
Research Article



Formulation and Characterization of Moisturizing Cream Based on Natural Oils and Emulsifying Agents

¹Ahmad AB Yosef Kinani, ²Mohammed H. Al-bayati and ³Tabarek Mohammed Yassen

¹⁻²University of Al-Farahidi, College of pharmacy, Department of pharmaceutics, Baghdad, Iraq

³University of Al-Farahidi, College of pharmacy, Department of chemistry, Baghdad, Iraq

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Abstract: The present study aimed to formulate and characterize an oil-in-water facial moisturizing cream based on natural oils, essential oils, and suitable emulsifying agents for cosmetic skin care application. Coconut oil (8%), almond oil (6%), and paraffin oil (5%) were incorporated as moisturizing and emollient agents, while lavender oil (0.5%) and rose oil (0.3%) were used to improve fragrance and provide additional soothing and antioxidant properties. Glyceryl Monostearate (6%) was utilized as the primary emulsifying agent for stabilization of the emulsion system. The moisturizing cream was prepared using the hot emulsification technique involving separate heating of oil and aqueous phases at $70 \pm 2^\circ\text{C}$ followed by controlled emulsification, homogenization, cooling, and incorporation of heat-sensitive ingredients. The prepared formulation was evaluated for physicochemical and cosmetic characteristics including appearance, pH, viscosity, spread ability, homogeneity, wash ability, skin compatibility, and stability. The formulated cream exhibited smooth texture, uniform consistency, pleasant aromatic odor, and absence of phase separation. The pH of the formulation was found to be 5.6 ± 0.2 , indicating compatibility with normal facial skin physiology. The viscosity of the cream was approximately $24,500 \pm 500$ cP, demonstrating suitable semisolid consistency and spread ability for facial application. The formulation also showed good homogeneity, satisfactory wash ability, minimal irritation potential, and acceptable physical stability under different storage conditions. The results of the present study indicate that stable and cosmetically elegant moisturizing creams can be successfully formulated using natural oils, essential oils, and appropriate pharmaceutical excipients. The prepared formulation demonstrated promising moisturizing properties and favorable physicochemical characteristics suitable for topical facial skin care application.

Corresponding Author:

Ahmad AB Yosef Kinani

University of Al-Farahidi, College of pharmacy, Department of pharmaceutics, Baghdad, Iraq

INTRODUCTION

Skin Structure and Physiological Properties: The skin is the largest organ of the human body and serves as the primary protective barrier between the internal body environment and external surroundings. It performs multiple essential physiological functions, including protection against microbial invasion, prevention of excessive water loss, thermoregulation, sensory perception, immune defense, and biochemical synthesis such as vitamin D production. Due to continuous exposure to environmental stressors including ultraviolet radiation, pollution, temperature variation, and chemical irritants, maintaining skin integrity and hydration is essential for preserving normal skin function and appearance ^[1].

Structurally, the skin consists of three principal layers: the epidermis, dermis, and hypodermis (subcutaneous tissue). Each layer possesses distinct anatomical and physiological characteristics contributing to overall skin health and barrier performance.

The epidermis represents the outermost layer of the skin and acts as the first defensive barrier against environmental damage. It is primarily composed of keratinocytes arranged in several sublayers including the stratum corneum, stratum lucidum, stratum granulosum, stratum spinosum, and stratum basale. Among these, the stratum corneum is considered the most critical layer for maintaining skin hydration and barrier function. It consists of dead keratin-filled cells embedded within a lipid matrix composed mainly of ceramides, cholesterol, and free fatty acids. This lipid-rich structure regulates transepidermal water loss (TEWL) and protects against penetration of harmful substances.

The dermis lies beneath the epidermis and is composed mainly of connective tissue containing collagen fibers, elastin, fibroblasts, blood vessels, sebaceous glands, sweat glands, and hair follicles. This layer provides structural strength, elasticity, and nourishment to the skin. Collagen and elastin are particularly important in maintaining firmness and flexibility. Reduction in these structural proteins due to aging or environmental exposure contributes to wrinkles, dryness, and loss of skin elasticity.

The hypodermis, or subcutaneous tissue, is the deepest skin layer and mainly consists of adipose tissue and loose connective tissue. This layer functions as an energy reservoir, thermal insulator, and mechanical shock absorber protecting internal organs and tissues.

Skin hydration is one of the most important factors influencing skin appearance, texture, and physiological stability. Adequate hydration preserves softness, elasticity, and smoothness of the skin surface. Conversely, insufficient hydration results in xerosis (dry skin), roughness, irritation, flaking, and increased

susceptibility to inflammation and microbial invasion. Multiple factors contribute to skin dehydration, including aging, excessive cleansing, low humidity, ultraviolet exposure, nutritional deficiencies, and dermatological disorders.

The maintenance of skin moisture depends largely on the integrity of the stratum corneum and the presence of natural moisturizing factors (NMFs), sebaceous secretions, and intercellular lipids. Disruption of these components may impair barrier function and increase water evaporation from the skin surface. Consequently, topical moisturizing preparations play a crucial role in restoring skin hydration, reinforcing barrier integrity, and improving overall dermatological health. Facial skin requires particular attention because it is continuously exposed to environmental stress and cosmetic products. Compared with other body areas, facial skin is generally thinner and more sensitive, making it more susceptible to dehydration, irritation, and premature aging. Therefore, the development of stable and effective facial moisturizing creams containing natural oils and skin-compatible ingredients has become an important area in cosmetic and pharmaceutical research.

Moisturizing Creams and Their Cosmetic Importance:

Moisturizing creams are semisolid topical preparations designed to improve skin hydration, restore barrier function, and protect the skin from excessive water loss. They are among the most widely used dermatological and cosmetic products due to their significant role in maintaining skin smoothness, elasticity, softness, and overall appearance. Moisturizers are commonly applied for both therapeutic and cosmetic purposes, particularly in individuals suffering from dry skin, irritation, scaling, or environmentally induced skin damage.

The primary mechanism of moisturization involves reducing transepidermal water loss (TEWL) while simultaneously increasing water content within the stratum corneum. Effective moisturizing formulations enhance skin hydration through three principal mechanisms: occlusion, humectancy, and emolliency. Occlusive agents form a hydrophobic film on the skin surface that minimizes evaporation of water. Humectants attract and retain moisture from the surrounding environment and deeper skin layers into the stratum corneum. Emollients soften and smooth the skin surface by filling gaps between desquamating skin cells and improving skin texture.

Moisturizing creams generally contain a combination of oils, water, emulsifying agents, humectants, preservatives, antioxidants, fragrances, and stabilizing materials. The careful selection and optimization of these ingredients determine the final product's physical

stability, spread ability, texture, absorption profile, and therapeutic performance. In modern cosmetic science, increasing attention has been directed toward formulations containing natural oils and plant-derived ingredients due to their improved bio compatibility and consumer preference for naturally sourced products.

