

Formulation And Evaluation of Polyherbal Under-Eye Cream for Dark Circle

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Abstract—Herbal cosmetics have become an important part of modern skincare because they provide natural nourishment and protection to the skin with fewer side effects compared to synthetic cosmetic products. The increasing awareness regarding the harmful effects of chemical-based cosmetics has encouraged the use of herbal formulations for daily skin care applications. Among various cosmetic concerns, dark circles, puffiness, wrinkles, and dryness around the eyes are commonly observed in people of different age groups due to stress, fatigue, lack of sleep, aging, pollution, dehydration, and unhealthy lifestyle habits. These conditions affect facial appearance and reduce self-confidence.

The present study was carried out to formulate and evaluate a polyherbal under-eye cream using natural ingredients with skin-protective and rejuvenating properties. Herbal ingredients such as green tea extract, cucumber extract, potato extract, aloe vera gel, almond oil, rose water, and vitamin E were selected for the formulation because of their antioxidant, soothing, moisturizing, anti-inflammatory, and skin-brightening activities. Various pharmaceutical excipients including beeswax, liquid paraffin, glycerin, borax, and preservatives were incorporated to prepare a stable and smooth semisolid cream base.

The cream was prepared by emulsification method using separate oil phase and aqueous phase preparation techniques. Five different batches of formulation were prepared by varying the concentration of herbal ingredients. The prepared formulations were evaluated for various physicochemical and stability parameters including appearance, color, odor, consistency, homogeneity, pH, spread ability, wash ability, irritancy, phase separation, and stability. The evaluation studies showed that the prepared cream possessed good texture, smooth consistency, acceptable pH, easy spread ability, non-greasy nature, and good homogeneity.

The stability study revealed that there was no significant change in physical appearance, fragrance, viscosity, or consistency during the study period. No signs of skin irritation, redness, edema, or allergic reactions were observed during irritancy testing. The herbal ingredients present in the formulation provided cooling, refreshing, hydrating, and soothing effects to the under-eye skin. The polyherbal under-eye cream also helped improve skin appearance and reduce puffiness and pigmentation naturally.

The present research concluded that the formulated polyherbal under-eye cream was safe, stable, effective, and suitable for skincare applications. Due to the presence of natural ingredients, the formulation may serve as an economical and beneficial alternative to synthetic cosmetic products for the management of under-eye dark circles and related skin problems.

Index Terms—Polyherbal Under-Eye Cream, Herbal Cosmetics, Dark Circles, Green Tea Extract, Aloe Vera Gel, Skin Care, Spread ability, Antioxidant.

I. Introduction

Skin is the outermost protective covering of the body and is considered the largest organ of the human body. It acts as a natural barrier against environmental pollutants, microorganisms, ultraviolet radiation, dust, chemicals, and harmful external agents. Healthy skin not only protects the body but also

contributes to physical appearance and personality. Proper skin care is therefore essential for maintaining healthy, attractive, and youthful skin. In recent years, the cosmetic industry has grown rapidly due to increasing awareness regarding beauty, skincare, and personal grooming among people of all age groups.

Cosmetics are products used for cleansing, beautifying, moisturizing, and improving the appearance of the skin and body. The word “cosmetics” is derived from the Greek word “Cosmetics,” meaning “to adorn.” Cosmetic preparations are available in different forms such as creams, lotions, powders, gels, ointments, and emulsions. Among these dosage forms, creams are one of the most commonly used topical preparations because they are easy to apply, spread uniformly on the skin, and provide prolonged contact time with better patient acceptability.

Nowadays, herbal cosmetics have gained tremendous popularity because they contain natural ingredients obtained from plants, herbs, fruits, and essential oils. Herbal cosmetic products are considered safer and more compatible with the skin compared to synthetic cosmetics that may cause irritation, allergies, dryness, or long-term harmful effects. Herbal formulations contain bioactive compounds such as flavonoids, vitamins, antioxidants, tannins, alkaloids, and phenolic compounds which provide therapeutic as well as cosmetic benefits to the skin.

The skin around the eyes is extremely delicate and thinner than other parts of the face. This region contains fewer sebaceous glands and collagen fibers, making it more prone to dryness, wrinkles, puffiness, pigmentation, and dark circles. Dark circles under the eyes are among the most common cosmetic problems observed in both men and women. They give the face a tired, dull, and aged appearance, negatively affecting confidence and personality.

Dark circles may develop due to several factors including stress, lack of sleep, fatigue, excessive screen exposure, aging, poor blood circulation, hereditary conditions, dehydration, nutritional deficiencies, hormonal imbalance, allergies, smoking, and environmental pollution. Continuous exposure to sunlight and unhealthy lifestyle habits also contribute to under-eye pigmentation and skin damage. Modern lifestyle patterns such as irregular sleeping schedules, mental stress, excessive use of electronic devices, and poor dietary habits have increased the incidence of under-eye problems in recent years.

Many synthetic under-eye creams are available in the market for reducing dark circles and puffiness. However, prolonged use of chemical-based products may lead to adverse effects such as skin irritation, redness, dryness, itching, burning sensation, and allergic reactions. Therefore, there is a growing demand for herbal skincare products that are safe, effective, economical, and free from harmful chemicals.

Polyherbal formulations have become an important approach in herbal cosmetics because the combination of multiple herbs provides synergistic therapeutic effects and improved efficacy. Polyherbal creams contain various plant extracts that work together to provide antioxidant, anti-inflammatory, moisturizing, soothing, and skin-brightening actions. Herbal under-eye creams help reduce puffiness, improve blood circulation, maintain skin hydration, and reduce pigmentation around the eyes naturally.

In the present study, a polyherbal under-eye cream was prepared using herbal ingredients such as green tea extract, cucumber extract, potato extract, aloe vera gel, almond oil, rose water, and vitamin E. Green tea extract is rich in polyphenols and antioxidants which help reduce oxidative stress and improve skin health. It also helps minimize puffiness and protects the skin from free radical damage. Cucumber extract provides cooling and refreshing effects and helps soothe tired eyes. Potato extract contains natural bleaching properties that help reduce pigmentation and dark circles.

