



Formulation And Evaluation of Anti-Aging Face Serum Containing Bakuchiol (Retinols Alternative)

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ABSTRACT- This study evaluates the efficacy and safety of a bakuchiol face serum containing jojoba oil as a novel anti-aging formulation. Bakuchiol, a natural retinol alternative, was formulated with jojoba oil to leverage its moisturizing and antioxidant properties. The serum's effects on skin elasticity, fine lines, wrinkles, and skin hydration were assessed in a clinical trial. Results showed significant improvements in skin elasticity, reduced appearance of fine lines and wrinkles, and enhanced skin hydration. The formulation was well-tolerated, with no adverse reactions reported. These findings suggest that the bakuchiol face serum containing jojoba oil is a promising anti-aging solution, offering a natural and effective alternative to traditional retinol-based products. Further studies are warranted to explore the long-term benefits and potential applications of this formulation.

KEYWORDS: Alternative of retinol, Bakuchiol, Cosmetic, anti-aging, anti-inflammatory, anti-bacterial, face serum, formulation, Evaluation.

INTRODUCTION: The examination of human skin is a crucial field for research and development in the fields of dermatology, toxicology, pharmacology, and cosmetology. This is because it allows for the evaluation of exogenous drugs' effects, interactions, absorption mechanisms, and/or toxicity towards various cutaneous structures. People have recognized the value of aesthetics from the dawn of time, and society has grown to value appearance as well as health. The term cosmetic originates from Greek and meaning "to adorn," as in adding something ornamental to a person or something. Studying and using aesthetic treatments is known as cosmetology. In addition to studying cosmetics and how they are applied, it is an art or science to enhance and beautify the skin, nails, and hair. To get the desired result, a skin care product must be able to carry the potent ingredient into the skin. To transfer the valuable active ingredient into the skin and avoid using dangerous chemicals to get results right away, face serum is the solution. Serums are skin care products with a moisturizing composition that can penetrate deeper into the skin and release active components^[1,2,3,4,5] A good quality facial serum can give your skin a smoother, firmer texture, reduce pore size and increase moisture levels. All these products - moisturizer, anti-wrinkle, anti-aging or face serum - should contain antioxidants, a cell-interacting chemical and a skin-like component. These ingredients are essential

for all skin types to achieve the healthiest complexion possible. Gel and liquid preparations are best for oily and combination skin; Serum and light cream are best for normal and dry skin; and emollient creams and moisturizers are best for very dry/very dry skin. [6,7] The components of healthy/great skin are the same for everyone, regardless of product, formula or personal taste. Texture depends on skin type. Although the largest and most protective organ of the body, the skin can sometimes appear due to several reasons, including exposure to UV rays, pollutants and makeup worn at night. you may have irritation allergic reactions. Bakuchiol (pronounced buh-KOO-chee-all) is a plant-derived compound extracted from the seeds and leaves of the Psoralea corylifolia plant, also known as the Babchi plant. Celebrated for centuries in traditional Ayurvedic and Chinese medicine, Bakuchiol is now making waves in modern skincare as a gentle, effective alternative to retinol. While retinol is known for its powerful anti-aging benefits, it often causes dryness, redness, and sensitivity especially in sensitive skin types. Bakuchiol, on the other hand, delivers similar benefits without harsh side effects. It is non-irritating, non-photosensitizing, and suitable for all skin types including sensitive and acne-prone skin. [8,9,10,11]

TOPICAL DRUG DELIVERY SYSTEM:

Topical drug delivery systems are a type of localized drug delivery system used to treat cutaneous disorders by delivering therapeutic chemicals via the skin. Usually, localized skin infections are treated with these methods. There are several forms of the formulas available, including solid, semisolid, and liquid. The skin plays a key role in improving medication absorption when the medicinal ingredient in the solution has a favourable lipid/water partition coefficient and is not an electrolyte. Although derma treatments come in a variety of formulations and consistency ranges, semisolid dosage forms are the most widely used type. [12,13]

Advantages of topical drug delivery system:

1. Avoiding the metabolism of main passes
2. Easy to apply and very convenient to use.
3. Simple way to stop taking the drugs.
4. Medication sent at a certain location with preference.
5. There will be no gastrointestinal incompatibility.
6. Offers a limited therapeutic window and a short biological half-life for medication use.
7. Enhanced adherence from patients.
8. Self-care with medicines.
9. It offers efficacy at low dosages and with continuous medication administration.
10. Reduces the chance of medication level and danger fluctuations. [14,15,16,17]

HISTORY OF FACE SERUM:

The origins of herbal facial serums may be traced back hundreds of years, to the eras of ancient Egypt, Greece, and China. These cultures employed oils and extracts from plants as skincare products. For example, oils like olive, almond, and sesame were widely used to moisturize and preserve skin in ancient Egypt. Herbal remedies with anti-inflammatory and antioxidant qualities, such as ginseng and green tea, were popular in China. Herbal medicines developed over time and were included into beauty rituals of many civilizations. As consumers look for natural alternatives to synthetic skincare products, the popularity of herbal face serums has increased in the modern day. These formulas frequently contain substances like rosehip oil, jojoba oil, and essential oils recognized for their nourishing and revitalizing benefits on the skin. [18,19,20]

Ideal Qualities of Serum

- Anti-aging properties: Reduces fine lines, wrinkles, and loss of skin elasticity
- Antioxidant-rich: Protects skin from environmental damage and oxidative stress
- Moisturizing: Hydrates and nourishes the skin, keeping it soft and supple
- Natural retinol alternative: Provides anti-aging benefits without irritation, suitable for sensitive skin [21,22,23]

Product Characteristics:

- Plant-based ingredients: Derived from natural sources, such as Babchi seeds and Jojoba oil
- Non-comedogenic: Won't clog pores, making it suitable for acne-prone skin
- Suitable for all skin types: Gentle and effective on sensitive, dry, oily, and combination skin [24,25]

Advantages:

- Stimulates collagen production: Enhances skin cell turnover, improving skin texture and tone
- Fades pigmentation: Helps reduce age spots and hyperpigmentation
- Calms inflammation: Soothes and protects the skin from environmental stressors
- Hydrating: Deeply moisturizes and nourishes the skin, reducing dryness and irritation [26,27]

TYPES OF SERUM:**1.Oil Serum:**

fig.1. oil serum

The serum made of oil Out of all the face serums; the oil serum is the easiest to prepare. Usually, it begins with a base consisting only of high-quality, quickly absorbing carrier oils, sometimes known as "dry" oils. The premium oils included in the serum not only have moisturizing and barrier-repairing properties, but also contain polyphenols, essential fatty acids, and other compounds that the skin may be able to break down. [28,29]

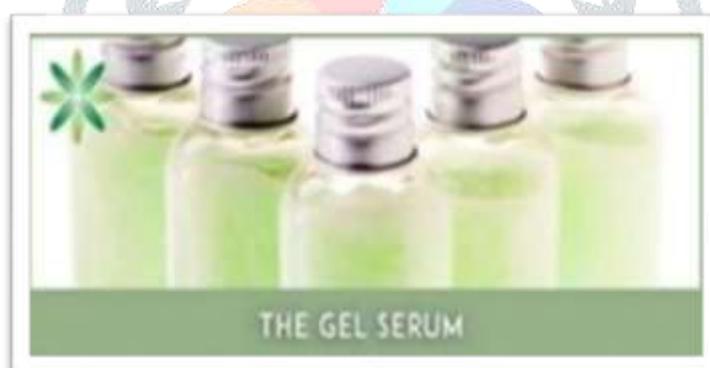
2.The Gel Serum:

fig. 2. gel serum

Gel serums give the skin a "tightening" feeling that makes your customer's skin appear temporarily lifted or tightened in specific facial areas. Because this formulation is water based, the gel serum gives you the opportunity to incorporate some amazing water-based (hydrophilic) plant extracts. [30]

3. The Water Based Serum:

Gel and water-based serums are similar, albeit the former may or may not contain thickeners and gums. A water-based face serum would be used to apply high-performance hydrophilic plant extracts that are trapped against the skin beneath a cream or lotion. Underneath an anti-aging facial mist greater skin penetration of water-based chemicals, providing them high performance emulsion and then beneath an oil is the best method for encouraging deeper within the skin's layers. An occlusive barrier that prevents penetration will be formed by the oils. [31]



fig.3. water based serum

4. The Emulsion Serum:

An emulsion-based face serum is a type of moisturizer that delivers high-performance ingredients to the skin and fortifies the skin's barrier function. An emulsion is made up of two "immiscible" phases-phases that don't want to

mix, such as water and oil. Water and oil are bound together and kept in a stable form by the application of an emulsifier. Using an emulsion gives you the best possibility of introducing potent actives deeper into the skin's tissues.