Cream formulations are commonly classified into two major categories based on the type of emulsion system: oil-in-water (O/W) creams and water-in-oil (W/O) creams. In oil-in-water creams, oil droplets are dispersed within a continuous aqueous phase. These formulations are generally non-greasy, easily washable, cosmetically elegant, and rapidly absorbed into the skin. Due to these properties, O/W creams are highly preferred for facial application and daily use. In contrast, water-in-oil creams contain water droplets dispersed within a continuous oil phase. These creams provide stronger occlusive effects and prolonged moisturization but often possess a heavier and greasier texture that may be less acceptable for facial cosmetic use [2].

The choice of emulsion type significantly influences the sensory characteristics and patient acceptability of topical preparations. Facial creams require lightweight texture, easy spread ability, rapid absorption, and minimal greasy residue to ensure user compliance and comfort. Therefore, oil-in-water emulsions are widely utilized in cosmetic facial moisturizers because they provide hydration while maintaining an aesthetically pleasant skin feel.

In addition to hydration, moisturizing creams may contribute to improving skin elasticity, reducing roughness, soothing irritation, and protecting against environmental stressors. Certain formulations may also exhibit antioxidant, anti-inflammatory, antimicrobial, and anti-aging properties depending on the incorporated active ingredients. Natural oils such as coconut oil and almond oil have gained considerable attention in cosmetic formulations due to their rich fatty acid composition, vitamins, and skin-conditioning effects. Similarly, essential oils including lavender and rose oils are frequently incorporated into skincare preparations because of their fragrance, soothing activity, and potential therapeutic benefits.

The effectiveness of a moisturizing cream depends not only on the active ingredients but also on formulation stability and physicochemical properties. Parameters such as pH, viscosity, homogeneity, spreadability, phase stability, and compatibility between ingredients are essential considerations during formulation development. An unstable cream formulation may undergo phase separation, microbial contamination, or loss of functional performance, thereby reducing product quality and consumer acceptability.

Recently, the cosmetic and pharmaceutical industries have shown increasing interest in developing formulations based on natural and multifunctional ingredients with minimal irritation potential. Consumers increasingly prefer products containing botanical oils and naturally derived components because of their perceived safety, sustain ability, and compatibility with sensitive skin. Consequently, formulation research involving natural oils and mild emulsifying systems has become an important field within cosmetic and dermatological sciences.

The present study focuses on the formulation and characterization of a facial moisturizing cream prepared using natural oils and suitable emulsifying agents to achieve optimal hydration, stability, and cosmetic acceptability. The incorporation of essential oils further aims to enhance sensory properties and provide additional skin benefits including soothing and antioxidant effects.

Natural Oils Used in Moisturizing Cream Formulations:

Natural oils are widely incorporated into cosmetic and dermatological preparations because of their emollient, moisturizing, protective, and nutritive properties. These oils are rich sources of fatty acids, triglycerides, vitamins, antioxidants, and bioactive compounds that contribute to maintaining skin hydration and improving skin barrier function. In modern skincare formulations, natural oils are increasingly preferred due to their biocompatibility, relatively low irritation potential, and consumer preference for naturally derived ingredients.

In moisturizing cream formulations, natural oils primarily function as emollients and occlusive agents. They reduce water evaporation from the skin surface, soften the stratum corneum, and improve skin smoothness and elasticity. The selection of appropriate oils significantly influences the texture, spreadability, absorption, stability, and sensory properties of the final cream formulation.

Among the various oils used in topical preparations, coconut oil, almond oil, and paraffin oil are commonly employed due to their favorable dermatological and physicochemical characteristics [3].

Coconut Oil: Coconut oil is a natural vegetable oil obtained from the kernel of *Cocos nucifera*. It is widely used in cosmetic and pharmaceutical formulations because of its excellent moisturizing, emollient, and protective properties. Coconut oil contains high concentrations of saturated fatty acids, particularly lauric acid, capric acid, caprylic acid, and myristic acid, which contribute to its stability and skin-conditioning activity. One of the major advantages of coconut oil is its ability to reduce transepidermal water loss by forming a

protective lipid layer on the skin surface. This occlusive effect helps preserve moisture within the stratum corneum and improves skin hydration. Additionally, coconut oil enhances skin softness and elasticity while reducing dryness and flaking.

Coconut oil also exhibits mild antimicrobial and anti-inflammatory properties, mainly attributed to lauric acid and related medium-chain fatty acids. These properties may help protect the skin against microbial growth and irritation. Due to its relatively good skin penetration ability, coconut oil can improve the delivery and distribution of other lipophilic ingredients within topical formulations.

From a formulation perspective, coconut oil contributes to cream smoothness and spread ability while providing a pleasant skin feel. However, excessive concentrations may produce oily texture and comedogenicity in some individuals, especially in facial applications. Therefore, optimization of concentration is essential during formulation development.

Because of its multi functional dermatological benefits and natural origin, coconut oil remains one of the most popular ingredients in moisturizing and cosmetic products.

Almond Oil: Almond oil is a fixed oil extracted from the seeds of *Prunus amygdalus*. It is extensively utilized in skincare products due to its emollient, soothing, and nutritive effects on the skin. Almond oil is rich in oleic acid, linoleic acid, palmitic acid, vitamins A and E, phytosterols, and antioxidant compounds that support skin health and hydration.

The high content of unsaturated fatty acids allows almond oil to penetrate the skin effectively and improve moisture retention within the epidermis. Its emollient action softens the skin surface, reduces roughness, and enhances skin smoothness without producing excessive greasiness. Consequently, almond oil is particularly suitable for facial moisturizing formulations intended for dry and sensitive skin.

Vitamin E present in almond oil acts as a natural antioxidant that may protect skin cells from oxidative stress induced by ultraviolet radiation and environmental pollutants. Furthermore, almond oil possesses mild anti-inflammatory properties that can help reduce irritation, itching, and redness associated with skin dryness.

In cosmetic formulations, almond oil improves cream texture, spreadability, and sensory acceptability. Its relatively lightweight nature and compatibility with various excipients make it a favorable ingredient in oil-in-water facial creams. Additionally, almond oil

contributes to enhancing the aesthetic appeal of topical products because of its smooth skin feel and conditioning effects.

Due to its moisturizing efficiency and dermatological compatibility, almond oil has become an important natural ingredient in modern cosmetic and pharmaceutical skincare formulations ^[4].

Paraffin Oil: Paraffin oil, also known as mineral oil or liquid paraffin, is a highly purified mixture of liquid hydrocarbons obtained from petroleum sources. Despite its mineral origin, paraffin oil is widely utilized in pharmaceutical and cosmetic formulations because of its excellent stability, safety profile, and effective occlusive properties.

