

A Review on Recent Advances in Herbal Face Serum

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Abstract: Herbal face serums are highly concentrated skincare formulations designed for rapid absorption and targeted treatment of various skin concerns. This review summarizes the role of herbal and natural ingredients—such as hyaluronic acid, vitamin C, retinol, salicylic acid, and botanical extracts—in improving hydration, reducing signs of aging, brightening skin tone, and managing hyperpigmentation. Different serum types, including oil-based, gel-based, water-based, emulsion, and balm serums, offer benefits for diverse skin types and conditions. While serums provide enhanced penetration and potent therapeutic effects, they may also cause irritation or instability in certain formulations. Overall, herbal face serums demonstrate significant potential in promoting healthy, youthful, and radiant skin

Keywords: Herbal face serum; Active ingredients; Skin hydration; Anti-aging; Brightening agents; Hyperpigmentation; Botanical extracts; Nanoemulsion; Nanocosmeceuticals; Liposomes; Niosomes; Delivery systems; Antioxidants; Moisturizing agents; Skin rejuvenation

I. INTRODUCTION

Cosmetics, commonly referred to as makeup products, are frequently utilized by young adults to enhance their appearance and present themselves attractively. The Food and Drug Administration of the United States defines cosmetics as substances intended for application on the human body for the purposes of beautifying, cleansing, altering appearance, and enhancing attractiveness, without affecting the body's structural functions [1]. The study of human skin constitutes a crucial area of research and development in dermatology, toxicology, pharmacology, and cosmetology. It focuses on assessing the effects of external agents, their interactions, absorption mechanisms, and potential toxicity on various skin structures. The importance of improving appearance has been acknowledged since ancient times, and society's desire for beauty and wellness has continuously evolved. [2] Herbal cosmetics are skincare and beauty products that include approved cosmetic ingredients alongside natural plant-based components. These herbal ingredients provide specific benefits to enhance appearance. The term "cosmetic" originates from the Greek word "cosmetics," which means having the power to arrange or skill in decorating. The history of cosmetics is linked to hunting, fighting, religion, and superstition, eventually becoming associated with herbal extracts. These extracts, derived from plants, have roots that can be traced back to ancient texts such as the Bible, Vedas, and Upanishads [3]. Herbal extracts are derived from herbs that have historical significance in the Vedas, Bible, and Unani writings. The term "herbal cosmetics" refers to products that contain one or more herbal components, designed to provide specific cosmetic benefits, and are made with a range of approved cosmetic compounds [4].

Like any other cream, face serum is a concentrated blend of water or oil. Serums, often called concentrates, contain about ten times more active ingredients than creams, allowing them to tackle cosmetic issues more quickly and effectively. The numerous active compounds in face serums help treat various skin conditions. They consist of a mix of ingredients that not only target a specific skin issue but also address related concerns. In comparison to moisturizers, serums are lighter skincare formulations [4]. Herbal face serum primarily addresses fine lines, wrinkles, loss of skin elasticity, and uneven skin tones that occur due to aging. It utilizes a range of herbs, including ginseng, aloe Vera, and



ginkgo biloba, as well as antioxidant-rich ingredients like green tea and rosemary, all of which are carefully chosen for their capacity to enhance cellular renewal, boost collagen production, and promote overall skin vitality [5].

Serum contains various beneficial active ingredients and nutrients, including antioxidants, ceramides, and amino acids. This is why the face serum is always the most expensive item in a skincare kit. All products, whether moisturizers, anti-aging or anti-wrinkle treatments, or skin serums, should include antioxidants, cell-communicating compounds, and skin-identical ingredients. Although the skin is the body's largest and most protective organ, it can develop dry patches due to factors like UV exposure, pollution, or makeup, which may irritate or trigger allergic reactions if left on overnight. The face serum includes several substances, such as a neuropeptide, that are associated with improved barrier function and the reduction of fine lines and wrinkles [6].

