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Review Article

Natural And Synthetic Active Ingredient in Skin Care Cosmetics

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ABSTRACT

Cosmetics are substances used to cleanse, nourish, and beautify the skin, available in various forms to address specific skin concerns. The primary goal of cosmetics is to beautify, clean, and alter appearance, enhancing skin and hair health. The skin's structure consists of two main layers: the epidermis and dermis. Cosmetic ingredients like aloe vera, turmeric, and neem offer antioxidant, anti-inflammatory, and antimicrobial benefits. Salicylic acid and glycolic acid are effective in treating acne and promoting skin renewal. Moisturizers hydrate and protect the skin, while sunscreens prevent premature aging. Face wash and exfoliators maintain skin cleanliness and texture. Effective skincare routines can boost confidence and promote healthy, radiant skin. Cosmetics play a significant role in modern skincare and beauty routines. By understanding skin types and concerns, individuals can choose products tailored to their needs. A consistent skincare routine leads to healthier, more radiant skin. Cosmetics can enhance skin health, appearance, and overall well-being. With the right products and routine, individuals can enjoy healthy, glowing skin and improved self-esteem. Overall, cosmetics are essential for achieving and maintaining healthy, beautiful skin. By leveraging the benefits of various cosmetic ingredients and products, individuals can address specific skin concerns and achieve their skincare goals.

INTRODUCTION

Cosmetics can be defined as the materials of various sources, technically compounded substances which can be used to cleanse, nourish, and moisturizes the skin of the face and other parts of the body. They can be used in various forms to alleviate skin problems, modify imperfections and beautify the skin [1]. The word cosmetic was obtained from "Kosm Tikos," a Greek word, means having the influence, arrange, and ability in decorating [2]. Cosmetics are the effective products used broadly all over the world for sustaining and brushing general outlook of the face and other body parts for example hand, mouth, finger, hair, lip, and eye. Cosmetics are available

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in numerous formulations which include creams, face pack, lotions, powder, shampoos, conditioners and for radiating, smooth and nourished skin and hair, positively count for an attractive woman and good-looking man.[3] Cosmetics are developed to reduce wrinkles, fight acne and to control oil secretion. For various types of skin ailments formulations like skin protective, sunscreen, anti-acne, anti-wrinkle and anti-aging are designed using varieties of materials, either naturals plant and animal base or synthetic.[4] The primary goal of cosmetics is to be rubbed, poured sprinkled on the skin for the purpose of beautifying, cleaning and altering the appearance improve the look of the face and other body parts by reducing the likelihood of skin problems. It's used to Enhance or maintain skin and hair health. Cosmetics make men and women seem more attractive, impressive.

❖ Structure Of the Skin:

The skin is the largest organ in the body and has a surface area of about 1.5–2 sqm in adults. In certain areas, it contains accessporory structures, glands, hair and nails. There are two main layers the epidermis, which covers the dermis between the skin and underlying structures is a subcutaneous layer composed of areolar tissue and adipose (fat) tissue.

