

Preparation and Evaluation Study Of Antioxidant-Rich Herbal Face Serum From *Clitoria Ternatea*

Pournima Das¹, chaitanya Dharavane², kajal Dhum³, Ritesh Dunghav⁴,
Mr. Lokesh Vyas⁵, Dr. Sonali Uppalwar⁶

Ideal Institute of Pharmacy, posheri, wada, Maharashtra, India, Mumbai university

DOI: 10.64823/ijter.2605018

© 2026 The Author(s). Published by *Ambesys Publications*. This is an open-access article distributed under the terms of **Creative Commons Attribution License (CC BY 4.0)** (<https://creativecommons.org/licenses/by/4.0/>)

Abstract: Background: *Clitoria ternatea*, commonly known as butterfly pea, is recognized for its rich antioxidant composition, especially anthocyanins called ternatins, which assist in protecting the skin against oxidative damage and early aging. Herbal cosmetic products are gaining popularity because they are naturally derived and generally associated with fewer adverse effects. The present study aimed to develop a herbal antioxidant face serum incorporating *Clitoria ternatea* along with a natural gelling agent.

Method: The flowers of *Clitoria ternatea* were collected, dried under shade, and converted into fine powder. The plant extract was obtained through aqueous or ethanolic extraction techniques. A herbal face serum was then prepared using xanthan gum as the natural thickening agent, glycerin as a moisturizing component, and Vitamin E to enhance antioxidant potential. The prepared formulation was assessed for different physicochemical parameters including pH, viscosity, spreadability, uniformity, and skin compatibility. Stability testing was carried out at room temperature, refrigerated conditions, and accelerated storage environments. Antioxidant potential of the serum was determined using the DPPH radical scavenging method.

Result: The developed serum showed appropriate consistency, uniform appearance, and a smooth texture suitable for topical use. The formulation demonstrated acceptable spreadability and good homogeneity without any evidence of phase separation. Stability evaluation confirmed that the serum maintained its physical characteristics under different storage conditions without major alterations.

Conclusion: The investigation successfully developed a stable antioxidant-enriched herbal face serum containing *Clitoria ternatea* and xanthan gum. The formulation displayed favorable physicochemical characteristics, satisfactory stability, and considerable antioxidant effectiveness, indicating its potential as a natural cosmeceutical product.

Keywords: *Clitoria ternatea*, xanthan gum, herbal face serum, antioxidant activity, antimicrobial activity, anti-aging, traditional medicine, pharmacological activities

I. INTRODUCTION

1.1 Introduction to disease:

Oxidative stress results from an imbalance between free radicals and antioxidants and is strongly associated with the progression of numerous skin and systemic disorders. When antioxidant levels in the body become insufficient to counteract free radicals, these unstable molecules start damaging cellular components such as

proteins, lipids, DNA, and tissues.(1,2) Persistent oxidative damage over time contributes to chronic inflammation, tissue deterioration, premature aging, and the onset of several long-term diseases.(3) In the skin, oxidative stress is responsible for conditions including wrinkles, hyperpigmentation, acne-related inflammation, dryness, reduced elasticity, and early skin aging. Continuous exposure to ultraviolet radiation and environmental pollutants further intensifies oxidative injury and weakens the natural skin barrier.(4)

In addition to dermatological effects, oxidative stress has been closely linked with major health disorders including cardiovascular diseases, diabetes mellitus, neurodegenerative conditions such as Alzheimer's and Parkinson's disease, impaired immune response, and certain cancers.(5,6) These pathological conditions are frequently associated with ongoing inflammation and cellular destruction triggered by excessive free radical generation. Antioxidants serve an essential protective role by neutralizing reactive molecules and minimizing oxidative stress within the body.(7,8)

Natural antioxidant-containing substances including vitamins C and E, green tea, berries, and *Clitoria ternatea* have been extensively investigated for their protective effects against oxidative injury and their beneficial role in maintaining healthier skin and overall well-being. One of the primary functions of antioxidants is their capacity to neutralize free radicals and limit oxidative stress.(9) Antioxidants stabilize reactive molecules by donating electrons without becoming unstable themselves, thereby preventing destructive chain reactions that may harm collagen, lipids, proteins, skin cells, and DNA. This mechanism supports cellular integrity and promotes normal biological activity.(10,11)

In skincare and health sciences, antioxidants are recognized for several important properties:

- 1.1.1 Free radical scavenging activity
- 1.1.2 Protection against oxidative damage
- 1.1.3 Anti-aging effects
- 1.1.4 Anti-inflammatory properties
- 1.1.5 Collagen preservation
- 1.1.6 Cellular and DNA protection
- 1.1.7 Support for skin repair and regeneration

A key characteristic of antioxidants is their ability to terminate oxidative chain reactions:(12,14)

“Free Radical” + “Antioxidant” → “Stable Molecules”

This reaction minimizes additional cellular injury and helps maintain tissue integrity and skin health. Naturally occurring antioxidants such as vitamin C, vitamin E, flavonoids, polyphenols, and anthocyanins derived from plants like *Clitoria ternatea* are highly valued because of their potent antioxidant activity and protective effects against environmental stressors and aging.(15)

Free radicals are highly reactive and unstable compounds produced from various external and internal sources including ultraviolet radiation, environmental pollution, smoking, psychological stress, unhealthy diet, and normal metabolic activities within the body.(16-18)

Antioxidants help neutralize free radicals before they damage skin cells by donating electrons to unstable molecules and interrupting harmful oxidative reactions within the skin.(19) In cosmetic and dermatological formulations, antioxidants are particularly important because they assist in collagen protection, skin repair, reduction of inflammation, enhancement of skin brightness, and maintenance of healthy skin function.(20) Ingredients such as vitamin C, vitamin E, niacinamide, green tea extract, resveratrol, and butterfly pea flower

extract are frequently incorporated into antioxidant serums because of their protective effects against environmental damage and oxidative stress.(21-24)

Regular application of antioxidant-enriched skincare products may contribute to smoother, firmer, brighter, and healthier-looking skin over time.(25) Antioxidants show greater effectiveness when combined with sunscreen use, as sunscreens help block ultraviolet rays while antioxidants reduce residual oxidative stress and cellular damage caused by environmental exposure.(26,27,28)