Paraffin oil primarily functions by forming a hydrophobic barrier over the skin surface, thereby reducing transepidermal water loss and preserving skin hydration. This mechanism makes it highly effective in the management of dry and dehydrated skin conditions. Unlike certain vegetable oils, paraffin oil is chemically stable and resistant to oxidation, which contributes to prolonged product shelf life and formulation stability.

Another important characteristic of paraffin oil is its relatively low irritancy and hypoallergenic nature when properly refined. Consequently, it is frequently incorporated into dermatological preparations intended for sensitive skin. In topical creams, paraffin oil enhances softness and smoothness while improving lubrication and spreadability.

From a pharmaceutical formulation perspective, paraffin oil contributes to cream consistency and assists in maintaining emulsion stability. However, because of its highly occlusive nature, excessive use may produce greasy sensation and reduce cosmetic elegance. Therefore, balanced incorporation with lighter natural oils and appropriate emulsifying systems is necessary, particularly in facial cream formulations.

The combination of paraffin oil with natural oils such as coconut and almond oils may provide synergistic moisturizing effects by integrating occlusive protection with nutritive and emollient benefits. For this reason, paraffin oil remains an important component in many moisturizing cream formulations despite the growing interest in exclusively plant-derived ingredients ^[5].

Essential Oils in Skin Care Formulations: Essential oils are concentrated volatile aromatic compounds obtained from various parts of plants including flowers, leaves, stems, peels, and roots. These oils are widely utilized in cosmetic and dermatological formulations because of

their characteristic fragrance and multiple biological activities such as antimicrobial, antioxidant, anti-inflammatory, soothing, and preservative effects. In recent years, essential oils have gained considerable popularity in skin care products due to increasing consumer preference for naturally derived ingredients with multi functional properties.

In topical cream formulations, essential oils are commonly incorporated at low concentrations to enhance sensory acceptability and provide additional therapeutic benefits. Besides improving product fragrance and consumer appeal, certain essential oils may contribute to skin relaxation, reduction of irritation, and protection against microbial contamination. However, because essential oils are highly concentrated bio active substances, their concentrations must be carefully optimized to minimize the risk of skin sensitization or irritation ^[6].

Among the various essential oils used in skincare products, lavender oil and rose oil are considered particularly valuable because of their pleasant aroma and dermatological compatibility.

Lavender Oil: Lavender oil is an essential oil primarily extracted from the flowers of *Lavandula angustifolia*. It is widely used in cosmetic, pharmaceutical, and aromatherapy applications because of its calming fragrance and beneficial effects on the skin. The major constituents of lavender oil include linalool, linalyl acetate, camphor, and terpinen-4-ol, which contribute to its biological activity and characteristic aroma.

One of the most important properties of lavender oil is its soothing and anti-inflammatory activity. It may help reduce skin irritation, redness, and discomfort associated with dryness and environmental stress. Additionally, lavender oil possesses mild antimicrobial properties against various microorganisms, which may support skin hygiene and contribute to preservation of topical formulations.

Lavender oil also exhibits antioxidant effects that may help reduce oxidative damage induced by ultraviolet radiation and environmental pollutants. Due to its relaxing aroma, lavender oil enhances the sensory experience and overall consumer satisfaction associated with cosmetic products.

In moisturizing cream formulations, lavender oil is generally incorporated in small concentrations to avoid irritation while maintaining desirable fragrance intensity and therapeutic benefits. Its compatibility with oil-based ingredients and emulsified systems makes it suitable for incorporation into facial skincare preparations ^[7].

Rose Oil: Rose oil is a highly valued essential oil obtained mainly from the petals of *Rosa damascena* and related rose species. It is extensively utilized in luxury cosmetic and skincare products because of its pleasant floral fragrance and beneficial dermatological properties. Rose oil contains numerous bioactive compounds including citronellol, geraniol, nerol, phenyl ethanol, and flavonoid-related constituents that contribute to its antioxidant and soothing activities.

Rose oil is recognized for its moisturizing and skin-conditioning effects. It may help improve skin softness and contribute to maintaining skin hydration by supporting the integrity of the epidermal barrier. In addition, rose oil possesses mild anti-inflammatory and calming properties that may reduce skin irritation and sensitivity.

The antioxidant activity of rose oil may assist in protecting skin cells against oxidative stress and premature aging. Furthermore, its pleasant fragrance significantly enhances the cosmetic elegance and market acceptability of topical formulations.

In facial creams, rose oil is commonly incorporated at low concentrations due to its potent aroma and concentrated nature. Proper formulation is essential to ensure stability, uniform distribution, and dermatological safety within the cream system.

The incorporation of lavender and rose oils into moisturizing cream formulations may provide synergistic sensory and dermatological benefits, improving both the therapeutic value and cosmetic appeal of the final product ^[8].

Emulsifying Agents and Cream Stability: Emulsifying agents are essential components in cream formulations because they facilitate the formation and stabilization of emulsions composed of immiscible phases such as oil and water. Since moisturizing creams commonly contain both aqueous and oily ingredients, the incorporation of suitable emulsifiers is necessary to maintain uniform dispersion, prevent phase separation, and ensure physical stability throughout storage.

An emulsion is defined as a biphasic system in which one liquid is dispersed as fine droplets within another liquid. Depending on the distribution of phases, creams may exist as oil-in-water (O/W) or water-in-oil (W/O) emulsions. In oil-in-water systems, oil droplets are dispersed within a continuous aqueous phase, whereas water-in-oil systems contain dispersed water droplets within a continuous oily phase.

Emulsifying agents function by reducing the interfacial tension between oil and water phases, thereby promoting formation of stable emulsions. These agents possess both hydrophilic and lipophilic portions

within their molecular structure, enabling interaction with both phases simultaneously. Proper emulsification contributes significantly to product texture, homogeneity, spreadability, appearance, and shelf stability.

For facial moisturizing creams, oil-in-water emulsions are generally preferred because they provide a lighter, less greasy texture with improved cosmetic elegance and ease of application. Such formulations are rapidly absorbed into the skin and can be easily removed with water, making them highly suitable for daily use.

In the present formulation, Glyceryl Monostearate (GMS) may be utilized as the primary emulsifying agent due to its excellent emulsification properties, compatibility with cosmetic ingredients, and ability to produce smooth and stable cream systems. GMS is a nonionic emulsifier widely used in pharmaceutical and cosmetic preparations because of its low irritancy and favorable stability profile.

The stability of cream formulations depends on several physicochemical factors including emulsifier concentration, oil-to-water ratio, droplet size distribution, viscosity, pH, temperature, and compatibility between ingredients. Instability may result in undesirable phenomena such as creaming, coalescence, cracking, phase separation, viscosity changes, or microbial growth. Therefore, careful optimization of formulation variables is essential during cream development.