Aloe Vera gel is widely used in cosmetic preparations because of its moisturizing, anti-inflammatory, healing, and soothing properties. It hydrates the skin and improves skin texture. Almond oil acts as a natural emollient and nourishes the delicate under-eye skin. Rose water provides a cooling effect and helps refresh and tone the skin. Vitamin E acts as a powerful antioxidant that protects the skin from oxidative damage and premature aging.

To prepare a stable cream base, excipients such as beeswax, liquid paraffin, glycerin, borax, methyl paraben, and propyl paraben were used. Beeswax acts as a thickening and stabilizing agent, while glycerin serves as a humectant that maintains skin moisture. Liquid paraffin improves smoothness and spread ability of the cream. Preservatives help prevent microbial contamination and increase the shelf life of the formulation.

The polyherbal under-eye cream was prepared by emulsification technique involving separate preparation of oil phase and aqueous phase followed by continuous stirring to obtain a homogeneous cream. Different batches of formulations were prepared by varying the concentration of herbal ingredients to achieve optimum formulation characteristics.

The prepared formulations were evaluated for various physicochemical parameters including color, odor, appearance, consistency, pH, spread ability, wash ability, homogeneity, irritancy, and stability. Stability studies were carried out to evaluate the physical stability of the formulation under storage conditions. A good herbal cream should possess smooth texture, acceptable pH, easy spread ability, non-greasy nature, and should not produce irritation on the skin.

The main objective of the present research work was to formulate and evaluate a safe, stable, and effective polyherbal under-eye cream using natural ingredients for reducing dark circles and improving skin

appearance. The study also aimed to develop an economical herbal cosmetic preparation with minimal side effects and better patient compliance. The formulated cream may serve as a beneficial alternative to synthetic cosmetic products for maintaining healthy and youthful under-eye skin naturally.

Importance of Herbal Cosmetics

Herbal cosmetics are widely preferred because they provide cosmetic as well as therapeutic benefits to the skin. Natural ingredients present in herbal formulations protect the skin from harmful environmental effects and improve skin health naturally.

Role of Herbal Ingredients in Under-Eye Cream

Herbal Ingredient	Role in Skin Care
Green Tea Extract	Antioxidant and anti-aging
Cucumber Extract	Cooling and soothing
Potato Extract	Reduces pigmentation
Aloe Vera Gel	Moisturizing and healing
Almond Oil	Nourishing and softening
Rose Water	Refreshing and hydrating
Vitamin E	Protects from oxidative stress

Need for Polyherbal Under-Eye Cream

The demand for herbal skincare products has increased due to growing awareness regarding the harmful effects of chemical cosmetics. Polyherbal formulations provide combined therapeutic benefits of multiple herbs and improve effectiveness of cosmetic products. Herbal under-eye creams help reduce puffiness, pigmentation, dryness, and wrinkles naturally while improving skin hydration and appearance.

The present research work was therefore undertaken to formulate and evaluate a polyherbal under-eye cream using natural ingredients with antioxidant, moisturizing, cooling, and soothing properties for skincare applications.

Advantages of Herbal Cosmetics

- Natural and safe to use
- Fewer side effects on skin

- Suitable for all skin types
- Eco-friendly and biodegradable
- Easily available ingredients
- Cost-effective compared to synthetic products
- Rich in antioxidants and vitamins
- Provide nourishment to the skin
- Improve skin texture naturally
- Less chance of allergic reactions
- Possess moisturizing and soothing properties
- Free from harmful chemicals
- Better patient compliance
- Can be used for long-term skincare
- Help protect skin from environmental damage
- Promote healthy and glowing skin
- Herbal ingredients provide therapeutic benefits
- Reduce skin irritation and dryness naturally

Disadvantages of Herbal Cosmetics

- Shorter shelf life compared to synthetic cosmetics
- Possibility of microbial contamination
- Slow onset of action

II. REVIEW OF LITERATURE

The review of literature is an important part of any research work because it provides detailed information regarding previous studies, research findings, medicinal importance of herbal ingredients, formulation techniques, and evaluation methods related to the present study. Literature review helps researchers understand the significance of herbal ingredients in cosmetic preparations and also provides knowledge regarding the advantages and limitations of previously developed formulations. In the present research work, various published articles, journals, books, and scientific reports related to herbal under-eye creams, herbal cosmetics, antioxidants, moisturizing agents, and skin care formulations were reviewed.

In recent years, herbal cosmetics have gained tremendous popularity throughout the world due to increasing awareness regarding natural skincare products. People are becoming more conscious about the harmful effects associated with prolonged use of synthetic cosmetic products containing artificial chemicals, colors, fragrances, and preservatives. As a result, the cosmetic industry has shifted its focus toward herbal and natural products that provide safer and more effective skincare benefits. Herbal formulations are prepared using plant extracts rich in vitamins, antioxidants, flavonoids, polyphenols, tannins, and other phytoconstituents that help protect and nourish the skin naturally.

Dark circles and puffiness around the eyes are common cosmetic concerns observed in both men and women. The skin around the eyes is thinner and more delicate than the skin present on other parts of the

face. Due to stress, lack of sleep, pollution, aging, nutritional deficiencies, dehydration, excessive screen exposure, and poor blood circulation, the under-eye area becomes dull and pigmented. Researchers have therefore focused on developing herbal cosmetic formulations capable of reducing under-eye pigmentation, improving blood circulation, and maintaining skin hydration.

Several researchers have reported successful formulation and evaluation of herbal under-eye creams using natural ingredients possessing antioxidant, anti-inflammatory, soothing, and moisturizing properties. Herbal ingredients such as green tea, aloe vera, cucumber, potato, almond oil, rose water, turmeric, sandalwood, coffee extract, and vitamin E are commonly used in cosmetic preparations due to their beneficial effects on skin health.

Sadhana Singh and co-workers formulated and evaluated a herbal under-eye cream using tea extract, coffee extract, aloe vera gel, and vitamin E. Their research reported that the prepared cream possessed good consistency, homogeneity, spreadability, and acceptable pH range suitable for skin application. The study concluded that herbal under-eye creams prepared using antioxidant-rich ingredients effectively reduced puffiness and pigmentation around the eyes while maintaining skin hydration. The researchers also observed that the prepared formulation was non-irritant and stable during storage conditions.