TABLE NO- 1.1.1 Common Antioxidants in Skincare:

Antioxidant	Main Benefit
Vitamin C	Brightening + collagen support
Vitamin E	Protects skin lipids
Niacinamide	Barrier repair + anti-inflammatory
Green Tea	Calming + antioxidant
Resveratrol	Anti-aging
Ferulic Acid	Stabilizes other antioxidants
Butterfly Pea Extract	Anthocyanin-rich antioxidant

1.2 Introduction to *Clitoria ternatea*

Clitoria ternatea, a member of the Fabaceae family, is a perennial climbing herb commonly found in tropical and subtropical regions of Asia, Africa, and South America. The plant is widely known by names such as Butterfly pea, Aparajita, and Shankhapushpi, and has been traditionally utilized in medicinal systems including Ayurveda, Siddha, and Unani medicine.(29) In Ayurvedic literature, *Clitoria ternatea* is classified as a *Medhya Rasayana*, indicating its importance in enhancing memory, intellect, and cognitive performance. In recent years, the plant has attracted growing scientific interest due to increasing evidence supporting its traditional therapeutic applications and health-promoting properties.(30)



Fig No 1.2.1 *Clitoria ternatea*.

Different parts of *Clitoria ternatea*, including the roots, leaves, flowers, and seeds, have traditionally been used for various medicinal purposes. The roots are commonly regarded as a brain tonic and are also used for their laxative and diuretic properties.(31-34) Leaves of the plant are traditionally applied in the management

of inflammation, wounds, and certain skin disorders. The flowers, particularly the characteristic blue petals, are rich in anthocyanins and are valued for their antioxidant activity as well as their potential role in relieving stress and anxiety. In addition, the seeds are reported to possess purgative and anti-inflammatory properties.(35)

Clitoria ternatea has received increasing attention in herbal medicine and phytopharmaceutical research because of its broad spectrum of therapeutic applications.(36) Scientific investigations have revealed the presence of several important bioactive constituents such as flavonoids, anthocyanins (ternatins), alkaloids, glycosides, saponins, tannins, phenolic compounds, steroids, and triterpenoids.(37,38) These phytochemical components contribute significantly to multiple pharmacological activities including antioxidant, neuroprotective, anxiolytic, antidepressant, anti-inflammatory, antimicrobial, antidiabetic, hepatoprotective, and cardioprotective effects.(39) The presence of these biologically active metabolites highlights the importance of implementing appropriate quality control measures to ensure the safety, consistency, and efficacy of herbal formulations prepared from this plant.(40)

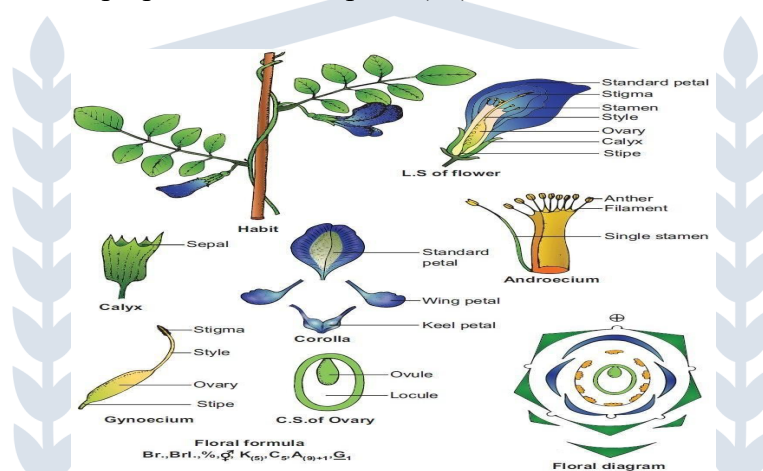


Fig No 1.2.2 Morphology of *Clitoria ternatea*.

The growing resurgence of interest in herbal medicine has emphasized the need for proper identification, authentication, and standardization of medicinal plants. Variations in the phytochemical composition of herbal drugs may arise due to several factors such as geographical location, climatic conditions, soil type, harvesting period, plant maturity, and post-harvest processing methods.(41-42) Furthermore, plant-based crude drugs are highly vulnerable to adulteration and substitution, which can ultimately reduce their therapeutic effectiveness.

Pharmacognostic standardization is considered an essential step in maintaining the quality and authenticity of herbal medicines.(43) It provides scientifically validated parameters for the identification and evaluation of raw plant materials. Pharmacognostic evaluation includes macroscopic and microscopic analysis along with the determination of physicochemical parameters such as ash values, extractive values, and moisture content. Additional assessments like fluorescence analysis and preliminary phytochemical screening are also included. These parameters are important for confirming the identity, purity, and quality of medicinal plant materials and serve as the basis for the development of official pharmacopeial standards.(44)

Standardization further establishes a scientific basis for advanced pharmacological, toxicological, and clinical studies. Macroscopic examination involves the observation of external characteristics such as shape, size, color, texture, odor, taste, and surface appearance of plant materials. Microscopic analysis provides detailed anatomical information including epidermal cells, stomata, trichomes, vascular bundles, fibers, starch

granules, and calcium oxalate crystals, all of which are valuable for authenticating medicinal plants.(45) In powdered crude drugs, powder microscopy is particularly useful for detecting adulteration and substitution.