In addition to emulsifiers, stabilizing agents and thickening materials may be incorporated to improve viscosity and enhance resistance to emulsion breakdown. Homogenization techniques and controlled heating processes also play critical roles in producing fine droplet dispersion and improving long-term formulation stability.

A stable moisturizing cream should maintain its appearance, texture, homogeneity, fragrance, pH, and therapeutic performance throughout storage without significant physical or chemical degradation. Consequently, evaluation of formulation stability constitutes an important aspect of cosmetic and pharmaceutical cream development^[9].

Additional Pharmaceutical Excipients Used in Cream Formulation: In addition to oils and emulsifying agents, moisturizing cream formulations contain various pharmaceutical excipients that contribute to product stability, safety, texture, preservation, and therapeutic performance. These excipients are carefully selected to optimize physicochemical properties, enhance consumer acceptability, and prolong shelf life of the final preparation.

The incorporation of appropriate auxiliary ingredients is essential in achieving a stable and cosmetically elegant facial cream formulation^[10].

Humectants: Humectants are hygroscopic substances capable of attracting and retaining water within the stratum corneum. They play an important role in maintaining skin hydration by reducing dryness and improving moisture content of the skin surface. Humectants also contribute to cream smoothness, spreadability, and overall sensory properties.

Glycerin is one of the most widely used humectants in topical formulations because of its excellent moisturizing ability, safety, and compatibility with various excipients. It enhances water retention within the epidermis and improves skin softness and elasticity. Additionally, glycerin may help reduce roughness and support restoration of skin barrier function.

Other commonly used humectants include propylene glycol, sorbitol, and hyaluronic acid. The concentration of humectants must be optimized carefully, as excessive amounts may produce sticky texture or undesirable sensory effects^[10].

Preservatives: Preservatives are incorporated into cream formulations to prevent microbial contamination and ensure microbiological stability during storage and repeated use. Since moisturizing creams contain aqueous components that may support microbial growth, effective preservation is essential for maintaining product safety and quality.

Common preservatives used in cosmetic and pharmaceutical creams include methylparaben, propylparaben, phenoxyethanol, and benzyl alcohol. Methylparaben and propylparaben are frequently used together because of their broad-spectrum antimicrobial activity and compatibility with various formulation ingredients.

The selection of preservatives depends on formulation pH, ingredient compatibility, antimicrobial spectrum, and safety considerations. Appropriate preservative concentration is necessary to achieve effective microbial protection without causing skin irritation or sensitization^[11].

Antioxidants: Antioxidants are incorporated into cream formulations to protect oils and other sensitive ingredients from oxidative degradation. Oxidation may lead to unpleasant odor, discoloration, reduced efficacy, and decreased product stability. Natural oils and essential oils are particularly susceptible to oxidation due to the presence of unsaturated fatty acids and volatile constituents.

Vitamin E (tocopherol) is commonly used as an antioxidant in topical formulations because of its ability to inhibit lipid peroxidation and stabilize oil-containing systems. In addition to improving formulation stability, vitamin E may provide beneficial effects on the skin through its antioxidant and skin-conditioning activities. Other antioxidants used in cosmetic preparations include butylated hydroxytoluene (BHT), butylated hydroxyanisole (BHA), and ascorbic acid derivatives ^[12].

pH Modifiers: The pH of topical formulations is an important factor influencing skin compatibility, stability, preservative effectiveness, and product performance. Human skin normally possesses a slightly acidic pH ranging approximately from 4.5 to 6.0, which contributes to maintenance of barrier integrity and microbial defense.

pH modifiers are added to cream formulations to adjust and maintain the desired pH range. Commonly used pH-adjusting agents include citric acid, sodium hydroxide, lactic acid, and triethanolamine. Proper pH adjustment helps minimize skin irritation and enhances compatibility between formulation ingredients.

Maintaining optimal pH is particularly important in formulations containing natural oils, essential oils, and preservative systems, as pH variations may affect emulsion stability and product shelf life ^[13].

Fragrances: Fragrances are incorporated into cosmetic formulations to improve product aroma and enhance consumer acceptability. Pleasant fragrance contributes significantly to the sensory experience associated with skincare products and may positively influence user satisfaction and compliance.

In natural moisturizing creams, essential oils such as lavender oil and rose oil may serve dual functions as both fragrance components and biologically active ingredients. These oils provide characteristic aromatic profiles while simultaneously contributing soothing, antioxidant, and antimicrobial effects.

However, fragrance concentration must be carefully controlled because excessive fragrance may cause skin irritation or allergic reactions, especially in sensitive facial skin. Therefore, mild and skin-compatible fragrance systems are preferred in facial moisturizing formulations. The careful selection and optimization of excipients are critical for achieving a stable, effective, safe, and aesthetically acceptable moisturizing cream suitable for cosmetic and dermatological application.

Challenges in Formulation of Natural Moisturizing Creams: The formulation of natural moisturizing creams presents several scientific and technological challenges

that may affect product stability, safety, efficacy, and consumer acceptability. Although natural oils and plant-derived ingredients offer numerous dermatological and cosmetic benefits, their incorporation into stable semisolid dosage forms requires careful optimization of formulation variables and manufacturing conditions.

One of the primary challenges associated with natural cream formulations is oxidative instability. Many natural oils contain high concentrations of unsaturated fatty acids that are susceptible to oxidation upon exposure to light, oxygen, heat, and environmental conditions. Oxidative degradation may result in unpleasant odor, discoloration, reduction in therapeutic activity, and deterioration of product quality. Essential oils are particularly sensitive because of their volatile aromatic constituents and chemically reactive compounds. Therefore, incorporation of suitable antioxidants and appropriate storage conditions is necessary to minimize oxidative degradation and preserve formulation stability. Another major challenge involves maintaining emulsion stability throughout storage. Moisturizing creams are biphasic systems composed of oil and water phases that are thermodynamically unstable by nature. Inadequate emulsification or improper selection of emulsifying agents may lead to phase separation, creaming, coalescence, cracking, or viscosity changes during storage. Factors such as oil concentration, emulsifier type, droplet size distribution, temperature fluctuations, and pH variations significantly influence emulsion stability. Consequently, optimization of emulsifier concentration and homogenization conditions is essential for producing a stable and homogeneous cream formulation.

Microbial contamination also represents an important concern in topical cream preparations, particularly those containing aqueous components and natural ingredients. Natural oils and botanical extracts may provide favorable conditions for microbial growth if appropriate preservation systems are not incorporated. Contaminated formulations may cause product spoilage, reduced shelf life, and potential skin infections or irritation. Therefore, effective preservatives must be carefully selected to ensure microbiological stability while maintaining dermatological safety.