Given the skin's barrier function, it is highly difficult for any cosmetic component to penetrate the dermis, yet an oil and water mixture is best suited to accomplish this remarkable feat. The skin's barrier function will be strengthened by the emulsion's moisturising characteristics. [31,32]



fig.4. emulsion serum

5. Pressed Balm Serum:

A balm serum contains active ingredients that are oil-soluble (lipophilic) and may benefit the skin in addition to the traditional balm base of butters, waxes, and oils. The occlusive barrier that the butters and waxes create on the skin nourishes and moisturizes it, enabling the active ingredients in the pressed serum to work. Dozens of fascinating, one-of-a-kind butters and waxes can be blended with thousands of wonderful plant oils to create a balm serum. [33,34]



fig.5. pressed balm serum

DRUGS AND EXCIPIENTS PROFIL

1. Bakuchiol

It is a chemical constituent derives from *Psoralea corylifolia* (Bakuchi) plant.



fig 6. psoralea corylifolia



fig 7. bakuchiol

- **Kingdom:** Plantae
- **Order:** Fabaceae
- **Family:** Asphodelaceae
- **Subfamily:** Papilionaceae
- **Genus:** Psoralea

- **Species:** Corylifolia
- **Botanical name:** Psoralea corylifolia Linn [35,36]

Chemical Constituents of Bakuchi:

Bakuchi (*Psoralea corylifolia*) contains a variety of chemical constituents, including furanocoumarins, flavonoids, and meroterpenes. Key active compounds include psoralen, isopsoralen, **bakuchiol**, and bavachinin. Other constituents include raffinose, corylifolean, psoralidin, isopsoralidin, triacontane, and various chalcones, isoflavones, and coumarins. [37,38]

Uses of Bakuchiol

1. **Anti-aging:** Reduces fine lines, wrinkles, and skin discoloration.
2. **Skin elasticity:** Improves skin elasticity and firmness.
3. **Antioxidant properties:** Protects skin from environmental stressors.
4. **Collagen production:** May help stimulate collagen production.
5. **Skin tone evening:** Can help even out skin tone. [39,40]

2. Jojoba Oil



fig 8. jojoba oil

- Use as Carrier Oil in Face Serum

Characteristics:

1. **Lightweight texture:** Jojoba oil is easily absorbed into the skin.
2. **Moisturizing properties:** Jojoba oil helps hydrate and nourish the skin.
3. **Antioxidant properties:** Jojoba oil contains antioxidants that help protect the skin from environmental stressors.
4. **Stability:** Jojoba oil is relatively stable and less likely to oxidize. [41,42]

Benefits for Bakuchiol Face Serum:

1. **Enhanced absorption:** Jojoba oil's lightweight texture can help improve bakuchiol absorption.
2. **Moisturizing benefits:** Jojoba oil can complement bakuchiol's anti-aging benefits with moisturizing properties.
3. **Antioxidant synergy:** Jojoba oil's antioxidants can work synergistically with bakuchiol's antioxidant properties. [43,44]

Uses in Face Serum

1. **Moisturizing and hydrating:** Jojoba oil can help moisturize and hydrate the skin, reducing the appearance of fine lines and wrinkles.
2. **Antioxidant protection:** Jojoba oil's antioxidant properties can help protect the skin from environmental stressors and promote overall skin health. [45,46]

3. Tween 20



fig 9. tween 20

- Tween 20, also known as Polysorbate 20, is a non-ionic surfactant and emulsifier commonly used in various industries.

Properties:

1. Emulsification: Tween 20 helps mix oil and water-based ingredients.
2. Solubilization: Tween 20 can solubilize lipophilic (oil-soluble) ingredients in aqueous solutions.
3. Stabilization: Tween 20 can stabilize emulsions and prevent separation.