Patil S. Vaishnavi and colleagues developed a polyherbal under-eye cream using different medicinal plant extracts with antioxidant and anti-inflammatory properties. The formulation was evaluated for parameters such as pH, spreadability, stability, washability, consistency, and irritancy. The study reported that the cream showed good physical stability and did not produce irritation or allergic reactions on the skin. The herbal ingredients present in the formulation provided cooling and soothing effects to the under-eye area and improved skin texture naturally.

Research studies related to aloe vera have demonstrated its importance in cosmetic and dermatological preparations. Aloe vera gel contains vitamins, amino acids, enzymes, minerals, and polysaccharides that provide moisturizing, anti-inflammatory, healing, and soothing activities. Several studies reported that aloe vera improves skin elasticity, maintains hydration, reduces irritation, and promotes wound healing. Due to these beneficial properties, aloe vera is widely used in creams, lotions, face packs, gels, and moisturizing preparations.

Green tea extract is another important herbal ingredient commonly used in skincare products. Green tea contains catechins, flavonoids, caffeine, and polyphenolic compounds possessing strong antioxidant properties. Researchers have reported that green tea helps protect the skin from oxidative stress and environmental damage caused by ultraviolet radiation and pollutants. Green tea also improves blood

circulation and reduces swelling and puffiness around the eyes. Its anti-aging property helps reduce wrinkles and fine lines by protecting skin cells from free radical damage.

Cucumber extract is widely used in cosmetic preparations because of its cooling, hydrating, and refreshing properties. Cucumber contains high water content along with vitamins and minerals that help soothe irritated skin and reduce puffiness around the eyes. Studies have shown that cucumber extract relieves tiredness and provides a cooling effect to the delicate under-eye area. It also helps maintain skin moisture and improves skin smoothness.

Potato extract has traditionally been used for reducing pigmentation and dark circles beneath the eyes. Researchers reported that potato contains natural enzymes, antioxidants, starch, and vitamins which help improve complexion and reduce under-eye discoloration. Potato extract also exhibits mild bleaching action that helps lighten dark pigmentation naturally without damaging the skin.

Almond oil is an important natural ingredient used in skincare formulations due to its nourishing and moisturizing effects. Almond oil is rich in vitamin E, essential fatty acids, and antioxidants which improve skin softness and elasticity. Studies have shown that almond oil helps reduce dryness, wrinkles, and fine lines while providing nourishment to delicate skin tissues. It also improves overall skin texture and appearance.

Rose water is widely used in cosmetic products because of its cooling, refreshing, and soothing properties. It acts as a natural skin toner and helps maintain the pH balance of the skin. Research studies have reported that rose water refreshes tired skin, reduces irritation, and provides a calming effect. It also contributes to hydration and improves the fragrance and acceptability of cosmetic formulations.

Vitamin E is one of the most commonly used antioxidants in cosmetic and pharmaceutical preparations. It protects the skin from oxidative stress caused by free radicals and environmental pollutants. Studies have shown that vitamin E helps reduce premature aging, wrinkles, and skin damage while improving skin nourishment and hydration. Due to its antioxidant activity, vitamin E is frequently incorporated into creams, lotions, and anti-aging skincare products.

The literature survey also revealed that herbal cosmetics possess several advantages over synthetic products. Herbal formulations are considered safer, eco-friendly, biodegradable, and more compatible with the skin. They contain natural phytoconstituents that provide therapeutic as well as cosmetic benefits. Herbal products are generally associated with fewer side effects and are suitable for long-term use. In contrast, synthetic cosmetic products may cause skin irritation, redness, allergic reactions, dryness, and long-term skin damage due to the presence of harsh chemicals and artificial additives.

Researchers have also emphasized the importance of polyherbal formulations in cosmetic science. Polyherbal preparations combine the therapeutic activities of multiple herbal ingredients and provide synergistic effects. Such formulations offer better effectiveness compared to single-herb preparations because different herbs act through multiple mechanisms to improve skin health. Polyherbal creams therefore provide enhanced moisturizing, antioxidant, anti-inflammatory, and skin-brightening effects.

The literature review clearly indicates that herbal ingredients such as green tea, aloe vera, cucumber, potato, almond oil, rose water, and vitamin E possess excellent cosmetic and therapeutic properties useful for under-eye skincare preparations. Previous research studies confirmed that herbal under-eye creams are effective, stable, safe, and suitable for reducing dark circles, puffiness, dryness, and pigmentation naturally. Based on these findings, the present research work was undertaken to formulate and evaluate a polyherbal under-eye cream using selected herbal ingredients with antioxidant, moisturizing, soothing, and skin-protective activities.