Physicochemical parameters also contribute significantly to quality control by indicating the presence of inorganic matter, extractable constituents, and moisture levels within the crude drug. Ash values are useful in determining total inorganic and acid-insoluble matter, whereas extractive values estimate the quantity of active constituents soluble in specific solvents. Moisture content is another critical factor because excess moisture may promote microbial contamination and chemical degradation, thereby affecting the stability and shelf life of herbal materials.(46)

In addition, fluorescence analysis under visible and ultraviolet light serves as a valuable identification technique, as many phytoconstituents exhibit characteristic fluorescence behavior. Although extensive pharmacological and phytochemical studies have been conducted on *Clitoria ternatea*, comprehensive pharmacognostic standardization data for this plant remains limited and dispersed across different reports. Therefore, establishing standardized pharmacognostic profiles is essential to ensure reproducibility of therapeutic efficacy, support regulatory acceptance, and encourage the worldwide commercialization of herbal products containing *Clitoria ternatea*. Such standardization also provides a reliable scientific foundation for future pharmacological, toxicological, and clinical research.(47)

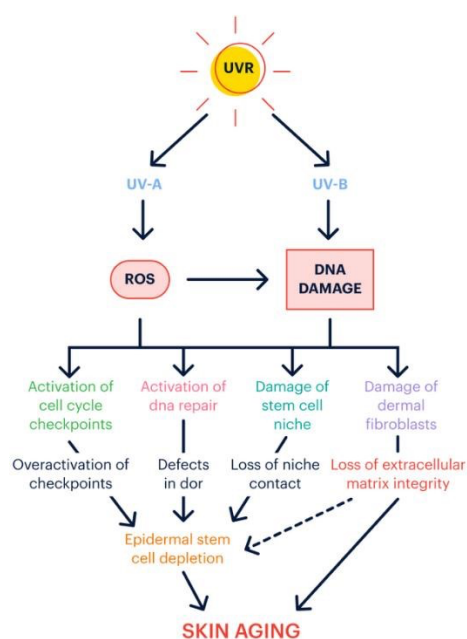


Fig No. 1.2.3 Free Redical formation

Therefore, the present review has been undertaken to systematically compile and critically evaluate the existing literature related to the pharmacognostic standardization of *Clitoria ternatea*. Special attention has been given to its botanical features, macroscopic and microscopic characteristics, physicochemical parameters, and phytochemical profiling required for proper quality assessment and standardization. This review may serve as a useful scientific resource for researchers, academicians, and the herbal pharmaceutical sector involved in the development of safe, reliable, and standardized herbal formulations.(48)

1.3 Introduction to Serum:

Butterfly pea serum is a herbal skincare preparation enriched with antioxidants obtained from *Clitoria ternatea*, commonly referred to as butterfly pea flower. The flower is naturally abundant in bioactive compounds such as anthocyanins, flavonoids, and polyphenols, which are recognized for their potent antioxidant properties.(49-50) These antioxidant constituents help defend the skin against oxidative stress produced by free radicals generated through ultraviolet radiation, pollution, stress, and various environmental factors. By neutralizing these reactive molecules, butterfly pea serum assists in minimizing premature aging, improving skin brightness, and supporting healthier skin integrity.

The serum has gained considerable importance in modern skincare because of its ability to support collagen preservation, improve hydration, soothe inflammation, and enhance overall skin appearance. Anthocyanins present in butterfly pea extract, especially ternatins, contribute to maintaining skin elasticity and reducing visible signs of aging including wrinkles, fine lines, dullness, and uneven skin tone. When formulated with moisturizing and soothing ingredients such as aloe vera, glycerin, rose water, and vitamin E, butterfly pea serum provides additional nourishing and protective benefits to the skin.(51)

Due to its rich antioxidant profile and plant-based origin, butterfly pea serum is increasingly incorporated into herbal and botanical skincare products intended for anti-aging, skin brightening, and environmental protection. Regular application may improve skin texture, maintain hydration balance, strengthen the skin barrier, and promote healthier, more radiant skin.

Butterfly pea serum is considered an advanced botanical skincare formulation prepared using extracts of *Clitoria ternatea*, a medicinal flowering plant widely known for its therapeutic and antioxidant properties.(52-53) The characteristic deep blue petals are rich in anthocyanins, particularly ternatins, along with flavonoids and polyphenolic compounds that possess strong antioxidant potential. These phytochemicals play a significant role in protecting the skin against oxidative stress caused by free radicals generated from environmental exposure such as ultraviolet radiation, air pollution, smoke, toxins, and stress. Oxidative stress can damage collagen, elastin, lipids, and DNA, leading to premature aging, inflammation, dryness, dullness, wrinkles, and uneven skin tone. Butterfly pea serum helps minimize such damage by neutralizing free radicals and supporting the skin's natural protective mechanisms.(54)

I. Botanical Source

- Derived from *Clitoria ternatea*
- Traditionally utilized in herbal medicine and skincare
- Rich source of natural anthocyanin pigments

II. Antioxidant Composition

- Contains anthocyanins (ternatins)
- Rich in flavonoids and polyphenolic compounds
- Helps neutralize free radicals
- Reduces oxidative stress

III. Skin Protection Mechanism

- Protects collagen and elastin fibers

- Prevents oxidative cellular injury
- Supports skin barrier function
- Minimizes environmental skin damage

IV. Anti-Aging Benefits

- Reduces wrinkles and fine lines
- Improves skin elasticity
- Supports youthful skin appearance
- Helps maintain smoothness and firmness

V. Hydration and Nourishment

- Assists in retaining skin moisture
- Prevents dryness and rough skin texture
- Enhances softness of the skin
- Provides soothing and nourishing effects

VI. Anti-Inflammatory Activity

- Helps soothe irritated skin
- Reduces inflammation and redness
- Suitable for sensitive or stressed skin
- Supports recovery of damaged skin

VII. Brightening Effects

- Improves dull and tired-looking skin
- Enhances natural skin glow
- Promotes even skin tone
- Supports healthy skin radiance

VIII. Environmental Defense

- Protects against pollution-related skin damage
- Reduces UV-induced oxidative stress
- Supports protection from environmental exposure

IX. Natural and Herbal Advantages

- Plant-derived skincare ingredient
- Suitable for herbal cosmetic formulations

- Eco-friendly and naturally sourced
- Popular in clean beauty products

X. Formulation Support Ingredients

- Aloe vera for hydration and soothing
- Glycerin for moisture retention
- Vitamin E for enhanced antioxidant protection
- Rose water for refreshing effects

XI. Applications in Cosmetics

- Antioxidant facial serums
- Anti-aging skincare formulations
- Herbal cosmetic preparations
- Skin rejuvenation products

XII. Overall Benefits

- Promotes healthier-looking skin
- Improves skin texture and smoothness
- Maintains hydration balance
- Provides long-term skin protection and care