Another formulation challenge relates to balancing moisturization efficiency with cosmetic elegance. Oils with strong occlusive properties may provide prolonged hydration but can also produce excessive greasiness, stickiness, or unpleasant sensory characteristics that reduce user compliance. Facial creams especially require lightweight texture, rapid absorption, smooth spreadability, and non-comedogenic properties to ensure consumer satisfaction. Achieving this balance requires

careful selection of oils, emulsifiers, and viscosity-modifying agents.

The incorporation of essential oils into topical formulations may further complicate formulation development. Although essential oils provide fragrance and beneficial biological activities, excessive concentrations may lead to skin irritation, sensitization, or allergic reactions in susceptible individuals. Furthermore, their volatility may affect fragrance retention and long-term stability of the formulation. Appropriate concentration optimization and compatibility testing are therefore necessary to ensure both efficacy and safety.

Maintaining appropriate pH represents another critical aspect in the formulation of moisturizing creams. Variations in pH may influence skin compatibility, preservative effectiveness, emulsion stability, and ingredient interactions. Since facial skin is relatively sensitive, formulations should ideally possess a slightly acidic pH compatible with normal skin physiology.

In addition to physicochemical stability, aesthetic properties such as color, odor, texture, consistency, and spread ability significantly influence consumer acceptance of cosmetic products. Modern consumers increasingly demand products that combine natural ingredients with pleasant sensory characteristics and long-term stability. Consequently, formulation scientists must carefully balance functionality, stability, safety, and cosmetic elegance during development of natural moisturizing creams.

Despite these challenges, advances in cosmetic and pharmaceutical formulation technologies have facilitated the successful development of stable and effective natural skin care products. Appropriate selection of ingredients, optimization of formulation parameters, and proper evaluation testing can contribute significantly to producing high-quality moisturizing creams with desirable therapeutic and cosmetic properties.

Aim and Objective of the Study: The present study aimed to formulate and characterize an oil-in-water facial moisturizing cream containing natural oils, essential oils, emulsifying agents, and suitable pharmaceutical excipients for cosmetic skincare application.

The study specifically focused on the incorporation of coconut oil, almond oil, paraffin oil, lavender oil, and rose oil to obtain a stable and cosmetically elegant moisturizing formulation with desirable skin compatibility and moisturizing properties.

The prepared formulation was evaluated for physicochemical characteristics including appearance, pH, viscosity, spreadability, homogeneity, washability,

skin compatibility, and physical stability under different storage conditions.

MATERIALS AND METHODS

The materials used in the formulation of the moisturizing cream were selected based on their moisturizing, emulsifying, stabilizing, and cosmetic properties. Natural oils including coconut oil and almond oil were utilized as emollient and moisturizing agents, while paraffin oil was incorporated to enhance occlusive properties and improve skin hydration retention. Essential oils including lavender oil and rose oil were used to provide fragrance and additional soothing effects [14].

All materials used in the study were of pharmaceutical or cosmetic grade and were utilized without further purification.

Apparatus and Equipment: Various laboratory apparatus and instruments were used during formulation and evaluation of the moisturizing cream. The equipment was selected to ensure accurate weighing, controlled heating, efficient mixing, homogenization, and evaluation of physicochemical properties.

All glassware and equipment were properly cleaned and dried before use to avoid contamination and ensure formulation quality [15].

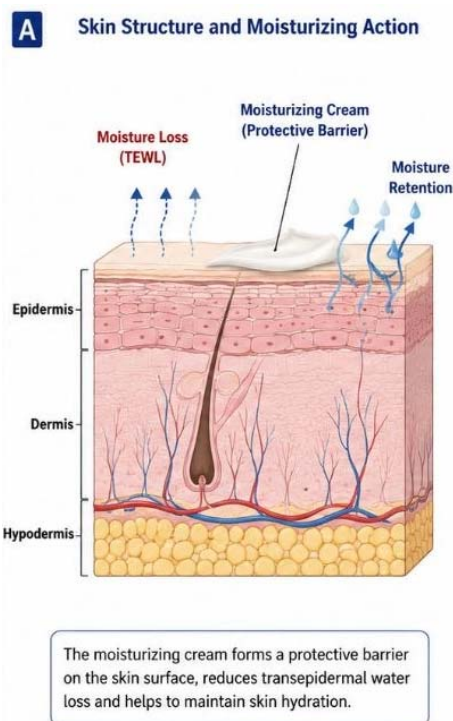


Figure 1: skin structure and Moisturizing Action

Table 1: The formulation components and their pharmaceutical functions are presented below.

Material	Function
Coconut oil	Natural emollient and moisturizing agent
Almond oil	Skin-conditioning and emollient agent
Paraffin oil	Occlusive moisturizing agent
Glyceryl Monostearate (GMS)	Emulsifying agent
Stearic acid	Thickening and stabilizing agent
Glycerin	Humectant
Lavender oil	Essential oil, fragrance, soothing agent
Rose oil	Essential oil, fragrance, antioxidant effect
Methylparaben	Preservative
Propylparaben	Preservative
Vitamin E (Tocopherol)	Antioxidant
Triethanolamine	pH adjustment and emulsification support
Distilled water	Vehicle/Aqueous phase

Table 2: The apparatus used in the present study included:

Apparatus/Instrument	Purpose
Analytical balance	Accurate weighing of ingredients
Hot plate magnetic stirrer	Heating and mixing
Water bath	Controlled heating of phases
Beakers	Preparation of oil and aqueous phases
Glass rods Manual stirring	Temperature monitoring
Thermometer	Emulsion homogenization
Homogenizer	Measurement of cream pH
pH meter	Determination of viscosity
Brookfield viscometer	Transfer and mixing
Spatulas	Volume measurement
Measuring cylinders	Packaging and stability study
Storage containers	

Table 3: Composition of Moisturizing Cream Formulation

Ingredient	Quantity (% w/w)	Function
Coconut oil	8%	Moisturizing agent
Almond oil	6%	Emollient
Paraffin oil	5%	Occlusive agent
Glyceryl Monostearate (GMS)	6%	Emulsifier
Stearic acid	4%	Thickening agent
Glycerin	5%	Humectant
Lavender oil	0.5%	Fragrance and soothing agent
Rose oil	0.3%	Fragrance and antioxidant
Vitamin E	0.5%	Antioxidant
Methylparaben	0.2%	Preservative
Propylparaben	0.02%	Preservative
Triethanolamine	q.s.	pH adjustment
Distilled water	Up to 100%	Vehicle

Formulation Design: The moisturizing cream was formulated as an oil-in-water (O/W) emulsion using natural oils, essential oils, emulsifying agents, humectants, preservatives, and stabilizers. The formulation was designed to achieve suitable moisturization, physical stability, smooth texture, and cosmetic elegance appropriate for facial application ^[16]. The proposed formulation composition is presented in Table 3.