The serum's small molecules enable profound skin penetration, thereby enhancing its efficacy in addressing specific skincare concerns, such as pigmentation and signs of aging. Face serums are highly concentrated skincare products, formulated with potent active ingredients, which render them effective in tackling specific cosmetic concerns. The absence of unnecessary additives and fillers in serums permits a more direct and efficient treatment of skin issues. Due to their thinner consistency, serums facilitate rapid absorption and deeper penetration into the skin, often boasting higher concentrations of active ingredients compared to creams. This characteristic makes serums ideally suited for nourishing and layering on the skin, providing targeted benefits and enhancing overall skin health [7].

OBJECTIVE

- i. Used to treat or giving therapeutic effect to skin
- ii. It maintains moisturizer and reduce dryness
- iii. Providing smoothing effects, maintain PH of skin
- iv. Face serum it contain a API with it suitable to all skin tone
- v. Fast absorbed in skin

THE HISTORY OF FACIAL SERUM

It is unsurprising that the precursors to modern serums originated from cattle placenta, horse blood, and egg albumin, given that a serum is defined as the clear, yellowish liquid produced by separating whole blood into its solid and liquid components after coagulation. To ensure the commercial viability of these products, oxyquinoline (and later parabens) ampoules were utilized to maintain their sterility. This method has since been employed for products with limited shelf life, where small quantities needed to be prepared and consumed promptly to prevent spoilage. During the 19th century, individuals placed significant emphasis on skincare, exercise, and hygiene. However, the use of zinc oxide for skin lightening often resulted in allergic reactions. The cost of hygiene products decreased, while their availability increased, making them more accessible to the masses [4].

SERUM:

It gets rapidly absorbed and easily penetrate into The deeper layers of the skin .Also has nongreasy Finish and intensive formula which contain high Concentration of active substances. It contains skin Smoothing ingredients which enhance skin texture And makes skin soft, silky smooth and fair.

The Formulation has good spreadability and makes the Pores appear smaller and increase moisture level [2].

Basics of Face Serum: Structure of the Skin

Aids in regulating temperature. Face serums are designed to provide a high concentration of active ingredients without extra additives. Their lighter consistency and lack of heavy oils improve absorption and penetration, making them effective for nourishing and layering on the skin. The emphasis on essential ingredients without emulsifiers ensures the optimal delivery of active agents, such as vitamins or botanical extracts [7].



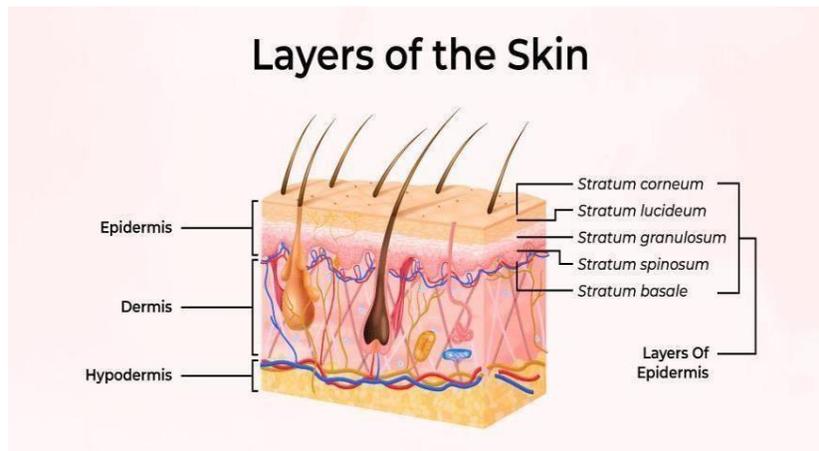


Fig: mechanism of drugs preparation through skin.