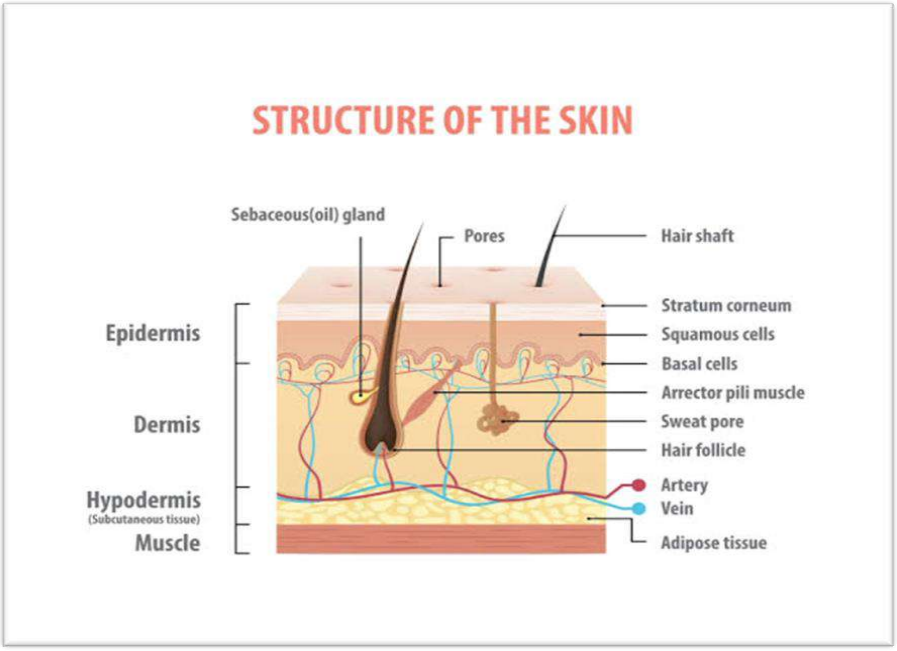

Fig No 1. Structures of Skin

➢ Epidermis:

This is the most superficial layer and is composed of stratified keratinised squamous epithelium. It varies in thickness, being thickest on the palms of the hands and soles of the feet. There are no blood vessels or nerve endings in the epidermis, but its deeper layers are bathed in interstitial fluid from the dermis , which provides oxygen and nutrients, and drains away as lymph .There are several layers (strata) of cells in the epidermis which extend from the deepest germinative layer to the most superficial stratum corneum (a thick layer) . Epidermal cells originate in the germinative layer and undergo gradual change as they progress towards the skin surface. The cells on the surface are flat, thin, non-nucleated, dead cells, in which the cytoplasm has been replaced by the fibrous protein keratin. The surface cells are constantly rubbed off and replaced by those beneath.

Complete replacement of the epidermis takes about a month. Hairs, secretions from sebaceous glands and ducts of sweat glands pass through the epidermis to reach the surface. Upward projections of the dermal layer, the dermal papillae anchor this securely to the more superficial epidermis and allow passage and exchange of nutrients and wastes to the lower part of the epidermis. Melanin, a dark pigment derived from the amino acid tyrosine and secreted by melanocytes in the deep germinative layer, is absorbed by surrounding epithelial cells. The amount is genetically determined and varies between different parts of the body. Between people of the same ethnic origin and between ethnic groups. The number of melanocytes is fairly constant so the differences in colour depend on the amount of melanin secreted. It protects the skin from the harmful effects of ultraviolet rays in sunlight. Exposure to sunlight promotes synthesis of melanin.

- Normal saturation of haemoglobin and the amount of blood circulating in the dermis give white skin its pink colour. When oxygen saturation is very low, the skin may appear bluish (cyanosis).

- Excessive levels of bile pigments in blood and carotenes in subcutaneous fat give the skin a yellowish colour.

➢ **Dermis:**

The dermis is tough and elastic. It is formed from connective tissue and the matrix contains collagen fibre interlaced with elastic fibres. Rupture of elastic fibres occurs when the skin is overstretched, resulting in permanent striae, or stretch marks, that may be found in pregnancy and obesity. Collagen fibres bind water and give the skin its tensile strength, but as this ability declines with age, wrinkles develop. Fibroblasts and Mast cells are the main cells found in the dermis. Underlying its deepest layer is the subcutaneous layer containing areolar tissue and varying amounts of adipose (fat) tissue. The structures in the dermis are:

- blood and lymph vessels
- sensory nerve endings
- sweat glands and their ducts

➢ **Sebaceous Glands:**

These consist of secretory epithelial cells derived from the same tissue as the hair follicles. They secrete an oily antimicrobial substance, sebum, into the hair follicles and are present in the skin of all parts of the body except the palms of the hands and the soles of the feet. They are most numerous in the scalp, face, axillae and groins. In regions of transition from one type of superficial epithelium to another, such as lips, eyelids, nipple, labia minora and glans penis, there are sebaceous glands that are independent of hair follicles, secreting sebum directly onto the surface. Sebum keeps the hair soft and pliable and gives it a shiny appearance. On the skin it provides some water-proofing and acts as a bactericidal and fungicidal agent, preventing infection. It also prevents drying and cracking of skin, especially on exposure to heat and sunlight. The activity of these glands increases at puberty and is less at the extremes of age, rendering the skin of infants and older adults prone to the effects of excessive moisture. 7-Dehydrocholesterol is a lipid-based substance in the skin and is converted to vitamin D by sunlight. This vitamin is used with calcium and phosphate in the formation and maintenance of bone. (5).

➢ **Functions of the skin:**

- Protection
- Regulation of body temperature
- Cutaneous sensation
- Absorption

- Excretion
- Formation of vitamin D.

❖ **Skin Care Cosmetics Includes:**

➢ **Moisturizer**:

The term "moisturizer" was popularized by marketers to highlight a product's skin-hydrating properties. While often used interchangeably with "emollient," these terms have distinct meanings. Emollients are lipids that fill gaps between skin cells, enhancing hydration, smoothness, and flexibility.

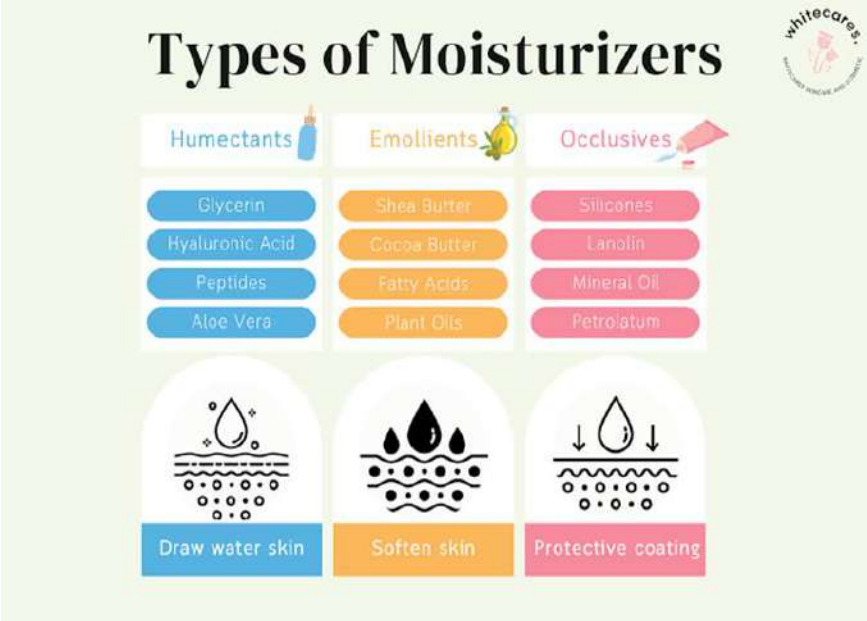

Fig No. 2 Types of Moisturizers

There are different types of moisturizers, including

- Emollients: Lipids that fill gaps between skin cells.
- Humectants: Hygroscopic chemicals drawing water into the epidermis.
- Occlusives: Oil-based ingredients forming a hydrophobic barrier to prevent water loss. (6)

1. Emollients:

Emollients, such as stearic, linoleic, oleic, and lauric acid, and fatty alcohols, are essential fatty acids derived from natural sources like wool fat, palm oil, and coconut oil. They're commonly used in cosmetics and topical therapeutics to support skin health. Emollients play a crucial role in:

- Maintaining skin barrier function
- Enhancing skin healing
- Regulating skin permeability
- Supporting skin health through various biological processes.