Preparation Method: The moisturizing cream was prepared using the hot emulsification technique, a commonly employed method for the preparation of stable oil-in-water (O/W) semisolid emulsions in pharmaceutical and cosmetic formulations. The method

was selected due to its suitability for achieving uniform dispersion of oily and aqueous phases, improved emulsion stability, and desirable consistency for facial application.

The preparation procedure involved separate preparation of the oil phase and aqueous phase under controlled temperature conditions, followed by emulsification, homogenization, cooling, and incorporation of heat-sensitive ingredients, pH adjustment, and packaging ^[17].

Preparation of Oil Phase: The oil phase consisted of coconut oil, almond oil, paraffin oil, Glyceryl Monostearate (GMS), stearic acid, and Vitamin E. All

Table 3.1 Physical Characteristics of the Prepared Moisturizing Cream

Parameter	Observation
Color	Off-white cream
Odor	Pleasant aromatic odor
Texture	Smooth
Consistency	Semisolid
Homogeneity	Uniform
Phase separation	Absent
Grittiness	Absent
Appearance	Elegant and stable

Table 3.2 pH of the Prepared Moisturizing Cream

Parameter	Result
Measured pH	5.6 ± 0.2
Skin compatibility	Acceptable
Irritation potential	Minimal

Table 3.3 Viscosity of the Prepared Moisturizing Cream

Parameter	Result
Viscosity	24,500 ± 500 cP
Consistency	Semisolid
Spreadability	Good
Physical stability	Acceptable

Table 3.4 Spreadability Characteristics of the Prepared Cream

Parameter	Observation
Ease of spreading	Good
Skin feel	Smooth
Drag during application	Minimal
Uniformity of application	Acceptable

Table 3.5 Homogeneity Evaluation of the Prepared Cream

Parameter	Observation
Uniformity	Excellent
Aggregates	Absent
Lump formation	Absent
Texture	Smooth

Table 3.6 Washability Characteristics of the Prepared Cream

Parameter	Observation
Ease of washing	Good
Residual greasiness	Minimal
Skin comfort after washing	Acceptable

Table 3.7 Stability Evaluation of the Prepared Cream

Parameter	Observation
Phase separation	Absent
Color change	Absent
Odor stability	Acceptable
pH stability	Stable
Consistency	Maintained
Overall stability	Acceptable

Table 3.8 Skin Irritation and Compatibility Evaluation

Parameter	Observation
Redness	Absent
Itching	Absent
Burning sensation	Absent
Edema	Absent
Skin irritation	Not observed
Skin compatibility	Acceptable

ingredients were accurately weighed using an analytical balance and transferred into a clean dry beaker.

The oil phase components were heated in a thermostatically controlled water bath at a temperature of $70 \pm 2^\circ\text{C}$ with continuous gentle stirring using a glass rod and magnetic stirrer until complete melting of solid ingredients and formation of a clear uniform oily mixture were achieved.

Glyceryl Monostearate and stearic acid were completely melted to ensure proper emulsification and consistency of the final cream formulation. Care was taken to avoid excessive heating in order to minimize degradation or oxidation of oil components.

Preparation of Aqueous Phase: The aqueous phase was prepared separately by dissolving glycerin, methylparaben, and propylparaben in distilled water. The mixture was transferred into another beaker and heated simultaneously in a water bath maintained at $70 \pm 2^\circ\text{C}$ with continuous stirring to ensure complete dissolution of the water-soluble ingredients.

Maintaining both oil and aqueous phases at approximately the same temperature was necessary to prevent premature solidification and facilitate efficient emulsification during phase mixing.

Emulsification Process: After complete preparation of both phases, the heated aqueous phase was slowly added to the oil phase under continuous stirring using a magnetic stirrer. The addition was performed gradually to promote uniform dispersion of oil droplets within the aqueous medium and to minimize the risk of phase separation.

Continuous stirring was maintained throughout the emulsification process at controlled temperature conditions to facilitate formation of a stable oil-in-water emulsion. The mixture gradually developed creamy consistency as emulsification progressed.

The rate of addition and mixing conditions were carefully controlled to ensure uniformity of the formulation and prevent formation of aggregates or instability within the emulsion system ^[18].

Homogenization: Following primary emulsification, the formulation was subjected to homogenization using a laboratory homogenizer operated at approximately 3000–5000 rpm for 10–15 minutes. Homogenization was performed to reduce globule size, improve uniform distribution of dispersed droplets, and enhance physical stability of the cream.

Reduction in droplet size contributes significantly to improved cream texture, smoothness, spreadability, and resistance to phase separation during storage. Proper homogenization also improves the aesthetic appearance and consistency of the final product.

During homogenization, care was taken to avoid excessive incorporation of air bubbles into the formulation, as entrapped air may negatively affect product appearance and stability.



Figure 2: Components of Moisturizing Cream Formulation

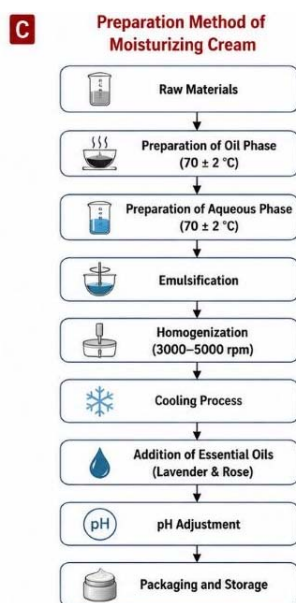


Figure 3: Preparation Method of Moisturizing Cream

Cooling Process: After homogenization, the prepared emulsion was allowed to cool gradually to room temperature under gentle continuous stirring. Controlled cooling was necessary to maintain emulsion stability and achieve uniform semisolid consistency.

Slow stirring during cooling helped prevent formation of lumps, sedimentation, or localized solidification of formulation components. Additionally, gradual cooling minimized stress on the emulsion system and improved texture uniformity.

The cream progressively developed a smooth, homogeneous, and aesthetically acceptable appearance during the cooling stage ^[19].

Addition of Heat-Sensitive Ingredients: When the temperature of the cream decreased to approximately 40°C or below, heat-sensitive ingredients including lavender oil and rose oil were incorporated into the formulation with gentle stirring.

The essential oils were added during the cooling stage to minimize volatilization and degradation of their aromatic and bioactive constituents that may occur at elevated temperatures. Uniform mixing was continued to ensure homogeneous distribution of essential oils throughout the cream base.

Triethanolamine was subsequently added in small quantities for pH adjustment and stabilization of the formulation. The pH was adjusted to obtain a value compatible with normal facial skin physiology ^[19].

Optimization Trials: Preliminary formulation trials were conducted prior to finalization of the cream composition in order to optimize the concentration of oils, emulsifying agents, and stabilizing materials.