FUNCTION OF SKIN:

- 1) Reduces the harmful effects of UV light. [7]
- 2) It prevents moisture loss. [8]
- 3) Aids in regulating temperature. [9]
- 4) Functions as a sense organ. [7]
- 5) The skin acts as a barrier against harmful substances and protects against mechanical, thermal, and physical harm. [8]

KAY INGREDIENTS COMMONLY USED IN FACE SERUM

• Hyaluronic acid:

Hyaluronic acid is a naturally occurring sugar molecule in the skin that specializes in replenishing moisture to dry, parched skin [1]. The interfaces and peripheries of collagen and elastin fibers have been found to contain hyaluronic acid (HA), which helps maintain the proper structure of these proteins. HA has become one of the key ingredients in both cosmetic and nutricosmetic products. It is a component of nearly all products that offer skin protection, anti-aging benefits, and moisturizing properties. [10]

Management of acne and photodamage involves using hyaluronic acid (HA). In treating acne, HA hydrates and calms irritated skin, diminishes post-inflammatory hyperpigmentation, and promotes skin repair. For photodamaged skin, HA enhances texture and tone by restoring moisture, lowering oxidative stress, and aiding in dermal remodeling. It is frequently paired with antioxidants or retinoids for added benefits. [11]

• Vitamin C

This essential nutrient significantly contributes to skin health. It is a strong antioxidant that shields the skin from harmful free radicals resulting from stress and common environmental factors. Due to its numerous skincare benefits, Vitamin C, also known as ascorbic acid, is a key ingredient commonly found in face serums. Vitamin C serves as an antioxidant, helping to protect the skin from free radical damage that can lead to premature aging and dullness. When applied topically as a serum, Vitamin C reduces oxidative stress and promotes a more youthful appearance [12]. The effectiveness of Vitamin C serum depends on its concentration, but only up to 20%. Once maximum concentration is reached, its half-life in the skin is 4 days. A consistent reservoir of Vitamin C is essential for proper photoprotection and can be maintained through regular applications every 8 hours. Since UV light decreases tissue Vitamin C levels, topical Vitamin C should be applied after UV exposure, not before. [1]



• **Retinol (vitamin A):**

Retinol is one of the most clinically supported anti-aging ingredients available today. It firms and plumps the skin while addressing fine lines, sagging, and wrinkles. Retinol also enhances tissue inhibitors of metalloproteinases and inhibits matrix metalloproteinases. As a Vitamin A derivative, retinol is a powerful component in face serums, widely used in skincare products for its ability to promote skin renewal and rejuvenation. When applied topically, retinol converts to retinoic acid, which boosts collagen production, accelerates cell turnover, and helps lighten hyperpigmentation and dark spots. These properties make retinol an effective anti-aging ingredient for uneven skin texture, fine lines, and wrinkles. [12]

• **Salicylic acid**

Salicylic acid (SA), a beta-hydroxy acid (BHA), helps promote the skin's natural exfoliation process. It was originally derived from the bark of various plants, such as wintergreen and white willow. Today, salicylic acid is most commonly synthesized in a laboratory. [1] SA serums are a popular choice for those dealing with oiliness and shine throughout the day, as they help mattify the skin and control excess oil production. However, SA can cause skin irritation or dryness, especially when used in high concentrations or by individuals with sensitive skin. It is important to start with a lower concentration of SA and gradually increase usage to minimize potential side effects. Additionally, combining SA serums with moisturizers and sunscreen can help reduce dryness and sensitivity while optimizing results. SA is particularly effective for individuals with oily, acne-prone skin, as it helps reduce blackheads and whiteheads. [12]

• **Botanical Extracts And oil**

Botanical extracts help replenish the skin while providing numerous healing benefits. Rich in antioxidants, they are often incorporated into skincare formulations for their powerful antioxidant, anti-inflammatory, and antimicrobial properties. These highly concentrated natural ingredients work to protect, soothe, and restore the skin's overall health and vitality. [1]

BENEFITS OF FACE SERUMS

- Brightens and Evens Skin Tones
- Anti-Aging and Repair
- Soothes Irritated Skin
- Fights Acne and Oiliness
- Improves Texture and Firmness
- Absorbs quickly into the skin
- Improves Texture and Fairness
- Lightweight and Non-Greasy
- Deep Hydration
- Enhanced Absorption of Skincare Products

1. 2 TYPES OF FACE SERUMS ARE SHOWN IN THE FIGURE

- 1) Oil serum
- 2) Gel serum
- 3) Water based serum
- 4) Emulsion serum

1 Oil serum:

Creating an oil serum is the simplest process compared to other facial serums. It usually starts with a base of high-quality, quickly absorbed carrier oils, known as "dry" oils. These premium oils, which are part of the serum, not only



provide moisturizing and barrier-repairing properties but also contain polyphenols, essential fatty acids, and other compounds that the skin can absorb [2].