Applications:

1. Pharmaceuticals: Tween 20 is used as an excipient in some pharmaceutical formulations.
2. Cosmetics: Tween 20 is used in skincare and haircare products as an emulsifier and solubilizer.
3. Food industry: Tween 20 is used as a food additive and emulsifier.

Benefits:

1. Improved stability: Tween 20 can improve the stability of formulations.
2. Enhanced solubility: Tween 20 can enhance the solubility of lipophilic ingredients.

Potential uses in bakuchiol formulation:

Tween 20 could be used to solubilize bakuchiol in aqueous solutions or to stabilize emulsions containing bakuchiol. ^[47,48]

4. Glycerine



fig 10. glycerine

Glycerine (also called glycerol) is a humectant, meaning it attracts water to the skin. It's commonly used in skincare due to its excellent moisturizing properties.

Role of Glycerine in Bakuchiol Serum:

1. Hydration Boost: Bakuchiol, while gentler than retinol, can still cause mild dryness in some skin types. Glycerine helps counteract this by drawing moisture into the skin.
2. Skin Barrier Support: It helps maintain the skin's moisture barrier, which is essential when using active ingredients like bakuchiol.
3. Enhances Absorption: Glycerine can improve the absorption of other ingredients, helping bakuchiol penetrate more effectively.
4. Smooth Texture: It gives the serum a smoother, more pleasant texture for application. ^[49,50]

General use:

1. Attracts and retains moisture: Glycerin attracts water from the air and retains it in the skin, leaving it feeling soft, supple, and hydrated.
2. Hydrates the stratum corneum: Glycerin penetrates the stratum corneum (the outermost layer of the skin) and provides hydration, improving skin elasticity and firmness.
3. Reduces trans-epidermal water loss (TEWL): By repairing the skin's natural barrier, glycerin reduces TEWL, minimizing moisture loss and preventing dryness. ^[51]

5. Sodium Benzoate

fig 11. sodium benzoate

➤ Used as Preservative**Benefits**

1. Preserves product stability: Prevents microbial growth, ensuring the product remains safe and effective.
2. Extends shelf life: Inhibits the growth of microorganisms, extending the product's shelf life.

Considerations

1. Concentration: Typically used at concentrations between 0.1-1.0%.
2. Skin sensitivity: Some individuals may experience skin irritation or allergic reactions.

Combination with Bakuchiol

1. Protects active ingredients: Sodium benzoate helps preserve the stability and effectiveness of bakuchiol.
2. Ensures product safety: Prevents microbial contamination, ensuring the product remains safe for use.

Uses

1. Cosmetics and personal care: Used in a wide range of products, including face serums, creams, and lotions.
2. Concentration: Typically used at concentrations between 0.1-1.0% ^[52]

INGREDIENTS AND THEIR CATEGORY

table 1: ingredients and category

EXTRACTION OF BAKUCHIOL:

The coarse powder of *P. corylifolia* L. (10 g) was extracted with different solvents (ethanol, methanol, acetone, petroleum ether, and dichloromethane) in drug: solvent ratio of 1:14 by ultra-sonication method for 45 min with input power of 220 V and heating power of 550 W, equipped with time and temperature controller. The extracts obtained were concentrated under reduced pressure to obtain brownish coloured sticky mass. The extract was evaporated to dryness to get brownish extract, which was weighed and subjected to further quantification. ^[53]

1. Collection of Seeds

SR.NO.	INGREDIENTS	CATEGORY
1	Bakuchiol	Anti-Aging
2	Jjoba Oil	Antioxidant, Carrier oil
3	Tween 20	Emulsifying Agent
4	Glycerine	Hydrating Agent
5	Sodium Benzoate	Preservative

fig 12. seeds of p. corylifolia

2. Extraction of Bakuchiol



fig 13. extraction by ultrasonic process

3. Filtration



fig 14. filtration

PREPARATION OF SERUM:

Equipment Needed:

1. Beakers (2 for oil and water phase)
2. Magnetic stirrer or hand whisk
3. Digital scale
4. Dropper or pipette
5. Clean container or bottle for storage