Different formulations were evaluated based on physical appearance, viscosity, spreadability, homogeneity, texture, and phase stability. The optimized formulation was selected according to its desirable cosmetic elegance, smooth consistency, ease of application, and absence of phase separation.

Optimization studies contributed to improving formulation stability and ensuring suitability of the cream for facial topical application ^[20].

Packaging and Storage: The final prepared cream was transferred into clean, dry, airtight containers immediately after preparation to minimize contamination and exposure to environmental conditions.

The containers were properly sealed and labeled, then stored at room temperature for further physicochemical

evaluation and stability studies. Protection from excessive heat, direct sunlight, and moisture was maintained throughout the storage period to preserve formulation stability and quality.

Proper packaging was considered important for maintaining product integrity, preventing microbial contamination, and preserving the fragrance and activity of essential oil components.

RESULTS AND DISCUSSION

Physical Appearance: The formulated moisturizing cream was evaluated visually for color, odor, texture, consistency, homogeneity, and phase separation. The prepared cream exhibited a smooth, uniform, and aesthetically acceptable appearance with soft semisolid consistency suitable for facial application.

The cream possessed an off-white to pale cream color with a pleasant aromatic odor resulting from the incorporation of lavender oil and rose oil. No evidence of phase separation, grittiness, or lump formation was observed during visual inspection, indicating successful emulsification and proper dispersion of formulation components.

The formulation demonstrated good homogeneity and smooth texture upon topical application. The cream spread easily over the skin surface without producing excessive greasiness or tackiness, which is an important characteristic for facial cosmetic products. The oil-in-water emulsion system contributed significantly to achieving lightweight texture and improved cosmetic elegance.

The desirable physical appearance of the formulation may be attributed to the balanced ratio of oily and aqueous phases, appropriate selection of emulsifying agents, and efficient homogenization during preparation. Glyceryl Monostearate and stearic acid played important roles in maintaining cream consistency and preventing emulsion instability.

The observed results indicate that the prepared formulation possessed acceptable physical characteristics suitable for cosmetic and dermatological use.

pH Determination: The pH of the formulated moisturizing cream was determined using a calibrated digital pH meter in order to evaluate compatibility with normal facial skin physiology. The measured pH of the prepared formulation was found to be approximately 5.6 ± 0.2 .

The obtained pH value falls within the normal physiological pH range of human skin, which generally varies between 4.5 and 6.0. Maintaining a slightly acidic

pH is important for preserving skin barrier integrity, minimizing irritation, and supporting normal microbial defense mechanisms of the skin surface.

The appropriate pH observed in the present formulation may be attributed to the controlled addition of triethanolamine during formulation preparation and the compatibility of incorporated excipients within the emulsion system. Proper pH adjustment also contributes to improved preservative effectiveness and enhanced formulation stability.

No significant pH fluctuation was observed during preliminary storage evaluation, suggesting acceptable chemical stability of the cream formulation.

The obtained results indicate that the prepared cream is suitable for facial topical application and is unlikely to produce significant skin irritation associated with extreme pH conditions.

Viscosity Measurement: Viscosity is one of the most important physicochemical parameters influencing the stability, spreadability, and consumer acceptability of semisolid topical formulations. The viscosity of the prepared moisturizing cream was evaluated using a Brookfield viscometer at controlled room temperature conditions.

The formulated cream exhibited appropriate viscosity with smooth semisolid consistency suitable for facial application. The measured viscosity was approximately $24,500 \pm 500$ cP, indicating formation of a stable and adequately thickened oil-in-water cream system.

The obtained viscosity value contributed to good retention of the cream on the skin surface while maintaining ease of spreading and application. Excessively high viscosity may reduce spreadability and consumer comfort, whereas very low viscosity may negatively affect formulation stability and consistency. Therefore, the observed viscosity range was considered suitable for cosmetic facial cream preparations.

The satisfactory viscosity characteristics may be attributed to the combined effects of Glyceryl Monostearate, stearic acid, and homogenization conditions employed during formulation preparation. These components contributed to stabilization of the emulsion system and development of desirable cream texture.

No major viscosity changes were observed during preliminary stability assessment, suggesting acceptable physical stability of the prepared formulation.

Spread ability Study: Spread ability is an important parameter in topical formulations because it influences

ease of application, uniform distribution on the skin surface, and patient compliance. A good moisturizing cream should spread easily with minimal drag while maintaining sufficient consistency.

The formulated cream demonstrated good spreadability and smooth application characteristics during evaluation. The cream distributed uniformly over the skin surface without excessive resistance or aggregation, indicating acceptable rheological behavior of the formulation.

The favorable spreadability observed in the present study may be attributed to the balanced composition of oils, emulsifying agents, and humectants within the formulation. The oil-in-water emulsion system also contributed to lighter texture and easier skin application compared with heavier water-in-oil systems. Appropriate spreadability is particularly important for facial creams because facial skin is relatively sensitive and requires cosmetically elegant formulations that can be applied comfortably without excessive greasiness.

The spread ability characteristics obtained in the present study suggest that the prepared cream possesses desirable application properties suitable for daily cosmetic use.

Homogeneity Evaluation: Homogeneity evaluation was performed to assess the uniform distribution of ingredients within the cream formulation and to detect the presence of aggregates, lumps, or phase separation.

The prepared moisturizing cream exhibited excellent homogeneity with smooth and uniform consistency throughout the formulation. No visible coarse particles, aggregates, or signs of emulsion breakdown were observed during visual inspection and manual examination.

The homogeneous nature of the cream may be attributed to proper emulsification and effective homogenization during formulation preparation. Reduction of globule size during homogenization contributed significantly to uniform distribution of the dispersed oil phase within the continuous aqueous phase.

Good homogeneity is essential for ensuring consistent delivery of active ingredients and maintaining acceptable aesthetic appearance and texture of topical formulations.

The obtained results indicate that the formulation process successfully produced a stable and uniform cream system suitable for cosmetic application.

Wash ability Test: Wash ability is an important characteristic of oil-in-water facial creams because it

influences consumer convenience and product acceptability. The washability of the prepared formulation was evaluated by applying the cream onto the skin followed by washing with water.

The formulated cream exhibited good washability and was easily removed from the skin surface using water without leaving excessive oily residue. This property may be attributed to the oil-in-water nature of the emulsion system, which generally allows easier removal compared with water-in-oil creams.

The balanced oil composition and appropriate emulsifier concentration contributed to maintaining acceptable cleansing properties while preserving moisturizing performance.

Good wash ability is considered advantageous for facial skincare products because it improves user comfort and reduces greasy sensation after application.