Fig.1.1 : Oil serum

2. Gel serum:

Gel serums provide a tightening sensation, giving customers a feeling that certain areas of their face are temporarily tightened or lifted. Since this formulation is water-based, it allows for the inclusion of remarkable, water-soluble, plant-based extracts. [13]



Fig 1.2 Gel serum

3. Water based serum:

Water-based serums are similar to gel serums, but they may have minimal or no gums and thickeners. These serums are optimal for delivering high-performance, hydrophilic plant extracts that are trapped against the skin beneath a cream or lotion. Applying an anti-aging face mist under an emulsion and then an oil is an effective method for achieving deep penetration of water-based compounds into the skin. To facilitate greater penetration of water-based ingredients into the skin, thereby delivering their high-performance ingredients deeper into skin layers, it is recommended to layer an anti-aging facial mist under an emulsion and then under an oil. The oil creates an occlusive barrier that enhances the penetration of ingredients. A facial serum typically contains a foundation of water-based ingredients, such as hydrosols, which possess soothing, skin-toning, and balancing properties. Additionally, skin-feel ingredients like humectants can be included to help the serum adhere to the skin. [3]



Fig 1.3 Water based serum



4. Emulsion serum:

An emulsion-based face serum is a high-performance moisturizer that effectively delivers potent ingredients to the skin, enhancing its barrier function. Comprised of two immiscible phases, typically water and oil, an emulsion is stabilized by an emulsifier that binds these phases together, maintaining a stable state. This formulation provides the optimal means of introducing active ingredients deep into the skin’s tissues. Despite the skin’s barrier function posing a significant challenge to penetration, an emulsion of oil and water offers the greatest potential for achieving this goal. By leveraging the moisturizing properties of the emulsion, the skin’s barrier function is reinforced, resulting in improved skin health. [12]



Fig 1.4: Emulsion serum

COMPARISON OF COSMETIC PRODUCT BASES

FEATURE	OIL BASED	GEL BASED	EMULSION	WATER BASED	PRESSD BALM SERUM
BASE	Oils derived from plants, nuts, or seeds.	Primarily waterbased.	A mixture of oil and water stabilized by emulsifiers.	Water mixed with a gelling agent.	A mixture of oil and water in a solid solid state.
TEXTURE	The texture is rich, silky, and viscous.	The substance is thin, fluid, and lightweight.	A lightweight, milky lotion that is thicker in consistency than a waterbased serum.	Thick and gellike, often providing a cooling effect.	A thick, concentrated balm that melts upon skin contact
ABSORPTION	Slower absorption leaves a nourishing sheen.	Absorbs quickly, but at a slower rate than water or gel-based products.	Absorbs quickly, but at a slower rate than water or gelbased products.	Absorbs at a moderate rate.	Melts gradually to create an occlusive layer that absorbs over time.
SUITABLE FOR	Dry, mature, and sensitive skin.	Primarily a combination skin type.	The skin type is primarily a combination.	Oily, a combination, and acne-prone skin type.	Extremely dry, mature, and dehydrated skin requiring intensive hydration.
BEST SEASON	A winter or dry climate	Year-round, it is easy to layer.	Availability	Summer or humid climate.	Winter



	characterized by low humidity and limited precipitation.		is possible yearround, especially in temperate climates.		or extremely dry climates.
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• ADVANTAGES: FEATURES

- 1) Enhances skin texture. [2]
- 2) Maintain skin hydration. [7]
- 3) Benefits of anti-aging. [8]
- 4) This product provides hydration and nourishment to the skin. [3]
- 5) This product cleanses and refreshes the skin. [13]

