumin from turmeric extracts are usually in the range of 5-15 µg/mL.

Aloe vera contains various bioactive compounds including aloin and emodin. IC₅₀ values for aloe vera extracts can be higher than others, usually in the range of 50-100 µg/mL (Afifah & Nurwaini, 2018).

Lavender extract (*Lavandula angustifolia*) linalool, linalyl acetate, and other terpenoids known to have antioxidant properties. IC₅₀ value: About 20-50 µg/mL. Lavender extract shows good antioxidant activity, contributes to protecting cells from oxidative damage, and provides calming and anti-inflammatory effects.

Chamomile (*Matricaria chamomilla*) extract contains apigenin, quercetin, and chamazulene which have antioxidant properties. The IC₅₀ value is about 30-60 µg/mL. Chamomile has antioxidant potential that can help relieve skin irritation and reduce oxidative stress on skin cells (Sulistiana & Darijanto, 2022).

Green Coffee Extract (*Coffea arabica*) is rich in chlorogenic acid and caffeine, which are powerful antioxidants. The IC₅₀ value is about 10-25 µg/mL. Green coffee extract has high antioxidant potential, effective in fighting free radicals and protecting the skin from premature aging and UV damage (Furqan & Nurman, 2020).

Cinnamon Extract (*Cinnamomum verum*) Contains cinnamaldehyde, eugenol, and proanthocyanidins. IC₅₀ value is about 20-40 µg/mL. Cinnamon shows strong antioxidant activity, potentially reducing inflammation and protecting the skin from oxidative damage (Husni et al., 2022).

Garlic Extract (*Allium sativum*) contains allicin and sulfides which have antioxidant properties. IC50 value is about 10-30 µg/mL. Garlic has significant antioxidant activity, helps fight free radicals and provides antimicrobial and anti-inflammatory effects.

Red Onion Extract (*Allium cepa*). Contains quercetin and other flavonoids that have antioxidant properties. IC50 value is about 30-70 µg/mL. Onion extract has antioxidant potential that can help protect the skin from oxidative damage and inflammation (Mardiah et al., 2017).

Olive Leaf Extract (*Olea europaea*). Potential Ingredients. Contains oleuropein, hydroxytyrosol, and other polyphenols. IC50 value is about 5-15 µg/mL. Olive leaf exhibits very high antioxidant activity, is effective in protecting the skin from free radical damage and has strong anti-inflammatory properties.

Face Serum Formulation

The effectiveness of antioxidants in protecting skin from premature aging and environmental damage. Serum formulations with plant extracts offer a natural and sustainable solution for skin care. This research supports the use of natural ingredients in cosmetics, providing a safer and more effective alternative to synthetic chemicals (Saputra et al., 2023).

Facial serums formulated from extracts of various plants have proven to have potential as effective skincare products. The use of natural antioxidants in serums can improve skin health, provide protection from environmental damage, and offer a sustainable solution in the cosmetic industry. Components Facial serum formulations involve various components that are carefully selected to provide maximum benefits to the skin.

Various serum formulas were developed by combining plant extracts together with other ingredients such as moisturizers (hyaluronic acid, glycerin), emulsifiers (lecithin, polysorbates), and preservatives (phenoxyethanol, parabens). The addition of penetration enhancers such as ethanol and dimethyl isosorbide helps the active ingredients penetrate deeper into the skin (Anggarini et al., 2021).

Evaluation of Facial Serum Preparation

The evaluation of a facial serum dosage formula involves a thorough analysis of the various components used in the formulation, including the concentration of antioxidant active ingredients, the type of moisturizers, stabilizers, and emulsifiers used. This evaluation aims to ensure that the facial serum formula is not only effective in reducing oxidative damage to the skin, but also safe and compliant with cosmetic safety standards (Annisya et al., 2023).

The evaluation process usually includes:

- 1) **Antioxidant Active Ingredient Analysis:** Check the type and concentration of antioxidant active ingredients such as plant extracts or synthetic compounds used. It is important to ensure that these concentrations are sufficient to provide anti-aging benefits and protect the skin from free radical damage.

- 2) **Stability Study:** Stability testing of serum formulas to ensure that the antioxidant active ingredients do not undergo significant degradation during the shelf life of the product. This involves stability studies at various storage conditions such as temperature and light.
- 3) **Safety Test:** Evaluate the safety of the serum formula through dermatological and skin irritation tests. This is important to ensure that the product does not cause allergic reactions or irritation in the user.
- 4) **Clinical Trials:** Where possible, clinical trials can be conducted to test the effectiveness of the product under real usage conditions and to measure potential improvements in skin conditions such as fine lines, skin moisture, or hyperpigmentation.
- 5) **Performance Monitoring:** Continuous evaluation of serum performance over a period of time to ensure that the product remains effective and meets user expectations.

CONCLUSION

Based on the literature review conducted from 55 journals in the Lowest IC50 Value category, the potential for Very Strong Antioxidant activity includes Mangosteen Fruit Extract (*Garcinia mangostana*), Kurkuma Extract (*Curcuma longa*), Olive Leaf Extract (*Olea europaea*), Green Tea Extract (*Camellia sinensis*), Green Coffee Extract (*Coffea arabica*), Garlic Extract (*Allium sativum*), Grapefruit Seed Extract (*Citrus paradisi*). The highest IC50 value that has very low antioxidant potential is Aloe Vera Extract.

Facial serum formulations using plant extracts as antioxidant active ingredients have been shown to be effective in reducing oxidative damage to the skin, slowing down the aging process, and improving overall skin health. Evaluation of antioxidant serum preparations from extracts of various plants showed great potential in skin care, offering strong antioxidant benefits and high safety.

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