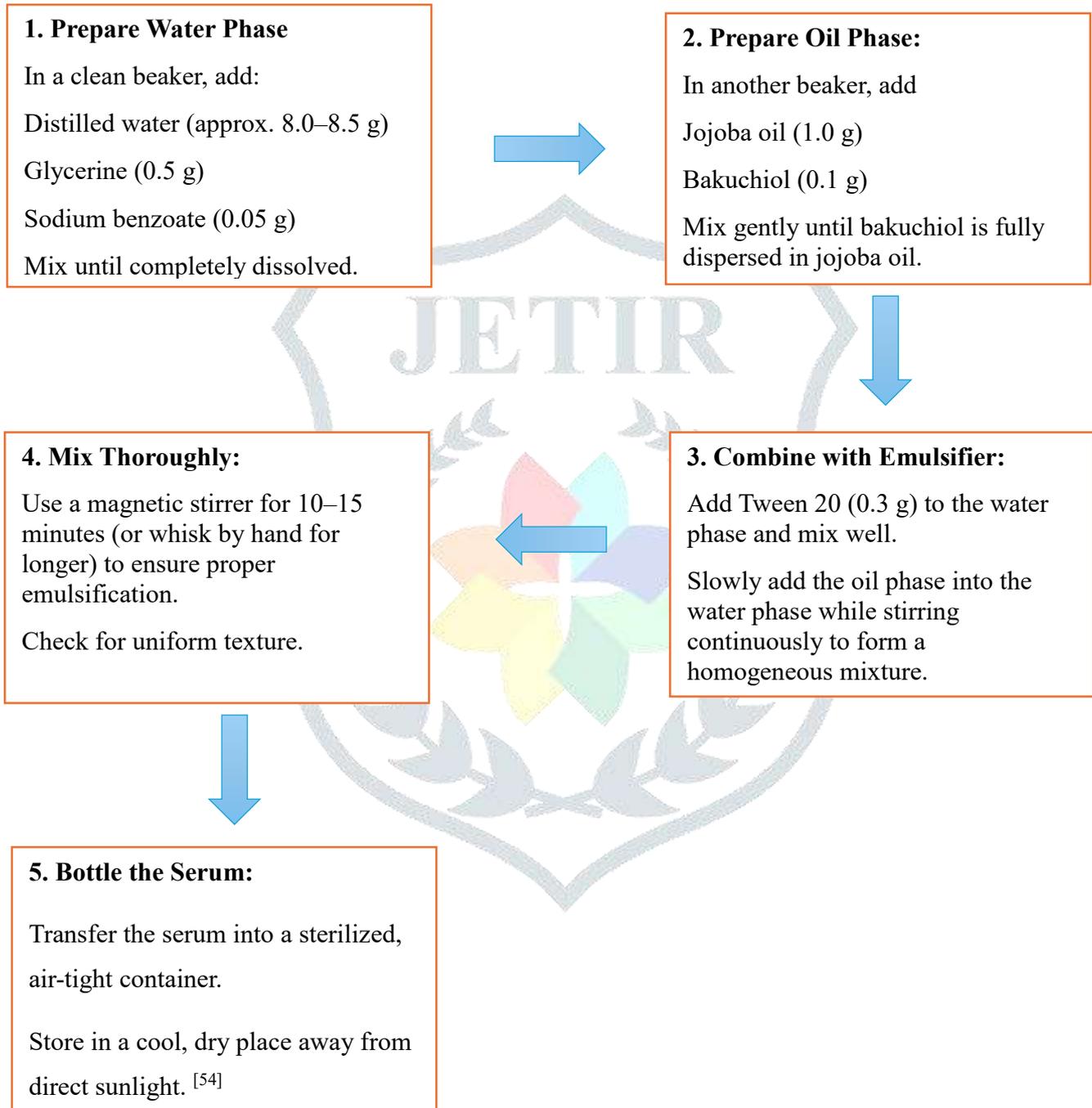
Procedure:**FORMULATION TABLE:**

table 2: formula table

Sr. No.	Ingredients	Batch 1	Batch 2	Batch 3
1	Bakuchiol	1%	1%	1%
2	Jojoba Oil	10%	15%	10%
3	Glycerine	5%	30%	35%
4	Tween 20	3%	3%	3%

5	Sodium Benzoate	1%	1%	1%
6	Distilled Water	80%	50%	50%

➤ Batch Number 2 is an Ideal Batch.

