

Preparation and Evaluation of Syzygium aqueum face serum for Antioxidant Effect

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ABSTRACT

Face serums have gained significant importance in recent years due to their ability to deliver active ingredients effectively into deeper layers of the skin, making them suitable for managing various dermatological conditions such as acne, skin aging, wrinkles, fine lines, and hyperpigmentation. The use of natural and non-toxic components in cosmetic formulations has further increased their acceptance for safe topical application.

Syzygium aqueum (watery rose apple) leaves are rich in phenolic compounds and flavonoids, which possess strong antioxidant activity and play an important role in neutralizing free radicals responsible for oxidative skin damage. In the present study, a water-based herbal face serum was formulated using Syzygium aqueum leaf extract. Glycerin and hyaluronic acid were incorporated to enhance hydration, moisture retention, and penetration of active ingredients.

The objective of this study was to formulate a face serum containing Syzygium aqueum leaf extract and to evaluate its antioxidant potential. The formulated serum was evaluated for physicochemical and quality parameters including colour, appearance, homogeneity, viscosity, absorbance, pH, and stability. The findings suggest that the developed herbal face serum possesses acceptable physicochemical characteristics and promising antioxidant activity, indicating its suitability for cosmetic and dermatological applications.

KEYWORDS: Syzygium aqueum herbal face serum, Organic skincare, Natural, Plant-based, Anti-aging, Antioxidant, Botanical, Phenols, Flavanoids.

I. INTRODUCTION

HERBAL COSMETICS

Herbal cosmetics are formulations prepared using approved cosmetic bases combined with herbal ingredients to provide specific cosmetic

benefits. The condition of skin and hair is influenced by factors such as health status, lifestyle, climate, and personal care practices. Seasonal variations often lead to skin problems including dehydration, pigmentation, wrinkles, sunburn, dryness, and infections.

Traditional systems of medicine, particularly Ayurveda, have long utilized herbs and plant-based materials for enhancing beauty and maintaining skin health. Herbal cosmetics contain plant-derived phytochemicals that support normal skin function and are generally considered safe and biocompatible. According to the Drugs and Cosmetics Act, cosmetics are products applied to the human body for cleansing or beautifying and are regulated under the same guidelines as conventional cosmetics, without therapeutic claims. Growing consumer awareness regarding the adverse effects of synthetic cosmetic products has increased the demand for herbal formulations, thereby expanding research and development in the cosmeceutical industry.

Basic skin care requirements include:

- Cleansing agents
- Toners
- Moisturizers [1]

Advantages of herbal cosmetics

- Herbal cosmetics reduce the risk of adverse reactions and are less likely to cause negative side effects.
- Herbal cosmetics are easily absorbed by the skin and hair.
- Herbal cosmetics are generally well-tolerated and accepted by users.
- Herbal cosmetics serve as a sustainable source of natural treatments.
- Herbal cosmetics are more affordable. [2]

FACE SERUM

Face serums are highly concentrated cosmetic formulations widely used in modern

skincare. Compared to conventional creams and lotions, serums contain higher concentrations of active ingredients, allowing targeted and rapid action on specific skin concerns. They may be formulated as water-based or oil-based systems and often contain significantly higher levels of biologically active compounds. Due to their low molecular weight and lightweight nature, face serums facilitate better penetration into the superficial layers of the skin, resulting in visible improvement with regular use.

Face serums are commonly enriched with antioxidants, ceramides, amino acids, and other essential nutrients that contribute to skin hydration, barrier protection, and anti-aging benefits. An ideal serum formulation should contain antioxidants, cell-communicating agents, and skin-identical ingredients to improve fine lines, wrinkles, and overall skin barrier function. [3]

In the present study, *Syzygium aqueum* leaves were selected due to their recognized cosmetic and antioxidant potential. The plant material was collected and authenticated using standard morphological evaluation and herbarium comparison. The authenticated leaves were subjected to extraction and phytochemical screening, which confirmed the presence of phenolic compounds and flavonoids as major bioactive constituents. The extract was incorporated into a topical face serum formulation, and its antioxidant activity was evaluated using the DPPH (2,2-diphenyl-1-picrylhydrazyl) free radical scavenging assay to assess its protective potential against oxidative skin damage.