• DISADVANTAGES

- 1) Individuals with sensitive skin may experience irritation from serums due to their rapid absorption rate. (13)
- 2) Limited shelf life: The serum has a shorter shelf life than other skincare products, as it can degrade over time, particularly when exposed to air and light. [2]
- 3) Skin allergies to specific ingredients. [8]
- 4) The gel or liquid serum texture is unsuitable for individuals with chronic skin conditions, such as eczema or rosacea, which compromise the skin barrier. [3]
- 5) Sensitive skin may react with irritation, redness, or breakouts due to specific serum formulations. [8]

DIFFERENT TYPES OF FACIAL SERUM

1. Anti-oxidant serum
2. Hydrating serum
3. Brightening serum
4. Serum for Hyperpigmentation
5. Anti-Aging Serum
6. Serums for Sensitive Skin
7. Serums for Combination Skin
8. Serums for Oily Skin

1. Anti-oxidant serum:

These serums protect the skin from free radicals, such as UV rays and pollution, which can accelerate the aging process. Many antioxidants also offer additional benefits, including increased collagen production and reduced irritation. Consequently, they are among the most sought-after serums, as they address various skin concerns. Incorporating serums with a high antioxidant content can enhance skin strength. Notable antioxidants to consider include Vitamins C and E, as well as Resveratrol. It is advisable to use them in the morning for all-day protection, although they can also be applied at night. [14]

2. Hydrating serum:

Hydrating serums, which contain humectants like Hyaluronic Acid, attract and hold moisture in the skin, promoting softness and suppleness. Although they are typically suitable for daily use, applying them once a week is often advised for optimal results. These serums can be used in the morning or at night, based on personal preference. [6]



3. Brightening serum:

Brightening serums are designed to enhance skin tone and radiance by minimizing dullness and preventing discoloration. Rather than addressing existing dark spots, these serums concentrate on inhibiting the processes that lead to pigmentation. By addressing the root causes of uneven skin tone, they promote a more balanced and luminous complexion. [6]

4. Serum for Hyperpigmentation:

Uneven pigmentation can result from a range of factors, including natural skin tone, genetics, excessive sun exposure, stress, and environmental changes. Pigmentation issues commonly occur in areas such as under the eyes, around the mouth, and on the cheeks. To address these concerns, Vitamin C and Niacinamide serums play a crucial role. Niacinamide is a versatile and effective ingredient, suitable for all skin types, particularly in targeting pigmentation problems. Its beginnerfriendly nature makes it an ideal option for those new to skincare routines. Incorporating Niacinamide into your skincare regimen can effectively combat hyperpigmentation. [3]

5. Anti-Aging Serum:

Individuals surpass the age of 25, the body's natural collagen production declines, making it crucial to integrate anti-aging serums into one's skincare regimen as early as the 20s. While peptides provide mild anti-aging benefits and are commonly incorporated into various serums, tretinoin emerges as a potent, albeit potentially irritating, form of vitamin A, often regarded as the gold standard for anti-aging treatments. For a subtler approach, retinol and retinyl palmitate serve as gentler alternatives. Provided the serum contains vitamin A derivatives, it can be utilized both during the day and at night to achieve optimal results. [15]

6. Serums for Sensitive Skin:

Sensitive skin necessitates gentle care to prevent irritation and dryness. Vitamin C is advantageous, but it is advisable to choose Sodium Ascorbic Phosphate, a stable and milder form of vitamin C compared to L-Ascorbic Acid typically found in skincare products. Furthermore, serums that include hyaluronic acid and peptides, which are naturally produced by the body, are excellent options for sensitive skin because of their soothing and hydrating properties. [3]

7. Serums for Combination Skin:

Individuals with combination skin, which is marked by the presence of both dry and oily areas, can benefit from utilizing serums that are specifically formulated to address these contrasting skin needs. It is recommended to select serums that contain key ingredients such as vitamin C, hyaluronic acid, and peptides, as these components work synergistically to maintain skin balance and effectively address both dryness and oiliness. The combined action of these ingredients helps to keep the skin thoroughly nourished and harmonized. [16]