EVALUATION OF FACE SERUM:

table no.3 evaluation parameters

Sr no.	Evaluation Parameters	Result
1	Physical Evaluations Colour and Appearance Odour Consistency Homogeneity and Texture	Light White Characteristics Smooth, Semiliquid Good, Smooth
2	Washability	Easily Washable
3	Phase Separation	25-1000°C after 24 hrs
4	Cyclical Temperature Test	Changes According to room temperature
5	pH	5

RESULT AND DISCUSSION

1. Physical Evaluation

i. Colour and Appearance

Visual observations were made of the face serum's hue and look, which was light white.

ii. Odour

By applying preparation to the hand, the scent of the formulation was tested to ensure that it had a characteristic Odor.

iii. Consistency

Visual inspection revealed that the consistency of face serum was smooth and semi-liquid.

iv. Homogeneity and Texture

A uniform distribution of the extracted material was used in the formulation. The lack of any particle matter and the product's tactile consistency served as visual cues that the preparation was homogeneous.

2. Washability

To determine if the formulation was easily washable, a tiny amount of the formulation was applied to the hand and then washed with tap water.

3. pH

pH of is evaluated by pH paper. The skin has an acidic range, and the pH of the skin serum should be in the range of 4.1-6.7. The pH of formulation was found to be 5.

CONCLUSION:

In the ever-evolving world of skincare, the demand for products that deliver visible results without compromising skin health continues to surge. Among the most sought-after benefits in this realm are anti-aging and anti-bacterial properties, both of which address widespread concerns across diverse skin types and age groups. The combination of Bakuchiol, Jojoba Oil, and Glycerine in a face serum represents a modern, evidence-backed solution that marries the best of nature and science.

Bakuchiol: A Natural Retinol Alternative

Bakuchiol has emerged as a powerful alternative to retinol—a compound long celebrated for its anti-aging benefits but frequently criticized for its irritative potential. Derived from the seeds and leaves of the *Psoralea corylifolia* plant, Bakuchiol offers a plant-based route to rejuvenation without the common side effects associated with retinoids such as redness, peeling, or photosensitivity.

Scientific studies have shown that Bakuchiol stimulates collagen production and promotes cell turnover. These effects lead to a visible reduction in fine lines, improved skin texture, and better skin elasticity. Unlike retinol, however, Bakuchiol is gentle enough for sensitive skin and can be used during the day without the risk of photodamage. Additionally, Bakuchiol has shown promising anti-bacterial and anti-inflammatory properties, making it suitable for acne-prone skin and for preventing infections that may exacerbate skin aging or discoloration.

Jojoba Oil: A Moisturizing Powerhouse with Antimicrobial Benefits

Jojoba Oil, derived from the seeds of the *Simmondsia chinensis* plant, is chemically similar to human sebum. This unique similarity allows it to balance oil production, deeply moisturize the skin, and enhance the absorption of active ingredients without clogging pores. Jojoba Oil's emollient properties soften and smooth the skin, reducing the appearance of fine lines and supporting the skin barrier.

What makes Jojoba Oil especially valuable in an anti-aging and anti-bacterial formulation is its rich content of vitamin E and essential fatty acids, both of which nourish and protect the skin. Additionally, its inherent antimicrobial and antifungal properties contribute to a cleaner, more resilient skin surface, reducing the risk of breakouts, infections, and inflammation—all of which can accelerate skin aging. When incorporated into a serum, Jojoba Oil acts not only as a delivery vehicle for active ingredients but also as a protective shield, locking in moisture and forming a breathable barrier that enhances skin repair and regeneration.

Glycerine: A Humectant for Deep Hydration

Glycerine, a tried-and-true ingredient in skincare, serves as the cornerstone for maintaining optimal skin hydration. As a humectant, Glycerine draws moisture from the environment into the skin and retains it in the outer layers. This intense hydration is critical for maintaining plumpness, elasticity, and a youthful glow.

In aging or dry skin, the natural moisture barrier is often compromised, leading to increased trans epidermal water loss and susceptibility to irritation. Glycerine not only replenishes lost moisture but also strengthens the skin's defensive layers, making it more resilient to environmental stressors like pollution, UV rays, and bacteria. Moreover, hydrated skin enhances the effectiveness of other active ingredients, ensuring that Bakuchiol and Jojoba Oil can perform optimally.

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