By incorporating emollients into skincare products, individuals can potentially experience therapeutic benefits, including improved skin hydration, smoothness, and overall skin health.[7]

Fig No. 3 Moisturizing Cream

2. Humectants:

Humectants, while drawing water into the epidermis, can paradoxically increase trans-epidermal water loss (TEWL) if used alone. To mitigate this, humectants are often combined with occlusives to enhance skin hydration and barrier function. Examples of humectants include:

- Honey
- Sorbitol
- Glycerine
- Panthenol
- Gelatine
- Hyaluronic acid
- Alpha-hydroxy acids (e.g., lactic acid)
- Propylene glycol
- Butylene glycol

By pairing humectants with occlusives, skincare products can more effectively retain moisture and support skin health.[8]

3. Occlusives:

Occlusives are most effective when applied to damp skin, forming a hydrophobic barrier that enhances skin hydration. By diffusing into intercellular lipid regions, occlusives strengthen the skin's natural barrier. Key examples include:

- Petroleum-based products (petrolatum, mineral oil.
- Petrolatum, in particular, is highly effective, outperforming olive oil

Even at low concentrations (around 5%), petrolatum can significantly reduce trans-epidermal water loss (by over 98%) and provide substantial moisture retention benefits.[9]

❖ **Sunscreen:**

Sunscreens play a crucial role in preventing UV-induced skin damage, including premature aging and pigmentation. With a history dating back to 1928 in the US, sunscreens have become a vital part of photoprotection strategies worldwide. They work by:

- Absorbing UV radiation
- Reflecting sunlight
- Scattering UV rays
- The effectiveness of sunscreen is measured by:

- SPF (Sun Protection Factor) : indicates protection duration and effectiveness against UVB rays
- PA (UVA Protection Grade) : measures protection.

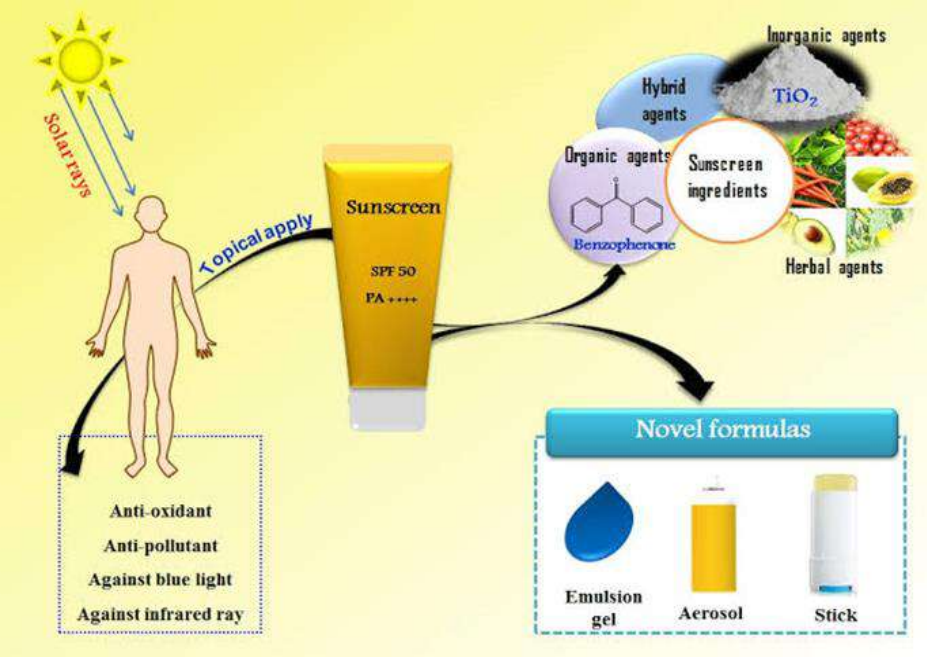

Fig No. 4 Sunscreen

- SPF ratings range from:

1. Low (SPF 6-10) 2. Medium (SPF 15-25)
2. High (SPF 30-50)
3. Extremely high (SPF 50+)

However, common misconceptions surround SPF values. For instance, the difference in UV protection between SPF 15 (93% absorption) and SPF 30 (96.7% absorption) is relatively small, highlighting the need accurate understanding and application of sunscreen products.[10] Sunscreens have undergone significant advancements over the years, driven by the introduction of new photo-protective compounds. Today, sunscreens are a crucial component of global photoprotection strategies, offering protection against UV radiation through:

a. Absorption
b. Reflection
c. Scattering of sunlight.