Another important benefit of butterfly pea serum lies in its natural origin and compatibility with herbal and clean beauty formulations. It is widely preferred in plant-based skincare because it combines aesthetic value with functional skincare benefits. The naturally occurring blue-purple pigment of butterfly pea flower not only enhances visual appeal but also reflects the high anthocyanin content responsible for its antioxidant capacity. Continuous use of antioxidant-rich butterfly pea serum may help improve skin brightness, reduce signs of tiredness, maintain hydration, and protect the skin against environmental factors that contribute to premature aging.(55)

1.4 Additional Benefits of Butterfly Pea Antioxidant Serum:

1.4.1 Anti-Aging Property

Butterfly pea serum is highly appreciated for its anti-aging potential because it contains anthocyanins and flavonoids that help protect collagen and elastin from oxidative damage. These proteins are essential for maintaining skin firmness, elasticity, and smooth texture.(56) Continuous exposure to ultraviolet radiation, stress, and pollution accelerates collagen degradation, leading to wrinkles, fine lines, and sagging skin. The antioxidant constituents present in *Clitoria ternatea* help neutralize free radicals, thereby reducing premature aging and supporting youthful-looking skin.(57)

1.4.2 Protective Property

The serum acts as a protective barrier against environmental stressors including sunlight, pollution, smoke, and dust. Free radicals produced by these factors damage skin cells and weaken the natural skin barrier. Butterfly pea extract helps reduce oxidative stress and supports cellular protection, allowing the skin to maintain strength and resilience. When used alongside sunscreen, the serum offers enhanced defense against environmental skin damage.

1.4.3 Hydration and Moisturizing Effect

Butterfly pea serum provides effective hydration, especially when combined with ingredients such as aloe vera gel and glycerin. Glycerin functions as a humectant by attracting moisture to the skin, while aloe vera offers soothing and moisturizing effects. Proper hydration supports soft, smooth, and healthy skin appearance. Well-moisturized skin also appears brighter and more youthful.(58-59)

1.4.4 Skin Brightening Effect

The antioxidant compounds present in butterfly pea extract help minimize dullness and improve skin radiance. Oxidative stress and environmental exposure often contribute to uneven and tired-looking skin. Regular application of antioxidant-rich serum may improve skin tone, enhance natural glow, and provide a refreshed appearance.

1.4.5 Anti-Inflammatory Activity

Butterfly pea serum contains bioactive compounds possessing anti-inflammatory properties. These compounds help soothe irritated skin, reduce redness, and calm sensitive or stressed skin conditions. This property makes the serum useful for individuals exposed to harsh environmental conditions or mild skin irritation.

1.4.6 Collagen Support

Collagen is a vital structural protein responsible for skin strength and elasticity. Oxidative stress activates enzymes that degrade collagen fibers. The antioxidant activity of butterfly pea serum helps reduce collagen breakdown and supports maintenance of skin structure, thereby contributing to smoother and firmer skin over time.

1.4.7 Skin Barrier Support

The serum helps strengthen the skin barrier by protecting skin lipids and maintaining moisture balance. A healthy skin barrier minimizes water loss and protects the skin against irritants, microbes, and pollutants, thereby improving overall skin resilience and health.

1.4.8 Soothing and Cooling Effect

Ingredients such as rose water and aloe vera incorporated into the serum formulation provide cooling and refreshing effects. These ingredients help reduce dryness, discomfort, and heat-induced irritation while enhancing skin comfort.

1.4.9 Herbal and Natural Advantage

Butterfly pea serum is widely accepted in herbal skincare because it is derived from a natural botanical source and contains plant-based antioxidants. It is highly suitable for clean beauty and botanical skincare products designed for gentle yet effective skin nourishment and protection.(60-62)

1.4.10 Regular Use Benefits

With regular application, butterfly pea antioxidant serum may help:

- a) Improve skin texture
- b) Maintain skin hydration
- c) Reduce visible signs of aging
- d) Enhance skin smoothness
- e) Promote radiant and healthy-looking skin
- f) Protect against environmental oxidative stress
- g) Support long-term skin wellness

II. MATERIALS AND METHODS

2.1 MATERIALS

Table 2.1.1: *Clitoria ternatea*

parameter	Description
Category	Herbal antioxidant / Botanical extract
Function	Provides antioxidant and anti-aging activity
Benefits	Protects skin from oxidative stress, improves radiance, reduces premature aging
Mechanism	Neutralizes free radicals and reduces oxidative damage to skin cells and collagen
Suitable For	Dull skin, aging skin, stressed skin, normal to sensitive skin



Fig 2.1.1 *Clitoria Ternatea*

Table 2.1.2 :Aloevera

parameter	Discription
Category	Natural moisturizer / Skin soothing agent
Function	Hydrates and calms the skin
Benefits	Reduces irritation, cools skin, improves hydration
Mechanism	Forms a protective moisturizing layer and reduces inflammation
Suitable For	Sensitive skin, irritated skin, dry skin



Fig 2.1.2 Aloe vera

Table 2.1.3 :Vit.E Capsule

parameter	Discription
Category	Antioxidant / Skin conditioning agent
Function	Protects skin lipids from oxidation
Benefits	Reduces oxidative stress and nourishes skin
Mechanism	Neutralizes free radicals and prevents lipid peroxidation in skin cells
Suitable For	Mature skin, dry skin, damaged skin



Fig 2.1.3 Vit.E Capsule

Table 2.1.4 : Rose Water

parameter	Discription
Category	Floral hydrosol / Natural toner
Function	Refreshes and tones the skin
Benefits	Provides soothing, cooling, and mild hydrating effects
Mechanism	Helps calm irritation and maintain skin freshness
Suitable For	Sensitive skin, normal skin, combination skin



Fig 2.1.4 Rose Water

Table 2.1.5: Glycerine

parameter	Discription
Category	Humectant / Moisturizer
Function	Maintains hydration and softness
Benefits	Prevents dryness and improves skin barrier function
Mechanism	Attracts water from surroundings and deeper skin layers to the skin surface
Suitable For	Dry skin, dehydrated skin, sensitive skin



Fig 2.1.5 Glycerine

Table 2.1.6: Xanthum Gum

parameter	Discription
Category	Thickening agent / Stabilizer
Function	Improves serum texture and stability
Benefits	Gives smooth consistency and prevents ingredient separation
Mechanism	Forms a gel-like network that increases viscosity and stabilizes the formulation
Suitable For	All skin types



Fig 2.1.6 Xanthan Gum

Table 2.1.7: Sodium Benzoate

parameter	Discription
Category	Preservative
Function	Prevents microbial contamination
Benefits	Extends shelf life and maintains product safety
Mechanism	Inhibits growth of bacteria, yeast, and fungi in formulations
Suitable For	Suitable for all cosmetic formulations



Fig 2.1.7 Sodium Benzoate

2.2 Methodology:

Collection of Raw Materials

The raw materials necessary for the formulation of butterfly pea antioxidant face serum were obtained from authentic and reliable sources. Fresh flowers of *Clitoria ternatea* along with other formulation ingredients such as rose water and aloe vera gel were carefully selected on the basis of their quality, purity, and suitability for cosmetic preparation. All collected materials were properly stored under appropriate conditions prior to their use in the formulation process.