III. AIM & OBJECTIVES

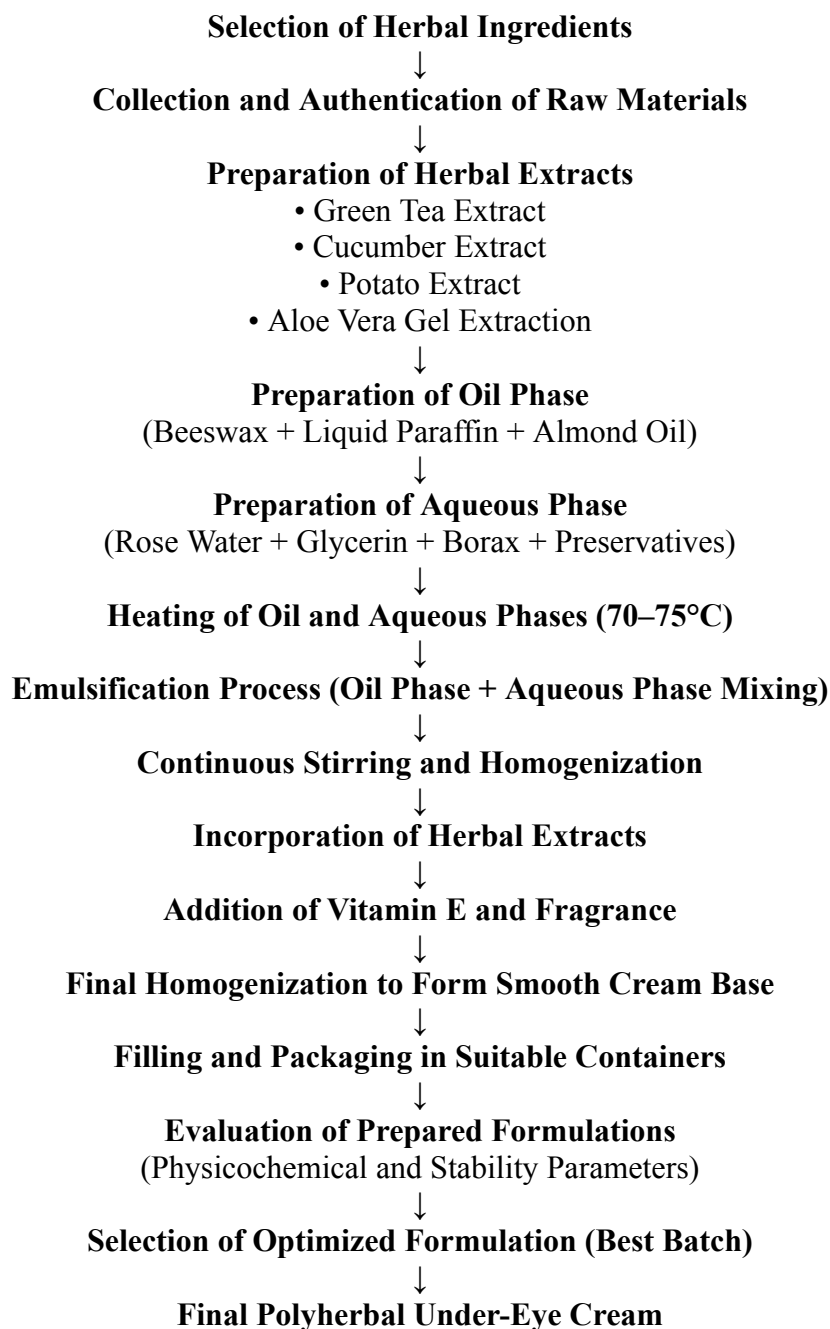
Aim

To formulate and evaluate a safe and effective polyherbal under-eye cream for reducing dark circles and improving skin appearance naturally.

Objectives

- To prepare a polyherbal under-eye cream using natural ingredients.
- To reduce dark circles and puffiness around the eyes.
- To provide moisturizing and soothing effects to the skin.
- To evaluate the prepared cream for physicochemical parameters.

IV. PLAN OF THE WORK



V. MATERIALS AND METHODS

MATERIALS

Materials and methods are the most important part of any pharmaceutical and cosmetic formulation research work. Proper selection of herbal ingredients, excipients, preparation techniques, and equipment plays a vital role in developing a stable, safe, and effective topical formulation such as an under-eye cream.

In the present study, a Polyherbal Under-Eye Cream (Batch 5) was formulated using selected herbal extracts and cosmetic-grade excipients. The formulation was designed to provide anti-aging, antioxidant, moisturizing, soothing, and skin-brightening effects specifically for the delicate skin around the eyes.

The study mainly focused on:

- [1] Selection of herbal ingredients
- [2] Preparation of oil and aqueous phases
- [3] Emulsification technique
- [4] Incorporation of herbal extracts
- [5] Evaluation and stability studies

MATERIALS USED

1. Tea (*Camellia sinensis*)

Tea leaves obtained from *Camellia sinensis* (Family: Theaceae) are widely used in cosmetic formulations due to their rich antioxidant profile. The leaves are green to dark brown in colour with an aromatic odour and bitter astringent taste. The major chemical constituents include caffeine, gallic acid, theobromine, theophylline, polyphenols, and flavonoids. Tea extract exhibits strong antioxidant, anti-aging, and anti-inflammatory activity, helping in reducing oxidative stress, improving skin tone, and protecting skin from environmental damage.

2. Cucumber (*Cucumis sativus*)

Cucumber fruit of *Cucumis sativus* (Family: Cucurbitaceae) is commonly used for its cooling and hydrating properties. It is light green in colour with a mild odour and watery taste. It contains water, vitamin C, flavonoids, caffeic acid, and minerals. Cucumber extract provides soothing, hydrating, and anti-puffiness effects, making it suitable for under-eye skin care.

3. Potato (*Solanum tuberosum*)

Potato tubers of *Solanum tuberosum* (Family: Solanaceae) are used for their natural skin-lightening properties. They are light brown externally with a starchy, odorless interior. The chemical constituents include starch, vitamin C, phenolic compounds, and enzymes. Potato extract helps reduce pigmentation, dark circles, and improves skin complexion naturally.

4. Aloe Vera (*Aloe barbadensis miller*)

Aloe vera gel obtained from *Aloe barbadensis miller* (Family: Asphodelaceae) is a well-known herbal ingredient in skincare. It is transparent green in colour with a mild characteristic odour. It contains polysaccharides, vitamins A, C, E, amino acids, and enzymes. Aloe vera provides moisturizing, wound healing, anti-inflammatory, and soothing effects to delicate skin.

5. Almond (*Prunus dulcis*)

Almond oil extracted from *Prunus dulcis* (Family: Rosaceae) is widely used as an emollient in cosmetic formulations. It is pale yellow in colour with a mild nutty odour. It contains vitamin E, fatty acids, and sterols. Almond oil nourishes under-eye skin, improves elasticity, and reduces dryness and fine lines.

6. Rose (*Rosa damascena*)

Rose water obtained from *Rosa damascena* (Family: Rosaceae) is used as a natural toner. It is colorless with a pleasant floral aroma. It contains flavonoids, phenolic compounds, and essential oils. Rose water provides cooling, soothing, and refreshing effects while maintaining skin pH balance.

7. Vitamin E (Tocopherol)

Vitamin E is a fat-soluble antioxidant widely used in cosmetic formulations. It appears as a yellow oily liquid with a mild odour. It contains tocopherols and tocotrienols. Vitamin E protects skin from oxidative damage, reduces aging signs, and improves skin hydration and repair.

8. Orange Peel (*Citrus sinensis*)

Orange peel obtained from *Citrus sinensis* (Family: Rutaceae) is used as a natural skin brightening agent. It is yellowish-orange in colour with a citrus aroma and bitter taste. It contains vitamin C, flavonoids, limonene, and essential oils. It helps in reducing pigmentation and improving skin glow.