8. Serums for Oily Skin:

Oily skin frequently leads to acne breakouts, which may cause scarring. To effectively address this issue, prioritize calming the skin and reducing irritation and inflammation. Choose a gentle serum that helps manage pimples without exacerbating skin problems. A niacinamide-based serum is recommended as a daytime moisturizer, particularly in warmer months, as it offers nourishment without the heavy, greasy sensation typically linked to cream-based moisturizers. [17]

Effects of Face Serum

Concentrates deliver the skin with the necessary amount of active substances in a readily absorbable form. The potent active ingredients function similarly to creams, providing moisturizing, renewing, and lifting effects. The key difference lies in the fact that when concentrates are utilized correctly, noticeable results can be achieved more rapidly.



In addition to moisturizing, numerous face serums possess anti-aging properties, with ingredients such as retinol, Vitamin C, peptides, and growth factors that can stimulate collagen production, reduce the appearance of fine lines and wrinkles, and enhance skin firmness and elasticity. Consistent use of these serums can help minimize signs of aging and promote a more youthful complexion. Another significant benefit of face serum is their brightening effect, achieved through ingredients like AHAs, niacinamide, and Vitamin C, which can reduce hyperpigmentation, dark spots, and sun damage, resulting in a more radiant and even-toned complexion. Furthermore, some face serums offer exfoliating properties, with AHAs, BHAs, and enzymes working to remove dead skin cells and unclog pores, leaving behind smoother, more radiant skin with fewer imperfections. Certain face serums also possess calming and soothing properties, making them beneficial for individuals with sensitive or reactive skin, as ingredients like niacinamide, chamomile, and Aloe vera can help alleviate redness, irritation, and inflammation. [18]

HOW TO USE FACE SERUM



To utilize a face serum effectively, follow these steps as illustrated:

Step 1: Cleanse and dry your face by washing with a gentle cleanser to remove dirt, oil, or makeup, and then pat dry with a clean towel.

Step 2: Apply 2-3 drops of serum using a dropper, applying directly to your face or onto your fingertips.

Step 3: Gently pat the serum onto your face to facilitate absorption, avoiding harsh rubbing to allow natural absorption.

Step 4: Moisturize to lock in hydration by following up with your regular moisturizer, which helps seal in the serum's nutrients and maintain skin hydration.

The purpose of this visual guide is to demonstrate the correct skincare routine, educate users on proper serum application, and ensure optimal product absorption and effectiveness. LIST OF

MEDICAL AND COSMETICS PLANT USED IN HARBAL FACE SERUM FORMULATIONS

Sr. No	Name of plant	Chemical Constituents	Functional properties	Parts used in face serum preparation	Image of Plant
1.	Aloe vera	Polysaccharide, vitamin, minerals Enzyme Amino acid.	Moisturizing, Soothing, Antioxidant, Brightening, Cleansing	Aloe vera leaf gel [19]	 Fig: Aloe Vera
2.	Lavender	Flavonoids, Saponins	Anti-aging, Anti-	Roots [19]	



		Liquiritin Glycyrrhetic acid β-sitosterol.	inflammatory, Antio xidant, UV protection,		
					Fig: Lavender
3.	Rosemary	Carnosic acid Rosmarinic acid Carnosol Limonene Borne	Antioxidant Borneol Antifungal Antiviral Neuroprotective	Leaves [20]	
					Fig: Rosemary
4.	Liquorice	Geraniol, Tannin Caryophyllaceo Linalool Flavonoids	β-Antifungal, Skinsoothing Antioxidant Antimicrobial	Essential Oil Derived from Flowers [19]	
					Fig: Liquorice
5.	Manjistha	Tannins Saponins Flavonoids GlycosidesIridoids	Anti-inflammatory Antimicrobial	Dried roots [20]	
					Fig: Manjistha
6.	Green tea	Volatile oils Amino acids Caffeine	Flavonoids Antioxidant Antimicrobial Anti-inflammat	ory:Leaves [20]	
					Fig: Green tea
7.	Almond	Tannins Phenolic acids Flavonoids	Moisturizing & Hydrating, Skin Anti- aging Brightening & Soothing Calming	Oil [20]	
					Fig:Almond oil