II. PLANT PROFILE

Syzygium aqueum (water apple) is a medicinally important species of the family Myrtaceae, native to Indonesia and Malaysia and widely cultivated across South and Southeast Asia for its edible fruits and ornamental value. It is a tropical evergreen tree that grows optimally at 25–32 °C, adapts to various soil types under adequate moisture conditions, is frost-sensitive, reaches 8–10 m in height, and begins fruiting within 2–5 years. The species is widely distributed in countries including India, Sri Lanka, Malaysia, the Philippines, Myanmar, and Pakistan. Phytochemical studies indicate that *S. aqueum*, particularly its leaves, is rich in bioactive compounds such as phenolic acids, flavonoids, anthocyanins, tannins, lignans, terpenoids, and volatile oils, which contribute to its medicinal and antioxidant properties. [4]

III. MATERIALS AND METHODS.

Preparation of *Syzygium aqueum* Extract:

Fresh and shade-dried leaves of *Syzygium aqueum* were subjected to extraction using an ethanol–water solvent system. The plant material was macerated with aqueous ethanol and the extract was filtered through Whatman filter paper to obtain a clear filtrate. The filtrate was concentrated to obtain the crude extract, which was transferred to a 100 mL volumetric flask and the volume was adjusted with ethanol to prepare solutions of different concentrations. The crude leaf extract of *Syzygium aqueum* was evaluated for antioxidant activity using the DPPH (2,2-diphenyl-1-picrylhydrazyl) free radical scavenging assay. The percentage radical scavenging activity was determined to assess the antioxidant potential of the extract. [5]

Formulation table

INGREDIENTS	OFFICIAL FORMULA (100ml)	WORKING FORMULA (30ml)
Syzygium aqueum extract	20ml	6ml
Glycerin	5ml	1.5ml
Xanthan gum	0.3gm	0.09gm
Hyaluronic acid	0.2gm	0.06gm
Phenoxyethanol	1ml	0.3ml
Tween 20	2ml	0.6ml
Rose water	10ml	3ml
Aloe vera gel	5ml	1.5ml
Vitamin E	0.5ml	0.15ml
Distilled water	56ml	16.8ml



Face serum

PROCEDURE

The face serum was prepared using xanthan gum as the gel base. Initially, required amount of distilled water was taken in a clean beaker, and xanthan gum was gradually sprinkled with continuous stirring until complete hydration was achieved. The hydrated gel was allowed to stand for 30 minutes to ensure complete swelling.

Subsequently, the aqueous phase components, including Syzygium aqueum leaf extract, glycerin, rose water, and aloe vera gel, were added to the hydrated gel and mixed gently until a uniform mixture was obtained. Hyaluronic acid was then added slowly with continuous stirring. The mixture was gently heated to approximately 40 °C for 5 minutes, if required, to ensure proper dispersion of the components.

Separately, the oil phase was prepared by mixing vitamin E oil with Tween 20 in a separate beaker. The mixture was gently warmed to about 35 °C until a clear or slightly yellow homogeneous solution was obtained. After cooling the aqueous phase to room temperature, the oil phase was slowly incorporated with continuous gentle stirring.

Phenoxyethanol was added as a preservative, and the pH of the formulation was adjusted to 5.0–5.5 using citric acid. The final serum was stirred thoroughly, filtered if necessary, and transferred into a suitable container for further evaluation. [6]

IV. EVALUATION STUDIES

a) Colour and Appearance:

The colour and appearance of the formulation were evaluated by visual inspection. Any variation in colour may indicate non-uniform distribution of ingredients or differences in particle size, while changes in colour may also suggest chemical instability of the formulation. [7]

b) Homogeneity:

Homogeneity of the formulation was initially assessed by visual inspection to detect any precipitation or phase separation. The formulation exhibited a uniform and homogeneous appearance, which was further confirmed by tactile evaluation. Homogeneity may also be evaluated using a clarity test apparatus. [7]

c) Determination of pH:

Since the serum is intended for topical application, its pH should be compatible with that of human skin, which is slightly acidic (4.0–5.5). Maintaining this pH range ensures skin safety, chemical stability, and adequate shelf life of the formulation. The pH of the serum was determined using a calibrated pH meter. [7]

chemical stability of the developed formulation under different storage conditions using short-term accelerated testing. [10]

d) Determination of viscosity:

Viscosity is an important parameter in cosmetic evaluation as it influences the spreadability and pourability of the formulation. Since viscosity can be affected by factors such as temperature, manufacturing conditions, and raw material quality, its determination is essential. The viscosity of the serum was measured using an Ostwald viscometer. [7]

f) Absorbance time:

The serum starts absorbing immediately after application and is fully absorbed into the skin within 1–2 minutes. [8]

g) Washability:

The washability of the formulation was evaluated on the face. After removal, the skin appeared fresh, radiant, and well hydrated. [8]

h) Determination of DPPH radical scavenging activity:

The DPPH (2,2-diphenyl-1-picrylhydrazyl) assay is based on the reduction of the stable free radical DPPH by an antioxidant. DPPH has a deep violet color in solution and shows strong absorbance at 517 nm. When an antioxidant donates a hydrogen atom or an electron to DPPH, it is reduced to a yellow-colored diphenylpicrylhydrazine. The decrease in absorbance at 517 nm is proportional to the free radical scavenging activity of the antioxidant. The percentage of DPPH radical scavenging can be calculated by comparing the absorbance of the test sample with that of a control containing DPPH without antioxidant.

DPPH scavenging activity (% of antioxidant activity) = $(A_0 - A_1)/A_0 \times 100$

Where; A_0 is absorbance of control,
 A_1 is absorbance of standard/Test. [9]

i) Stability Studies:

Stability studies were conducted according to ICH guidelines to evaluate the physical and

V. RESULTS AND DISCUSSION

1. PREPARATION OF EXTRACT:



Syzygium aqueum leaf extract

2. CHEMICAL TEST:

Syzygium aqueum leaf extract

EXPERIMENT	INFERENCE
TEST FOR FLAVANOIDS Alkaline reagent test: To 1ml of crude extract, a few drops of dil. NaOH was added. An intense yellow colour appeared in the plant crude extract and the yellow colour disappears when dilute acid was added.	Positive
TEST FOR PHENOLS Ferric chloride test: To 2ml of extract add few drops 5% ferric chloride solution. Lead acetate test: To 2ml of extract add few drops of lead acetate solution	Positive Positive

3. COLOUR AND APPEARANCE:

PARAMETER	RESULT
Colour	White cloudy colour
Odour	Characteristic
State	Slightly viscous

4. HOMOGENEITY:

EXPERIMENT	RESULT
Clarity Test	Absences of white particles and black particles

5.DETERMINATION OF pH:

The formulation showed a pH of 5.1, which is within the expected range.

within 120 seconds, which is close to the expected value.

6.VISCOSITY:

The viscosity of the serum, measured using an Ostwald viscometer, was found to be **1050 cps**, which is in close agreement with the expected value.

8.WASHABILITY:

The washability of the serum was evaluated, and it was easily removed, leaving the skin feeling fresh and moist.

7.ABSORBANCE TIME:

The serum began to absorb immediately upon application and was completely absorbed

9.DETERMINATION OF ANTIOXIDANT ACTIVITY:

Sample / Standard	Absorbance (517 nm)	% DPPH Radical Scavenging
Control	0.903	–
Sample (1 mg/ml)	0.458	49.22%
Standard (Ascorbic acid, 1 mg/ml)	0.212	76.5%

RESULT: The plant extract at 1 mg/mL exhibited 49.22% DPPH radical scavenging activity, indicating moderate antioxidant potential. In comparison, ascorbic acid at the same concentration showed 76.5% activity. These findings suggest that the extract contains antioxidant compounds capable of donating electrons or hydrogen atoms to neutralize free radicals.

10.STABILITY STUDY:

Throughout the stability study, the product’s quality, safety, and efficacy was maintained.

PARAMETER	INFERENCE	
	During preparation	After one month of preparation
Visual Appearance	White cloudy colour	White cloudy colour
pH	5.1	5.1
Homogeneity	uniform appearance	uniform appearance

VI. CONCLUSION

The present study demonstrates that *Syzygium aqueum* leaf extract is a rich source of phenolic compounds and flavonoids, which contribute to its significant antioxidant potential. These bioactive constituents play an important role in protecting the skin from oxidative stress caused by free radicals, which are associated with premature aging and uneven skin tone. The antioxidant activity of the extract supports its suitability for incorporation into cosmetic formulations. The formulated herbal face serum containing *Syzygium aqueum* leaf extract exhibited acceptable physicochemical properties and stability, indicating its potential for topical cosmetic application. The presence of antioxidant and skin-soothing components suggests that the formulation may help in maintaining skin health and improving overall skin appearance. Therefore, *Syzygium aqueum* leaf extract can be considered a promising natural ingredient for the development of herbal cosmetic products.

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