Sr. No.	Plant Material	Botanical Name	Family	Part Used	Category	Function
1	Tea	Camellia sinensis	Theaceae	Leaves	Herbal Extract	Antioxidant, anti-aging, reduces puffiness

2	Cucumber	Cucumis sativus	Cucurbitaceae	Fruit	Herbal Extract	Cooling, soothing, hydrating
3	Potato	Solanum tuberosum	Solanaceae	Tuber	Herbal Extract	Reduces pigmentation and dark circles
4	Aloe Vera	Aloe barbadensis miller	Asphodelaceae	Leaf gel	Herbal Extract	Moisturizing, healing, anti-inflammatory
5	Almond	Prunus dulcis	Rosacea	Seed oil	Natural Oil	Emollient, nourishes skin
6	Rose	Rosa damascena	Rosacea	Petals	Natural Vehicle	Refreshing, toning, cooling effect
7	Vitamin E	Tocopherol	—	Oil form	Active Ingredient	Antioxidant, prevents skin aging
8	Orange Peel	Citrus sinensis	Rutaceae	Peel	Herbal Powder	Skin brightening, antioxidant

Table 2 – Materials Used in Polyherbal Under-Eye Cream

Sr. No.	Material	Category	Function
1	Green Tea Extract	Herbal Extract	Antioxidant, anti-aging, reduces puffiness
2	Cucumber Extract	Herbal Extract	Cooling, soothing, hydrating
3	Potato Extract	Herbal Extract	Reduces pigmentation and dark circles
4	Aloe Vera Gel	Herbal Extract	Moisturizing, healing, anti-inflammatory
5	Almond Oil	Natural Oil	Emollient, nourishes skin
6	Rose Water	Natural Vehicle	Refreshing, toning, cooling effect
7	Vitamin E	Active Ingredient	Antioxidant, prevents skin aging
8	Beeswax	Base	Thickening and consistency agent
9	Liquid Paraffin	Oil Base	Softens skin, improves spreadability
10	Glycerin	Humectant	Moisturizing agent, retains water

11	Borax	Emulsifier	Stabilizes oil-in-water emulsion
12	Methyl Paraben	Preservative	Prevents microbial growth
13	Propyl Paraben	Preservative	Increases shelf life
14	Distilled Water	Solvent	Aqueous phase preparation

FORMULATION DETAILS

Table 3 – Composition of Polyherbal Under-Eye Cream (Batch 5)

Ingredients	Quantity	Role
Beeswax	q.s.	Base consistency agent
Liquid Paraffin	q.s.	Oil phase base
Almond Oil	q.s.	Emollient
Green Tea Extract	q.s.	Antioxidant activity
Cucumber Extract	q.s.	Cooling effect
Potato Extract	q.s.	Anti-pigmentation
Aloe Vera Gel	q.s.	Skin healing and hydration
Rose Water	q.s.	Skin refreshing agent
Glycerin	q.s.	Moisturizer
Borax	q.s.	Emulsifying agent
Vitamin E	q.s.	Anti-aging antioxidant
Methyl Paraben	q.s.	Preservative
Propyl Paraben	q.s.	Preservative

EQUIPMENT USED

Table 5 – Equipment Used in Preparation

Sr. No.	Equipment	Purpose
1	Electronic Weighing Balance	Accurate measurement of ingredients

2	Water Bath	Controlled heating of phases
3	Beaker (Glassware)	Mixing of ingredients
4	Magnetic Stirrer	Continuous stirring
5	Homogenizer	Formation of smooth emulsion
6	pH Meter	pH determination
7	Viscometer	Measurement of viscosity
8	Refrigerator	Stability storage conditions
9	Spatula	Handling semi-solid formulation

METHOD OF PREPARATION

The polyherbal under-eye cream (Batch 5) was prepared by the **emulsification method**, which involves the preparation of oil phase and aqueous phase separately, followed by mixing under controlled temperature conditions to form a stable semisolid cream.

This method was selected because it provides:

TABLE I. Smooth texture

TABLE II. Stable emulsion system

TABLE III. Better skin compatibility

TABLE IV. Improved spread ability

EXTRACTION OF HERBAL INGREDIENTS

1. Extraction of Green Tea (*Camellia sinensis*) Extract

Green tea extract was prepared using a simple **aqueous infusion method** due to its ease, safety, and suitability for cosmetic applications.

Procedure:

Dried green tea leaves of *Camellia sinensis* were collected and cleaned to remove dust and impurities. The leaves were then shade dried and finely powdered using a grinder. Accurately weighed quantity (10 g) of powdered green tea was taken and mixed with 100 ml of distilled water.

The mixture was heated at 60–70°C for 20–30 minutes with continuous stirring. After heating, the solution was allowed to cool at room temperature. The extract was then filtered using Whatman filter paper to

remove plant residues. The filtrate obtained was the **green tea aqueous extract**, which was stored in a refrigerator for further use in formulation.

Precautions:

- Temperature should not exceed 70°C to avoid degradation of polyphenols
- Fresh extract should be used to maintain antioxidant activity

2. Extraction of Cucumber (*Cucumis sativus*) Extract

Cucumber extract was prepared using a **cold maceration and filtration method** to preserve its heat-sensitive vitamins and enzymes.

Procedure:

Fresh cucumber fruits (*Cucumis sativus*) were washed thoroughly with distilled water to remove dirt and impurities. The outer skin was removed, and the pulp was cut into small pieces. The pulp was crushed using a blender to obtain a smooth paste.

The crushed cucumber pulp was placed in a muslin cloth and pressed to obtain juice. Alternatively, maceration was done by keeping the pulp in a closed container for 24 hours at room temperature. The obtained liquid was filtered to remove solid particles.

The clear filtrate was collected as **cucumber extract** and stored in a refrigerator at 4–8°C until use.

Precautions:

- Extraction should be done under hygienic conditions
- Fresh extract should be used to avoid microbial contamination
- Avoid exposure to heat to preserve vitamin content

3. Extraction of Potato (*Solanum tuberosum*) Extract

Potato extract was prepared using juice extraction and maceration techniques for its skin-lightening properties.