8.	Coconut	Vitamins Compounds Minerals Phenolic Fatty Acids:	Cleansing Hydrating Antimicrobial Nourishing	Oil [21]	 Fig: Coconut Oil
9.	Ginseng	Amino acids Polycetylenes Ginsenosides Minerals Essential oils	Anti-inflammatory Soothing Hydrating Anti-aging	Roots & leaf [22]	 Fig: Ginseng
10.	Jojoba	Trace proteins and amino acids, Sterols, Tocopherols, Sterols	Antiaging, Soothing & Calming, Balancing, Nourishing	Oil [22]	 Fig: Jojoba
11.	Olive	Oleoresin	Antioxidant (antiaging), Antiinflammatory	Fruit And leaves [22]	 Fig: Olive oil
12.	Turmeric	Curcumin	Anti-inflammatory, Antioxidant, Brightening, Acne control	Powdar Rhizomes of Turmeric [23]	 Fig: Curcumin
13.	Calendula	Flavonoids, Triterpenoids Saponins Carotenoids	Antimicrobial, Healing & Soothing	Petals [24]	



					 <p>Fig: Calendula</p>
14.	Thyme	Tannins, Carvacro	Antioxidant, Astringent, Toning	Oil [25]	 <p>Fig: Thyme</p>
15	Peppermint	Tannins, Menthone	Oil control, Antioxidant	Oil [26]	 <p>Fig: Peppermint</p>
16.	Chamomile	Coumarin, Apigenin, Luteolin,	Anti-aging, brightening, antioxidantc	Flowers oil [27]	 <p>Fig: Chamomile</p>
17.	Shea Butter	Oleic acid, Cinnamic acid, Stearic acid	Softening & Smoothing, Cleansing, Antioxidant	Oil, shea Butter [28]	 <p>Fig: Shea Butter</p>
18.	Argon	Linoleic acid, Oleic acid	Brightening, Antio xidant	Argon Oil [28]	

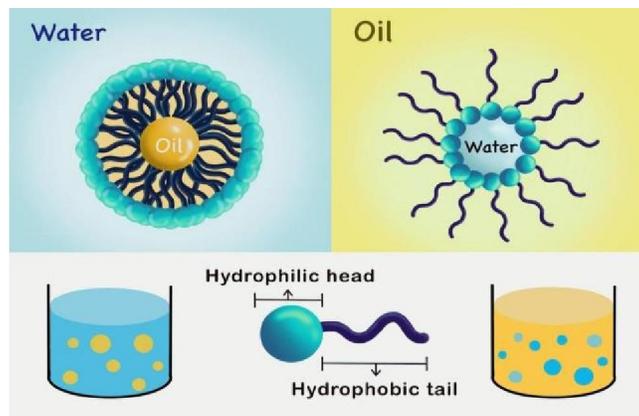


					 Fig:Argon
19.	Cilantro	Tannins, Flavonoids	Antiaging, Brightening	Leaves or coriander leave [29]	 Fig: Cilantron
20.	Bay leaf	Tannins, Cineole	Antioxidant	Leaf Oil	 Fig: Bay leaf

INNOVATIVE DELIVERY SYSTEM

Nanoemulsions

Nanoemulsions are submicron-sized colloidal systems, considered thermodynamically and kinetically stable, consisting of two immiscible liquids, such as water and oil, stabilized by a surfactant and co- surfactant. Various surfactants, including non-ionic, anionic, cationic, and zwitterionic, are used to form these single-phase systems. Nanoemulsions are categorized into oil-in-water, water-in-oil, and bi- continuous types, with transformations possible by altering components. Multiple emulsions, combining oil-in-water and water-in-oil emulsions, require both hydrophilic and lipophilic surfactants for stabilization.



Drawbacks of Nanoemulsion Drug Delivery Systems

1. A high concentration of surfactants and co-surfactants is required to stabilize the Nano-droplets.
2. There is a limited solubility capacity for substances with high melting points.
3. The surfactant must be non-toxic to be suitable for pharmaceutical applications.
4. The stability of nanoemulsion is influenced by environmental factors such as temperature and pH.