Face Wash or Cleansers:

❖ Face wash is a gentle cleansing product that removes dirt, oil, and pollutants from the skin while maintaining its natural moisture barrier. Its benefits include:

a. Cleaning and purifying the skin
b. Reducing acne and inflammation
c. Moisturizing and hydrating the skin
d. Anti-wrinkle and anti-aging effects
e. Skin fairness and brightening

Face wash is an essential part of daily skincare routines, helping to:

a. Remove dead skin cells and impurities
b. Prevent skin problems like acne and dermatitis
c. Maintain skin health and appearance

Some face washes also contain ingredients that target specific skin concerns, such as:

- Anti-microbial properties to combat acne-causing bacteria
- Skin whitening agents to reduce melanin production. [11,12,13]

Fig No 5 Face Washes

❖ **Exfoliators:**

Exfoliation is a process that removes dead skin cells from the skin's surface, revealing smoother, healthier skin. Herbal exfoliators (HEs) can:

- Remove dead skin cells
- Unclog pores
- Promote cell renewal
- Counteract environmental stressors
- Improve skin appearance

Exfoliation helps maintain skin health and address concerns like:

- Dull skin
- Clogged pores
- Aging skin [14]

Fig No.6 Methods of Exfoliation

❖ **Active ingredients in Skin care cosmetics:**

1. Aloe Vera:

Scientific name :- *Aloe barbadenis miller*

Family:- *Liliaceae.*

Biological source:- The inner gel of the leaves .

Fig No. 7 Aloe Vera

Aloe vera is an herbal plant species. It is an ingredient in many cosmetics because it heals, moisturizes, and softens skin. Simply cut one of the Aloe vera leaves to extract the soothing gel. Aloe vera contains amino acids like leucine, isoleucine, saponin glycosides that provide cleansing action, vitamins A,B,C,E, choline, B12 and folic acid and provide antioxidant activity. (15) Aloe vera is a widely used plant in traditional medicine, particularly for skin treatments, with a history dating back thousands of years. Despite its popularity, scientific evidence supporting its effectiveness for cosmetic or medicinal purposes is limited and often contradictory. Some studies suggest potential benefits for conditions like diabetes, but more research is needed. Aloe vera is commonly used in cosmetics, food products, and alternative medicine, although its actual benefits are debated. Additionally, potential uses include biofuel production, food preservation, and agricultural applications.(16)

➢ **Mechanism of action in skin care :**

The incorporation of Aloe vera in dermal care formulations emphasizes its hydrating and moisturizing characteristics, anti-inflammatory benefits, wound healing capabilities, antioxidant activity, and antimicrobial properties.

➢ **Hydration and Moisturizing:**

Aloe Vera's polysaccharides, like acemannan, provide deep hydration by retaining moisture, making it an effective moisturizer for:

- Dry skin: Retains water levels.
- Inflamed skin: Soothes and calms.
- Anti-Inflammatory and Healing Effect.
- Aloe vera contains anti-inflammatory agents.
- Reduce inflammation: Soothes skin irritations.
- Promotes wound healing: Enhances fibroblast activity and collagen production.

Aloe Vera Is Used to Treat:

1. Eczema: Reduces inflammation and irritation.
2. Acne: Soothes and calms skin.
3. Burns: Accelerates healing and reduces recovery time.

Aloe Vera's properties make it a popular ingredient in skincare products. (17)

2.Turmeric:

Scientific name:- *Curcuma longa*

Family:- *Zingiberaceae*

Biological source:- dried rhizome of curcuma longa. Turmeric, a plant native to South Asia, has diverse uses. It's utilized in:

- Cosmetics: Sunscreens, skin glow enhancers, and hair removal.
- Cultural practices: Applied to brides and grooms for its perceived benefits.

Fig No. 8 Turmeric.