Fig 2.2.1 Raw Material

Step 1 – Preparation of Butterfly Pea Extract

Fresh flowers of *Clitoria ternatea* were thoroughly washed with clean water to eliminate dust, dirt, and other impurities. A measured quantity of the cleaned flowers was transferred into distilled water and heated on a water bath for approximately 15–20 minutes to prepare the extract. After completion of the extraction process, the mixture was allowed to cool to room temperature and then filtered through filter paper to remove unwanted plant residues and suspended particles. The filtered butterfly pea extract was collected and preserved in a clean, airtight container for subsequent use in the preparation of the serum formulation.



Fig 2.2.2 Extraction



Fig 2.2.3 Filtration

Step 2 – Preparation of Wet Gum Base

A required quantity of xanthan gum was accurately weighed and transferred into a clean mortar. Glycerin was then added gradually in small portions while continuous trituration was carried out using a pestle to obtain a smooth wet gum base. Mixing was continued carefully to avoid the formation of lumps and to ensure uniform dispersion of the gum. The process was continued until a homogeneous and glossy paste was formed.

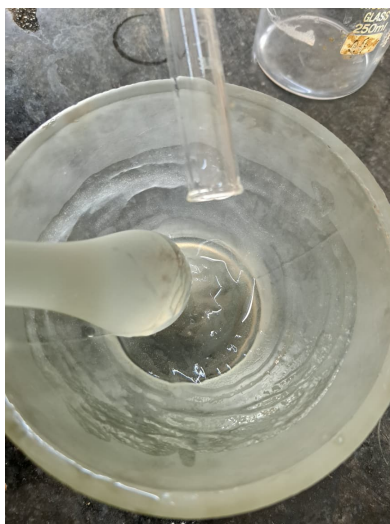


Fig 2.2.4 Wet gum Base

Step 3 – Preparation of Serum Base

Rose water was added gradually to the previously prepared wet gum base with continuous stirring. The mixture was blended thoroughly until a smooth, uniform, and gel-like serum base was obtained. Proper mixing was ensured to avoid the presence of lumps or unevenly dispersed particles within the formulation.



Fig 2.2.5 serum Base

Step 4 – Addition of Aloe Vera Gel

A measured quantity of aloe vera gel was incorporated into the prepared serum base. The mixture was then stirred continuously using a glass rod or a mechanical stirrer to ensure proper blending. Mixing was carried out until the aloe vera gel was evenly and completely dispersed throughout the formulation, resulting in a uniform consistency.



Fig 2.2.6 Aloe vera Gel.

Step 5 – Incorporation of Butterfly Pea Extract

The prepared extract of *Clitoria ternatea* was slowly added into the formulated serum base with continuous stirring. During addition, constant mixing was maintained to ensure uniform blending and even distribution of color throughout the formulation. Stirring was continued until a homogeneous antioxidant-rich serum was obtained with consistent texture and appearance.



Fig 2.2.7 Incorporation of Butterfly Pea Extract

Step 6 – Addition of Vitamin E

The vitamin E capsule was carefully pierced or cut open, and the oil content was extracted. The obtained vitamin E oil was then added to the prepared formulation. The mixture was stirred thoroughly to ensure uniform dispersion of the antioxidant component throughout the serum, resulting in a well-blended final product.



Fig 2.2.8 Addition of Vit E capsule.

Step 7 – Addition of Preservative

The required amount of sodium benzoate was incorporated into the formulation as a preservative. The mixture was stirred thoroughly to ensure complete and uniform distribution of the preservative throughout the serum. This step helps inhibit microbial growth and enhances the overall shelf life and stability of the product.



Fig 2.2.9 Addition of Perservative

Step 8 – Final Homogenization

The complete formulation was stirred continuously for several minutes to achieve proper homogenization. During this process, the texture, consistency, and overall appearance of the serum were carefully observed. Mixing was continued until a smooth, uniform, and lump-free formulation was obtained, ensuring no phase separation was present.

Step 9 – Packaging and Storage

The prepared butterfly pea antioxidant serum was transferred into a clean, dry, and airtight container under hygienic conditions. The container was properly labeled for identification. The final product was stored in a cool, dry place, protected from direct sunlight, in order to maintain its stability, quality, and effectiveness over time.



2.2.10 packaging and storage

2.3 Ingredients used in serum:

Ingredient	Category	Key Property	Main Use in Serum	Additional Notes
Rose Water	Floral hydrosol / Natural solvent	Soothing, hydrating, refreshing	Acts as the base liquid and helps calm the skin	Provides mild fragrance and improves skin freshness
Xanthan Gum	Thickening agent / Stabilizer	Increases viscosity and stabilizes formulation	Gives smooth serum consistency and prevents separation	Must be added slowly while stirring to avoid lumps
Aloe Vera Gel	Humectant / Botanical extract	Hydrating, soothing, anti-inflammatory	Helps moisturize and calm irritated skin	Supports skin healing and cooling effect
Butterfly Pea Extract	Natural antioxidant / Plant extract	Rich in anthocyanins and flavonoids	Provides antioxidant and anti-aging benefits	Derived from Clitoria ternatea and helps protect against oxidative stress
Glycerin	Humectant	Attracts and retains moisture	Maintains skin hydration and softness	Helps improve skin barrier function
Vitamin E Oil	Lipid-soluble antioxidant	Protects against free radical damage	Enhances antioxidant activity and nourishes skin	Helps improve product stability and skin conditioning
Preservative	Preservation agent	Prevents microbial growth	Extends shelf life and product safety	Essential for water-based skincare formulations