Procedure:

Fresh potatoes (*Solanum tuberosum*) were washed, peeled, and cut into small pieces. The pieces were grated

or blended to form a fine pulp. The pulp was pressed using muslin cloth to obtain fresh juice. The extract was then filtered to remove fibrous material and impurities. The clear filtrate was collected as potato extract and stored under refrigeration for further use.

Precautions:

- Fresh potatoes should be used immediately after peeling
- Exposure to air should be minimized to prevent oxidation
- Proper hygiene should be maintained to avoid contamination

4. Extraction of Aloe Vera (*Aloe barbadensis miller*) Gel

Aloe vera gel was extracted directly from fresh leaves using a manual separation method.

Procedure:

Fresh mature leaves of *Aloe barbadensis miller* were washed thoroughly with distilled water. The outer green rind was carefully removed using a sterile knife. The inner transparent gel was scooped out using a sterile spatula. The gel was homogenized to obtain a uniform consistency and stored in an airtight container under refrigeration at 4–8°C until use.

Precautions:

- Only fresh mature leaves should be used
- Yellow latex (aloin) must be completely removed
- Hygienic and sterile conditions must be maintained
- Gel should be stored in cold conditions to prevent microbial growth

5. Extraction of Orange Peel (*Citrus sinensis*) Extract

Orange peel extract was prepared using a simple drying and aqueous extraction method to obtain its skin-brightening constituents.

Procedure:

Fresh orange peels (*Citrus sinensis*) were collected, washed thoroughly, and cut into small pieces. The peels were shade dried until completely moisture-free and then finely powdered using a grinder. Accurately

weighed powder was mixed with distilled water and heated gently at 60–70°C for 20–25 minutes with continuous stirring. The mixture was then cooled and filtered using Whatman filter paper. The filtrate obtained was collected as orange peel extract and stored under refrigeration for further use.

Precautions:

- Peels should be properly dried to avoid microbial growth
- Overheating should be avoided to preserve vitamin C content
- Freshly prepared extract should be used for best activity

STEPWISE MANUFACTURING PROCEDURE (BATCH 5)

1. Weighing of Ingredients

All herbal extracts and excipients were accurately weighed using an electronic balance according to the formulation requirements.

2. Preparation of Oil Phase

Beeswax, liquid paraffin, and almond oil were taken in a beaker and heated in a water bath at 70–75°C until complete melting and formation of a uniform oil phase.

3. Preparation of Aqueous Phase

Distilled water, rose water, glycerin, borax, methyl paraben, and propyl paraben were mixed and heated separately at 70–75°C until a clear aqueous solution was obtained.

4. Emulsification Process

The hot aqueous phase was slowly added into the oil phase with continuous stirring to form a primary emulsion. Constant stirring ensured proper dispersion of both phases.

5. Cooling Process

The emulsion was allowed to cool gradually at room temperature with continuous stirring to prevent phase separation and to maintain uniform consistency.

6. Incorporation of Herbal Extracts

After cooling, green tea extract, cucumber extract, potato extract, and aloe vera gel were added slowly with continuous mixing to ensure uniform distribution of active ingredients.

7. Addition of Vitamin E

Vitamin E was added as a natural antioxidant to protect the formulation from oxidative degradation and improve skin benefits.

8. Homogenization

The final mixture was homogenized using a homogenizer to obtain a smooth, uniform, and stable cream base without lumps or phase separation.

9. Packaging

The prepared Batch 5 cream was filled into clean, sterile, air-tight containers and stored in a cool place for further evaluation studies.

PROCESS PARAMETERS

Process Step	Critical Parameter
Heating	Temperature (70–75°C)
Mixing	Stirring speed and time
Emulsification	Phase addition rate
Cooling	Cooling time control
Homogenization	Speed and duration

Sr. No.	Ingredients	F1	F2	F3	F4	F5	Role
1	Green Tea Extract	0.5 g	0.75 g	1.0 g	1.25 g	1.5 g	Antioxidant, reduces puffiness
2	Cucumber Extract	0.5 g	0.75 g	1.0 g	1.25 g	1.5 g	Cooling and soothing agent
3	Potato Extract	0.25 g	0.5 g	0.75 g	1.0 g	1.25 g	Reduces pigmentation and dark circles

4	Aloe Vera Gel	1 ml	1.5 ml	2 ml	2.5 ml	3 ml	Moisturizing and healing agent
5	Almond Oil	0.5 ml	0.75 ml	1 ml	1.25 ml	1.5 ml	Emollient and skin nourishment
6	Rose Water	1 ml	1.5 ml	2 ml	2.5 ml	3 ml	Refreshing and cooling effect
7	Vitamin E	0.2 ml	0.3 ml	0.4 ml	0.5 ml	0.6 ml	Antioxidant and anti-aging
8	Beeswax	1 g	1 g	1.2 g	1.2 g	1.5 g	Thickening and consistency agent
9	Liquid Paraffin	2 ml	2.5 ml	3 ml	3.5 ml	4 ml	Improves spread ability
10	Glycerin	1 ml	1.5 ml	2 ml	2.5 ml	3 ml	Moisturizing agent
11	Borax	q. s	q.s	q.s	q. s	q.s	Emulsifying agent
12	Methyl Paraben	0.1 g	0.1 g	0.1 g	0.1 g	0.1 g	Preservative
13	Propyl Paraben	0.02 g	0.02 g	0.02 g	0.02 g	0.02 g	Preservative
14	Distilled Water	q. s	q. s	q. s	q. s	q. s	Solvent / Aqueous phase

EVALUATION OF POLYHERBAL UNDER-EYE CREAM

Evaluation studies are essential to determine the quality, safety, stability, and effectiveness of the prepared polyherbal under-eye cream. The formulated Batch 5 was evaluated using various physicochemical and stability parameters.

1. PHYSICAL EVALUATION

The prepared cream was visually observed for appearance, color, odor, and consistency.

Table 7 – Physical Evaluation of Polyherbal Under-Eye Cream

Parameter	Observation
Appearance	Smooth and uniform
Color	Light cream/off-white
Odor	Pleasant herbal fragrance
Consistency	Semi-solid, smooth
Homogeneity	Uniform, no lumps

Greasiness	Non-greasy
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Observation:

The formulation showed good physical properties suitable for cosmetic application.

2. PH DETERMINATION

The pH of the formulation was determined using a digital pH meter.