Stability Study: Stability studies were conducted to evaluate the physical stability of the prepared moisturizing cream under different storage conditions. The formulation was observed for changes in appearance, color, odor, pH, viscosity, consistency, and phase separation during the storage period.

The prepared cream remained physically stable throughout the evaluation period with no significant evidence of phase separation, creaming, cracking, or microbial deterioration. Minor variations in viscosity and fragrance intensity were observed at elevated temperature conditions; however, these changes remained within acceptable limits and did not adversely affect overall formulation quality.

The pH of the formulation remained relatively stable during storage, indicating good compatibility among formulation ingredients and acceptable chemical stability of the emulsion system.

The satisfactory stability observed in the present study may be attributed to appropriate emulsification, effective homogenization, suitable preservative incorporation, and balanced formulation composition. The results suggest that the prepared moisturizing cream possesses acceptable physical stability and is suitable for topical cosmetic application.

Skin Irritation and Compatibility Test: Skin irritation and compatibility evaluation are important parameters in the assessment of topical cosmetic formulations, particularly facial creams intended for regular application. The present study included a preliminary skin compatibility assessment to evaluate the potential of the formulated moisturizing cream to produce irritation, redness, itching, or other undesirable dermatological reactions.

A small quantity of the prepared cream was applied to a limited area of intact skin on healthy volunteers and observed for signs of irritation over a specified period following application. The evaluated parameters included redness, edema, itching sensation, burning, discomfort, and visible skin reactions.

The formulated cream demonstrated good skin compatibility and did not produce significant irritation or hypersensitivity reactions during the observation period. No visible erythema, itching, inflammation, or discomfort was observed among the tested individuals, indicating acceptable dermatological tolerability of the formulation.

The favorable compatibility profile of the prepared cream may be attributed to several formulation factors including the use of skin-compatible natural oils, controlled concentration of essential oils, appropriate pH adjustment, and selection of mild emulsifying agents. The oil-in-water emulsion system also contributed to lighter skin feel and reduced occlusive burden compared with heavier semisolid preparations.

The slightly acidic pH of the formulation, which was compatible with normal skin physiology, may have further contributed to minimizing irritation potential. Additionally, incorporation of lavender oil and almond oil may have provided soothing effects that supported skin comfort following application.

The absence of significant irritation suggests that the prepared moisturizing cream is suitable for facial topical application and may be considered safe for cosmetic use under normal conditions of application. However, despite the favorable preliminary observations, further dermatological and long-term safety studies involving larger populations may be required for comprehensive evaluation of product safety and tolerability.

Overall Discussion of Formulation Performance: The present study successfully demonstrated the formulation and characterization of an oil-in-water facial moisturizing cream containing natural oils, essential oils, emulsifying agents, and pharmaceutical excipients. The prepared formulation exhibited desirable physicochemical characteristics, acceptable stability, and favorable cosmetic properties suitable for topical facial application.

The incorporation of coconut oil and almond oil contributed significantly to the moisturizing and emollient properties of the cream. Coconut oil provided occlusive and skin-softening effects that assisted in reducing transepidermal water loss and preserving skin hydration. In addition, its fatty acid composition may have supported skin barrier protection and improved skin smoothness.

Almond oil contributed to enhancing skin softness, spread ability, and sensory acceptability of the

formulation due to its lightweight emollient nature and high content of unsaturated fatty acids and vitamin E. The combination of coconut oil and almond oil produced balanced moisturization without excessive heaviness or greasiness, which is particularly important for facial skin care products.

Paraffin oil played an important role as an occlusive moisturizing agent by forming a protective hydrophobic layer over the skin surface. This effect enhanced moisture retention and contributed to improved hydration efficiency of the cream. Furthermore, paraffin oil contributed to smooth texture and improved consistency of the semisolid formulation.

The incorporation of lavender oil and rose oil enhanced the sensory and cosmetic properties of the cream through their pleasant aromatic characteristics and soothing effects. In addition to fragrance enhancement, these essential oils may have contributed antioxidant and mild antimicrobial activities that support skin protection and formulation quality.

The use of Glyceryl Monostearate as the primary emulsifying agent successfully facilitated formation of a stable oil-in-water emulsion system with smooth texture and acceptable physical stability. Proper emulsification and homogenization contributed significantly to the observed homogeneity, spreadability, and resistance to phase separation during storage.

The measured pH of the formulation was compatible with normal facial skin physiology, indicating suitability for topical application with minimal irritation potential. Similarly, the observed viscosity and spreadability characteristics reflected balanced rheological behavior appropriate for cosmetic facial creams.

The formulation also demonstrated good wash ability, which is an important characteristic of oil-in-water facial creams intended for daily use. Easy removal from the skin surface without excessive oily residue improves consumer acceptability and user comfort.

Stability studies revealed that the prepared cream maintained acceptable appearance, consistency, pH, and homogeneity during storage under different environmental conditions. The absence of significant phase separation or major physicochemical deterioration indicated satisfactory formulation stability.

Overall, the prepared moisturizing cream successfully combined natural moisturizing oils, essential oils, and pharmaceutical excipients to produce a stable, cosmetically elegant, and skin-compatible facial cream. The formulation demonstrated favorable physicochemical and sensory properties that support its potential application as a topical moisturizing cosmetic product.

The present findings also emphasize the importance of appropriate formulation design, emulsifier selection, and optimization of ingredient composition in the development of effective natural skincare products. Further studies involving advanced stability analysis, microbiological evaluation, and large-scale dermatological assessment may provide additional information regarding long-term product performance and commercial applicability.

CONCLUSION

The present study successfully formulated and characterized an oil-in-water facial moisturizing cream containing natural oils, essential oils, and suitable pharmaceutical excipients. The prepared formulation demonstrated acceptable physicochemical properties including smooth texture, good homogeneity, appropriate viscosity, favorable spreadability, skin-compatible pH, and satisfactory stability. The incorporation of coconut oil, almond oil, and paraffin oil contributed effectively to the moisturizing and emollient properties of the cream, while lavender oil and rose oil enhanced fragrance and sensory acceptability. The selected emulsifying system successfully produced a stable and cosmetically elegant formulation suitable for facial application.

The formulated cream exhibited minimal irritation potential and maintained acceptable physical stability throughout the evaluation period, indicating its suitability for topical cosmetic use. The findings of the present study support the potential application of natural oil-based formulations in skincare and cosmetic preparations.

Further studies involving advanced stability analysis, microbiological evaluation, and clinical assessment may provide additional information regarding long-term safety and commercial applicability of the formulation.

Recommendations: Further studies are recommended to evaluate the long-term stability, microbiological safety, and clinical effectiveness of the formulated moisturizing cream under different storage and usage conditions.

Additional investigations involving larger dermatological studies and incorporation of other natural bioactive ingredients may further improve the therapeutic and cosmetic properties of the formulation and support its potential commercial application.

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