2.4 Formulation Table with Batches:

Ingredients	B1	B2	B3
Xanthum gum	0.01g	0.02g	0.05g
Glycerine	0.5ml	0.5ml	0.5ml
Rose water	6.9ml	6.5ml	5.9ml
Aloe vera gel	0.3ml	0.7ml	1ml
Butterfly Pea flower extract	2ml	2ml	2ml
Vit.E capsule	0.2ml	0.2ml	0.2ml
preservative	0.05g	0.05g	0.05g
Final Texture	Thin & watery	Smooth Serum	Thick gel

2.5. Evaluation of Face Serum

2.5.1 Appearance:

The formulated herbal face serum exhibited a smooth, uniform, and homogeneous consistency with a light blue coloration. No visible particles, phase separation, or impurities were observed in the final product, indicating good visual quality and proper formulation.

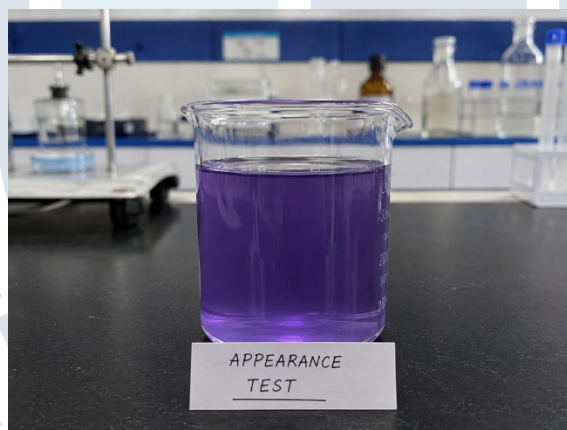


Fig 2.5.1 Appearance Test

2.5.2 pH Determination:

The pH of the formulated serum was found to be in the range of 5.5–6.5, which falls within the normal physiological pH of human skin. This indicates that the formulation is suitable for topical application without causing irritation or disruption to the skin's natural barrier.



Fig 2.5.2 PH Determination

2.5.3 Spreadability Test:

The serum showed good spreadability and spread easily on the skin without excessive rubbing.



Fig 2.5.3 Spreadability test

2.5.4 Absorption:

The formulated serum showed rapid absorption into the skin upon application. It was easily absorbed without leaving any oily, greasy, or sticky residue, indicating good skin compatibility and a lightweight texture suitable for topical use.



Fig 2.5.4 Absorption test

2.5.5 Texture:

The formulated serum exhibited a smooth and uniform texture with a non-greasy and pleasant feel. It spread easily on the skin, indicating good consistency and user-friendly application properties.



Fig 2.5.5 Texture determination.

2.5.6 Viscosity:

The viscosity of the formulated serum was found to be appropriate, ensuring a balanced consistency. It allowed easy spreading on the skin while maintaining adequate thickness, which contributed to convenient and uniform application.



Fig 2.5.6 Viscosity Determination

3.1. RESULT:

Table 3.1 OBSERVATION TABLE

SR.NO.	PARAMETERS	IDEAL VALUES
1.	Appearance	Smooth And Unifrom
2.	Spreadability	Good
3.	Skin Feel	Light And Refreshing
4.	Absorption	Fast
5.	Texture	Serum like
6.	Ease Of Application	Very Easy
7.	Overall Acceptability	Good
8.	PH Determination	5.82
9.	viscosity	Satisfactory viscous

3.2 DISCUSSION:

1. Xanthan gum played a key role in regulating the viscosity and overall thickness of the serum.

2. Aloe vera gel contributed significantly to skin hydration and also supported the gel-like consistency of the formulation.
3. Rose water imparted a light, soothing, and refreshing sensory feel to the serum.
4. Proper dispersion of xanthan gum in glycerin was essential in preventing lump formation and ensuring uniformity.
5. Among all formulations, Batch 2 was identified as the optimized batch due to its balanced viscosity, smooth texture, improved spreadability, and superior cosmetic acceptability.

III. CONCLUSION:

The present work successfully developed and evaluated a herbal face serum formulated with *Clitoria ternatea* extract, demonstrating satisfactory physical properties including stability, spreadability, consistency, and overall cosmetic acceptability. The butterfly pea flower extract was selected as the primary active component due to its well-documented antioxidant, soothing, and skin-beneficial properties. Additional excipients such as rose water, aloe vera gel, glycerin, vitamin E oil, xanthan gum, and sodium benzoate were incorporated to enhance hydration, improve texture, support preservation, and optimize overall formulation performance.

During formulation development, it was observed that xanthan gum concentration had a significant influence on the viscosity and texture of the serum. Higher concentrations resulted in a thicker, gel-like consistency, whereas lower concentrations produced a lighter and more fluid formulation. Aloe vera gel also contributed to both viscosity enhancement and moisturizing effects, while rose water served as the aqueous phase, providing a light, refreshing sensory profile.

To optimize the formulation, three trial batches of 10 mL each were prepared and assessed. Batch 1 exhibited a low-viscosity, watery consistency with excellent spreadability and rapid absorption, making it suitable for users preferring lightweight formulations, although its structural stability was comparatively lower. Batch 2 showed an optimal balance of viscosity, smooth texture, good spreadability, and improved stability, and was therefore identified as the most suitable formulation. Batch 3 resulted in a highly viscous gel due to increased levels of xanthan gum and aloe vera gel, offering enhanced moisturization but reduced flow properties.

The study further emphasized the importance of proper preparation technique, particularly the pre-dispersion of xanthan gum in glycerin, which helped prevent lump formation and ensured uniform distribution throughout the formulation. Adequate stirring and hydration time were also essential for achieving a stable and homogeneous system.

Overall, the developed serum demonstrated good appearance, pleasant sensory attributes, ease of application, and beneficial skin feel. The presence of glycerin and aloe vera improved hydration, while vitamin E contributed antioxidant support and skin nourishment. Sodium benzoate ensured microbial stability and extended shelf life of the formulation.