Acceptance Criteria:

Skin-friendly pH: 4.5 – 6.5

Table 8 – pH of Formulation

Batch	pH Value
Batch 5	5.8

Observation:

The pH of the formulation was within the acceptable range, indicating compatibility with skin.

3. SPREADABILITY TEST

Spread ability was determined by placing a small amount of cream between two glass slides.

Formula: $S=TM \times L$

Where:

S = Spread ability

M = Weight tied to upper slide

L = Length moved

T = Time taken

Table 9 – Spread ability Test

Parameter	Observation
Time (sec)	12 sec
spread ability	Good
Texture	Smooth

Observation:

The cream showed good spread ability and was easily applicable on skin.

4. WASHABILITY TEST

Method:

A small quantity of cream was applied on skin and washed with water.

Observation Table

Test	Result
Wash ability	Easily washable

Observation:

The formulation was easily removable with water without leaving residue.

5. IRRITANCY TEST

Method:

Cream was applied on a small area of skin and observed for redness or irritation.

Table 10 – Irritancy Test

Parameter	Observation
Redness	abe
Swelling	Nil
Irritation	Nil

Conclusion:

The formulation was found to be non-irritant and safe for skin application.

6. STABILITY STUDY

The formulation was stored at room temperature and observed for physical changes.

Table 11 – Stability Study

Time Period	Observation
Day 1	Stable
7 Days	No change

14 Days	No phase separation
28 Days	Stable formulation

Observation:

No significant change in color, odour, or consistency was observed.

7. VISCOSITY TEST

Viscosity was measured using a viscometer.

Observation Table

Batch Viscosity

Batch 5 Moderate consistency

Observation:

The cream showed ideal viscosity suitable for under-eye application.

8. GRAPHICAL REPRESENTATION

Figure 4 – PH Graph of Formulation

Fig. 1. Shows stable pH around 5.8 (skin compatible range)

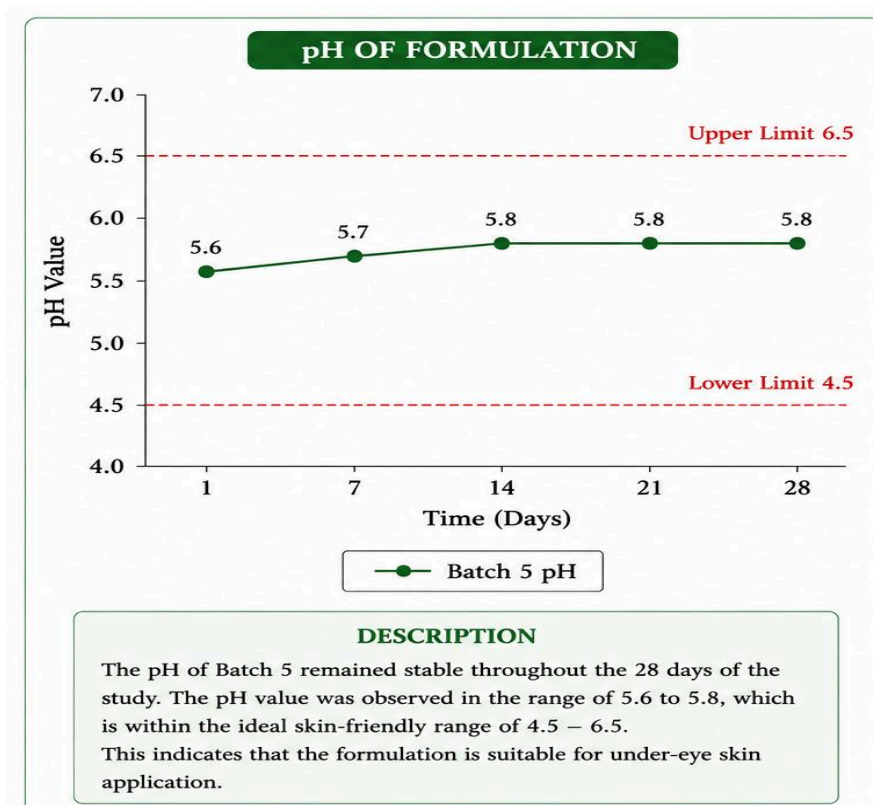
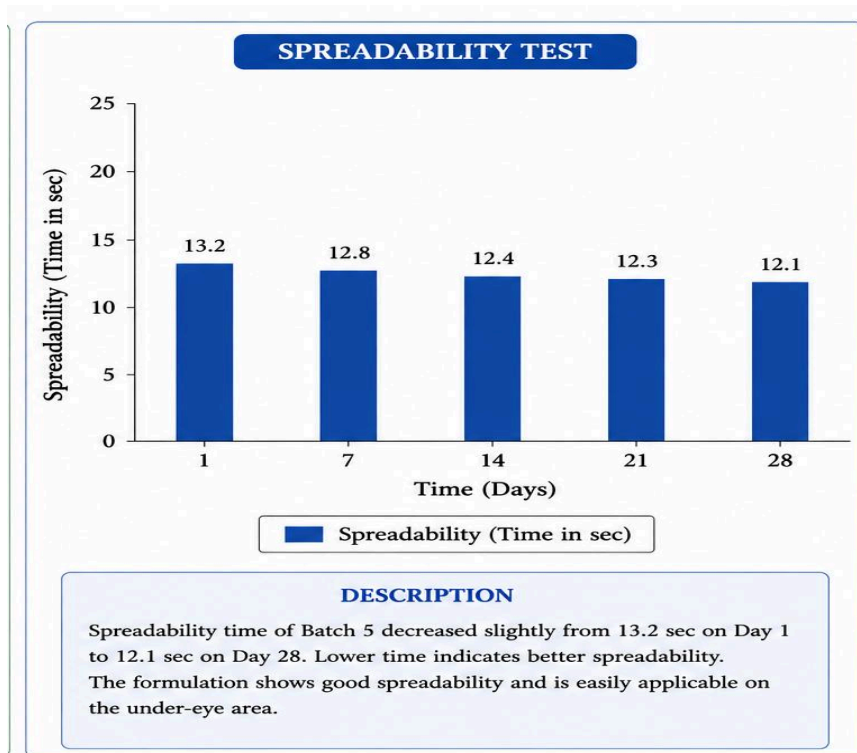


Figure 5 – spread ability Graph

[1] Indicates good spread ability within short time (12 sec)



VI. RESULTS AND DISCUSSION

The present study was undertaken to formulate and evaluate a **polyherbal under-eye cream** using herbal ingredients such as green tea extract, cucumber extract, potato extract, aloe vera gel, almond oil, rose water, and vitamin E. The formulated cream was evaluated for various physicochemical and stability parameters to assess its quality, safety, and effectiveness.