Components of Nanoemulsion

Emulsification is primarily influenced by several factors: (1) the type and concentration of oil, the aqueous phase, co-surfactants, and surfactants; (2) the ratios of surfactant to co-surfactant and oil to surfactant; (3) the pH and temperature of the environment; and (4) various physicochemical parameters, including lipophilic, hydrophilicity, and the pKa coefficient of the drug.

Oil phase Serum

The selection of a suitable oil phase is crucial as it directly controls the passage of other nanoemulsion components, particularly in oil-in-water nanoemulsions. Generally, the oil with the highest possible solubility with the drug candidate is preferred as the oil phase in nanoemulsion formulation. However, combining maximum solubility and emulsification properties into a single oil component poses a significant challenge. It is widely recognized that oils with exceptionally long hydrocarbon chains, such as soybean oil, are difficult to emulsify.

Aqueous phase

ingredients with modern formulation techniques to deliver highly concentrated active compounds deep into the skin. Their antioxidant, antiinflammatory, and regenerative properties make them effective for improving hydration, elasticity, and overall skin texture. Although natural actives may present challenges such as higher cost and lower stability, herbal serums remain safer and more skin-compatible than many synthetic alternatives. With growing demand for natural and scientifically supported skincare, herbal face serums hold strong potential for continued innovation and wider application in cosmetology.

Surfactant and co-surfacts

To achieve a nanoemulsion, a co-surfactant or amphiphilic short-chain molecule is often necessary to supplement the surfactant, as it alone may not sufficiently reduce the oil-water interfacial tension. The formation of liquid crystalline phases is influenced by the surfactant film's rigidity. Co- solvents, such as glycerol and propylene glycol, enhance the solubilization power of the oil and are typically used in high concentrations to maximize hydrophilicity in nanoemulsion production. Additionally, co-surfactants like PEG 400 can be utilized to facilitate this process

2 NONOCOSMECEUTICE

A nanocosmeceutical face serum is a lightweight skincare product formulated with nano-sized active ingredients that penetrate deeper into the skin. Using nano-carriers such as nanoemulsions, liposomes, niosomes, and solid lipid nanoparticles, these serums enhance absorption, stability, and effectiveness of ingredients like vitamins, antioxidants, and herbal extracts. They provide quick action, improve hydration, skin brightness, anti-aging effects, and deliver active compounds more efficiently than regular serums.

Cosmeceuticals bridge the gap between pharmaceuticals and personal care products, offering measurable therapeutic benefits for the skin. These products have diversified to address various concerns, including hair and body issues, and are utilized to treat a range of conditions such as hair damage, wrinkles, photoaging, skin dryness, dark spots, uneven complexion, and hyperpigmentation.



3 LIPOSOMES

Liposomes are microscopic, spherical vesicles composed of phospholipids that replicate the structure natural cell membranes. In facial serums, they function as sophisticated delivery systems, encapsulating active ingredients such as vitamins, antioxidants, and herbal extracts.

Due to their miniature size and biocompatible composition, liposomes are capable of penetrating deeper layers of the skin, safeguarding sensitive ingredients from deterioration, and releasing them in a regulated manner. This augmentation enhances the serum's absorption, stability, and efficacy, resulting in smoother, more hydrated, and radiant-looking skin.

4 NIOSOMES

Niosomes are microscopic, vesicular carriers composed of non-ionic surfactants and cholesterol, which facilitate the encapsulation and deeper skin penetration of active ingredients.

In the context of face serums, niosomes serve to:

- Enhance the penetration of active ingredients into the deeper layers of the skin
- Improve the stability of vitamins, antioxidants, and herbal extracts
- Provide a controlled release mechanism, resulting in longer-lasting effects
- Reduce irritation by protecting sensitive active ingredients
- Boost hydration and skin nourishment

The benefits of utilizing a niosome-based face serum include:

- Enhanced absorption of active ingredients
- Increased effectiveness of the active ingredients
- Soft, smooth, and hydrated skin
- Improved skin texture and glow

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