In conclusion, the optimized formulation yielded a stable and cosmetically acceptable herbal serum suitable for skincare applications. The study highlights that even minor variations in ingredient concentration can significantly influence formulation characteristics, making optimization through trial batches essential. The developed butterfly pea serum shows promising potential for further refinement, scale-up production, and application as a natural, antioxidant-rich herbal cosmetic product with moisturizing and soothing benefits.

IV. REFERENCE :

- [1] Kirtikar KR, Basu BD. *Indian Medicinal Plants*. Vol. 1. Dehradun: International Book Distributors; 2006.
- [2] Sharma PV. *Dravyaguna Vijnana*. Vol. 2. Varanasi: Chaukhambha Bharati Academy; 2010.
- [3] Nadkarni KM. *Indian Materia Medica*. Vol. 1. Mumbai: Popular Prakashan; 2009.
- [4] Jain SK. *Medicinal Plants*. New Delhi: National Book Trust; 2012.
- [5] Mukherjee PK. *Quality Control of Herbal Drugs*. New Delhi: Business Horizons; 2019.
- [6] Kumar V, Mukherjee K. Phytochemical and pharmacological profile of *Clitoria ternatea*. *Int J Pharm Sci Rev Res*. 2016;38(1):210–215.
- [7] Gollen B, Mehla J, Gupta P. *Clitoria ternatea* Linn: A comprehensive review on phytochemistry and pharmacology. *J Pharm Res*. 2018;12(2):170–178.
- [8] Rai KS, Murthy KD. Neuropharmacological effects of *Clitoria ternatea*. *Indian J Exp Biol*. 2015;53(3):164–170.
- [9] Jeyaraj EJ, Lim YY. Antioxidant properties of *Clitoria ternatea* flower extracts. *Food Chem*. 2017;221:1520–1527.
- [10] Daisy P, Santosh K. Evaluation of antidiabetic activity of *Clitoria ternatea*. *Indian J Pharm Sci*. 2018;80(2):302–308.
- [11] WHO. *Quality Control Methods for Herbal Materials*. Geneva: World Health Organization; 2011.
- [12] Kokate CK, Purohit AP, Gokhale SB. *Pharmacognosy*. Pune: Nirali Prakashan; 2018.
- [13] Evans WC. *Trease and Evans' Pharmacognosy*. 16th ed. London: Saunders Elsevier; 2009.
- [14] Indian Pharmacopoeia Commission. *Indian Pharmacopoeia*. Ghaziabad; 2022.
- [15] Wallis TE. *Textbook of Pharmacognosy*. New Delhi: CBS Publishers; 2014.
- [16] arborne JB. *Phytochemical Methods*. London: Chapman & Hall; 2005.
- [17] Kirtikar KR, Basu BD. *Indian Medicinal Plants*. Vol. 1. Dehradun: International Book Distributors; 2006.
- [18] Namdev, S., & Patidar, S. (2024). An overview of formulation and evaluation of herbal serum. *International Journal of Advanced Research in Science, Communication and Technology*, 4(4), 123.
- [19] Dr. Rahul Kumar Gupta, Dr. Pawan Kumar Sharma, Dr. Anand Pandey, Dr. Maneesh Kumar Gupta and Dr. Umesh Mujhalda. Ayurveda perspective of skin care: a review on cosmaceuticals And traditional of European Journal of Biomedical AND Pharmaceutical sciences. Year: 2018, Volume: 5, Issue: 5, 1110-1113.
- [20] Cho JM, Lee YH, Baek RM, Lee SW J, Effect of platelet rich plasma on ultraviolet B induced skin wrinkles in nude mice, *Plastrons Aesthet Surg*, 2011; 64(2): e31-9
- [21] Smrithi ojha, Surabhi Sinha ,Swadhapriya Das Chaudhuri ,Hina Chadha, Babhita Aggarwal ,Seema Mahor Jain, Ajeet and Meenu. "Formulation and evaluation of face serum contain Bee Venom and Aloe vera gel "World journal of pharmaceuticals research, Edition 2019 ,vol.8(2) ,PP 1100-1105.
- [22] Arsha, S. A., Puthanmadathil, B. M., Bilal, M. R., Sivadethu, M. G., & Anuroop, U. P. (2024). Formulation and evaluation of herbal face serum using *Clitoria ternatea*. *International Journal of Novel Research and Development*, 9(8),
- [23] Salvioni L, Morelli L, Ochoa E, Labra M, Fiandra L, Palugan L, et al. The emerging role of nanotechnology in skincare. *Adv Coll Interface Sci* 2021;293:102437.