1 RESULTS OF PHYSICAL EVALUATION

The prepared formulation showed satisfactory physical properties.

Table 12 – Physical Evaluation Results

Parameter	Observation
Appearance	Smooth, uniform
Color	Light cream
Odour	Pleasant herbal fragrance

Consistency	Semi-solid, smooth
Homogeneity	Good
Greasiness	Non-greasy

Result:

The formulation exhibited acceptable physical characteristics suitable for cosmetic application.

2 PH RESULT**Table 13 – pH Result**

Batch	pH Value
Batch 5	5.8

Result:

The pH of the formulation was found to be within the skin-compatible range (4.5–6.5), indicating it is safe for under-eye application.

3 SPREADABILITY RESULT**Table 14 – spread ability Result**

Parameter	Observation
Time	12 sec
spread ability	Good

Result:

The formulation showed good spread ability, indicating ease of application on delicate under-eye skin.

5.4 WASHABILITY RESULT**Table 15 – wash ability Test**

Test	Result
wash ability	Easily washable

Result:

The cream was easily removable with water, leaving no residue on the skin.

5 IRRITANCY RESULT

Table 16 – Irritancy Test

Parameter	Observation
Redness	non-irritant
Swelling	non-irritant
Irritation	non-irritant

Result:

The formulation was found to be non-irritant and safe for topical application.

5.6 STABILITY RESULT

Table 17 – Stability Study

Duration	Observation
1 Day	Stable
7 Days	No change
14 Days	No phase separation
28 Days	Stable

Result:

The formulation remained physically stable throughout the study period.

DISCUSSION

The present study focused on the development of a polyherbal under-eye cream using natural ingredients with antioxidant, moisturizing, and anti-inflammatory properties. The combination of herbal extracts such as green tea, cucumber, potato, and aloe vera provided synergistic effects in improving skin condition around the eyes.

Green tea extract contributed strong antioxidant activity, helping to reduce oxidative stress responsible for skin aging and dark circles. Cucumber extract provided a cooling and soothing effect, reducing puffiness and irritation. Potato extract contributed to mild skin-lightening action, helping to reduce pigmentation under the eyes. Aloe vera gel improved skin hydration and promoted healing of delicate skin tissues.

Almond oil acted as an excellent emollient, improving skin softness and nourishment. Rose water provided a refreshing and toning effect, while vitamin E acted as a powerful antioxidant protecting skin from free radical damage.

The evaluation results confirmed that the formulation had suitable physicochemical properties. The pH value was found to be within the ideal range for skin compatibility. Spreadability results indicated ease of application, which is essential for under-eye formulations. The absence of irritation confirmed the safety of herbal ingredients. Stability studies showed no phase separation or degradation, indicating good formulation stability.

Overall, the synergistic action of herbal ingredients contributed to improved skin appearance and reduction of under-eye concerns such as dark circles, puffiness, and dryness.

VII. CONCLUSION

The present research work entitled **“Preparation and Evaluation of Polyherbal Under-Eye Cream for Skin Care”** was successfully carried out with the objective of formulating a safe, effective, and stable herbal cosmetic preparation for under-eye skin problems such as dark circles, puffiness, dryness, and pigmentation.

The polyherbal under-eye cream was prepared using the **emulsification technique** by incorporating selected herbal ingredients such as green tea extract, cucumber extract, potato extract, aloe vera gel, almond oil, rose water, and vitamin E. These ingredients were selected based on their well-documented antioxidant, moisturizing, soothing, and skin-protective properties.

The formulated cream (Batch 5) was evaluated for various physicochemical and stability parameters including appearance, colour, odour, pH, spread ability, homogeneity, wash ability, irritancy, viscosity, and stability studies. The results obtained from all evaluation tests indicated that the formulation possessed good quality characteristics suitable for topical application.

The pH of the formulation was found to be within the skin-compatible range, indicating that it is safe for sensitive under-eye skin. The spreadability test showed that the cream spreads easily on the skin, ensuring better application and patient compliance. The irritancy test confirmed that the formulation is non-irritant and safe for use, as no redness, swelling, or allergic reactions were observed.

Stability studies revealed that the formulation remained physically stable during the observation period, with no phase separation, change in colour, or odour. This indicates that the formulation has good shelf stability under normal storage conditions.

The synergistic action of herbal ingredients contributed significantly to the overall effectiveness of the formulation. Green tea extract provided antioxidant protection, cucumber extract offered cooling and soothing effects, potato extract helped in reducing pigmentation, aloe vera improved hydration and healing, almond oil provided nourishment, rose water refreshed the skin, and vitamin E protected against oxidative stress and premature aging.

Overall, the study concludes that the prepared polyherbal under-eye cream is **safe, stable, effective, and suitable for cosmetic use**. It offers a natural and economical alternative to synthetic under-eye creams available in the market.

The formulation may be further improved and developed for commercial use after conducting long-term stability studies and clinical trials on a larger population.

VIII. FUTURE SCOPE

The present study on **polyherbal under-eye cream** provides a strong foundation for further research and development in herbal cosmetic formulations. Based on the findings of this study, the following future possibilities can be suggested:

- Clinical evaluation of the formulation on a larger human population for long-term safety and effectiveness
- Development of advanced delivery systems such as Nano emulsion or liposomal herbal creams for better skin penetration
- Incorporation of additional herbal actives such as peptides, plant stem cells, and collagen boosters for enhanced anti-aging effects
- Long-term stability studies (6–12 months or more) under different environmental conditions
- Industrial scale-up production for commercialization of the formulation
- Comparative studies with marketed synthetic under-eye creams to evaluate performance differences
- Development of additional dosage forms such as gels, serums, and eye patches using the same herbal base

The study concludes that herbal cosmetic formulations have significant potential in the skincare industry and can serve as safe and effective alternatives to synthetic products.

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