- [25] Abhirami, V., Ali, A. K., P. N., A., V., D., K. U., R., & Varghese, J. V. (2023). Formulation and evaluation of polyherbal face serum: Research article. *International Journal of Creative Research Thoughts (IJCRT)*, 11(7), b294.
- [26] Ashwini. R. Patil, Miss. Anjali. R. Patil, R. B. Lovhare, Formulation and evaluation of herbal face Serum containing aloevera and aegle marmelos, *International Research Journal of Modernization in engineering Technology and Science*, Volume:05/ Issue:04/ April-2023
- [27] Chatekar, P., Waghamare, K., Garje, S., & Sayyad, G. (2024). Preparation and evaluation of Aloe vera face serum. *International Research Journal of Modernization in Engineering, Technology and Science*, 6(6), 420–426.
- [28] Palave, A. D., Bhabad, R., & Kotkar, V. T. (2024). Formulation and evaluation of face serum. *International Journal of Advanced Research in Innovation and Engineering*, 10(2), 4542.
- [29] M. Itrat, Zarnigar, Aloe vera a review of its clinical effectiveness, *International research journal of Pharmacy*, 2013; 4(8).
- [30] Agarwal S, Sharma TR, Aloe vera and its therapeutic efficacy, *Asian journal of Pharmacy and life Science*, 2011; 1(2): 195-205.
- [31] Urvashi N and Bhardwaj R.L, Aloe vera for human nutrition, health and cosmetic use, *International Research journal of plant science*, 2012; 3(3): 38-46.
- [32] Y. Cai, Q. Luo, M. Sun, H. Corke, Antioxidant activity and phenolic compounds of 112 traditional Chinese medicinal plants associated with anticancer, 74 (2004) 2157–2184.
- [33] V. Akey, A. Can, N. Sutlupinar, E.Candoken, N. Ozsay, T. Y. Ozden, R. Yanardag, E. Uzen, "Twenty years of research on Aloe vera", *Istanbul Ecz.FakDerg. / J. Fac. Pharm. Istanbul* 42(2)2015 pp.191-215.
- [34] Anand A. Zanwar, Sachin L. Badole, Rashmi Saini, Vitamin C (l-Ascorbic Acid): Antioxidant Involved in skin care, 2013, 61-66.
- [35] Flavia Alvim Sant Anna Adoor, Antioxidants in dermatology, 2017; 92(3):356-362.
- [36] Glaser DA, Anti-aging producer and cosmaceuticals, *Facial Plast Surg. Clin NAM*, 2004, 12(4), 363-372.
- [37] Poljšak B, Dahmane R, Godić A. Intrinsic skin aging: the role of oxidative stress. *Actadermatovenerol Alp Pannonica Adriat.* 2012; 21(2):33–36.
- [38] Choudhary, N. M., & Saini, D. (2024). Formulation and evaluation of poly herbal face serum. *International Journal of Creative Research Thoughts (IJCRT)*, 12(4), j83.
- [39] Khan, T. N., Pawar, S. B., Dapkekar, S. A., Shinde, P. M., & Datkhile, S. V. (2022). Formulation and evaluation of herbal face serum. *International Journal of Advanced Research in Science, Communication and Technology*, 2(1), 1-9.
- [40] Tejal sejul , Kiran Kudal , Facial serum: Its formulation ,usage ,special ingredients , various ,types And benefits ,*International journal of research and application* , volume 8, Issue 2 ,2023,680-692.
- [41] Begoun P, The original beauti bible (skincare facts for ageless beauty),
- [42] United State book trade Publisher group, west 1700 fourth street Berkeley, California. Edition 1st
- [43] Purva S Rajdev, Prof.Gaikwad S.D, Miss .Akanksha A Somvanshi, Miss.Shubhangi S Gunjalp, Formulation and evaluation of face serum, 2011; 1: 19-20.
- [44] Shalini Singh, Alka Lohani, Arun Kumar Mishra and Anurag Varma, Formulation and evaluation of Carrot seed oil-based cosmetics emulsion, *Journal of cosmetic and laser therapy* ,2018

- [45] Gaurav Kumar Sharma Jayesh Gadiya, Meenakshi Dhanawat, Text book of cosmetic Formulations,2018,1.8.,51-66
- [46] Sanjana Patil, Akshada Deshmukh , Dr S. V. Patil , Prajakta Patil, Riya Patil ,Pratiksha Patil, Shivtej Patil, Sayali Hogade , Ashokrao Mane College of Pharmacy, PethVadgaon, Introduction and SkinStructure,IJIRT,Vol.9issue12 ,ISSN:2349-6002 .Page no: 1396.
- [47] Aishwarya Vishnukant Gite, Dr. Prachi P. Udupurkar, Prof. A. S. Sanap ,Kishori College of Pharmacy , Beed ,Maharashtra-431122 , IJCRT, Vol.11, Issue 6 June 2023, Page no. a833 to a845.
- [48] Kokate C.K, Purohit A.P and Gokhale S.B, Pharmacognosy, Nirali Publication, edition 50,p95.
- [49] Siri Sindhura, D. K. Vikas Jain
- [50] “Challenges in Formulating Herbal Cosmetics” International Journal of Applied Pharmaceuticals, 2018, Vol.10(6),PP 47.
- [51] Indian Materia Medica Nadkarni KM. *Indian Materia Medica*. 3rd ed. Mumbai: Popular Prakashan; 2007.
- [52] The Wealth of India CSIR. *The Wealth of India: Raw Materials*. New Delhi: Council of Scientific and Industrial Research; 2003.
- [53] Pharmacognosy Kokate CK, Purohit AP, Gokhale SB. *Pharmacognosy*. 54th ed. Pune: Nirali Prakashan; 2010.
- [54] Clitoria ternatea Mukherjee PK, Kumar V, Kumar NS, Heinrich M. The Ayurvedic medicine Clitoria ternatea—From traditional use to scientific assessment. *Journal of Ethnopharmacology*. 2008;120(3):291–301.
- [55] Aloe vera Surjushe A, Vasani R, Saple DG. Aloe vera: A short review. *Indian Journal of Dermatology*. 2008;53(4):163–166.
- [56] Vitamin E Brigelius-Flohé R, Traber MG. Vitamin E: Function and metabolism. *FASEB Journal*. 1999;13(10):1145–1155.
- [57] Cosmetic Science Barel AO, Paye M, Maibach HI. *Handbook of Cosmetic Science and Technology*. 4th ed. Boca Raton: CRC Press; 2014.
- [58] Carbopol 940 Rowe RC, Sheskey PJ, Quinn ME. *Handbook of Pharmaceutical Excipients*. 6th ed. London: Pharmaceutical Press; 2009.
- [59] Pharmaceutics Lachman L, Lieberman HA, Kanig JL. *The Theory and Practice of Industrial Pharmacy*. 3rd ed. Philadelphia: Lea & Febiger; 1986.
- [60] Antioxidants Pandey KB, Rizvi SI. Plant polyphenols as dietary antioxidants in human health and disease. *Oxidative Medicine and Cellular Longevity*. 2009;2(5):270–278.
- [61] Clitoria ternatea Kamkaen N, Wilkinson JM. The antioxidant activity of Clitoria ternatea flower petal extracts and eye gel. *Phytotherapy Research*. 2009;23(11):1624–1625.
- [62] Herbal Formulation Kapoor VP. Herbal cosmetics for skin and hair care. *Natural Product Radiance*. 2005;4(4):306–314.
- [63] Phytochemistry Harborne JB. *Phytochemical Methods: A Guide to Modern Techniques of Plant Analysis*. 3rd ed. London: Chapman and Hall; 1998.
- [64] Herbal Drug Technology Pathak AK. *Herbal Drug Technology*. 2nd ed. Hyderabad: Universities Press; 2012.