➢ **Medical applications:**

Potential antioxidant, anti-inflammatory, and antibacterial properties. Research focuses on extracting compounds like tetrahydro curcuminoids (THC) for:

- Skin conditions: Acne, dermatitis, photoaging and more.
- Wound healing: Antiseptic and antioxidant properties.

Turmeric's benefits are attributed to its antioxidant properties, which protect skin cells and aid in recovery. (18) It is a deep yellow-to-orange powder that comes reduce the number of ultraviolet B (UVB)-induced sunburn cells in mice .Turmeric contains a wide range of phytochemicals including, demethoxycurcumin, bisdemethoxycurcumin, zingiberene, curcumol, curcumenol, eugenol,m tetrahydrocurcumin, triethylcurcumin, curcumin, turmerin, turmerones.. It is used as anti-septic, analgesic, anti-inflammatory, anti-oxidant, anti-malarial,

insect-repellant, and other activities associated to turmeric .(19)

2. Neem:

Scientific name:- *Azadirachta Indica.*

Neem family:- *Meliaceae*.

Biological source:- neem tree.

Neem is a revered tree in India, known for its medicinal properties It's used in Ayurvedic herbal cosmetics, and has potential applications in skincare and environmental conservation.

- **Medicinal properties**: Treats various conditions, including fungal infections, diabetes, and skin diseases.

Fig No. 9 Neem

- **Skincare**: Neem oil is used in acne treatment, maintaining skin elasticity, and promoting relaxation

- **Uses:**

4. Ayurvedic medicine: Treats skin diseases and other health conditions.

5. Herbal cosmetics: Neem oil is used in various products.

6. Traditional medicine : Used to treat conditions like chickenpox.

- **Opportunities**

1. Growing demand: Herbal cosmetic industry boom.

2. Neem oil production;: Opportunity for manufacturers to produce high-quality oil for cosmetic use.(20)

❖ **Animal base:**

Our skin has an acidic pH which protects the largest organ from external pathogens and infectious agents. The acidic pH is created by the action of symbiotic microflora on the dermal surface, by their own lipase and esterase enzymes on triglycerides to form free fatty acids. So applying skin care products containing triglycerides and their derivatives positively affects skin care since it supports symbiotic micro flora to maintain dermal health. Since animal fat contains triglycerides, it favours skincare along with symbiotic organisms. There are various reasons which cause human skin can fail its normal functions. Exter-nal environmental change is one of it, especially in winter skin becomes dry due to changes in moisturization at the horny layer of skin (Stratum corneum). Applying moisturizer with any type of oil or fat over skin forms a thin layer of hydrophobic film that reduces water evaporation and prevents Trans Epidermal Water Loss (TEWL). So applying moisturizer containing fat and oil gives a good balance of quality hydro-philic substance with moisturizing capacity during unfavourable seasons. Cosmetics act as emollients on the skin and are similar to sebum,para pharse it (21)

Table I: Uses Of Various Animal Origin Oils for Cosmetic Purpose

Oil used	Animal origin	Use
Shark liver oil	Shark (Selachimorpha)	Used in moisturizing creams, lip balm, sunscreen, hair dyes and facial moisturizers Fat is rich in Ω-3, 6 fatty acids, and oleic acid
Crocodile oil	Crocodile (Crocodylinae)	Used in skin care products due to its good healing ability Stimulate skin and hair growth, and have a good penetrating ability.
Fish oil and Marine oil	Marine fish and mammals	Linolenic acid and linoleic acid. Also it contain DHA (docosahexaenoic acid) and EPA (eicosapentaenoic acid)
Cod liver oil	Cod fish (Gadus morhua)	Squaline – cosmetic industry is the major user of animal squaline Used in skin care products as occlusive

❖ **Synthetic base:**

❖ **Salicylic acid:**

Salicylic acid (SA) has a rich history, dating back over 2,000 years, with early uses in treating skin disorders like corns and calluses. Naturally occurring in willow bark, wintergreen leaves, and sweet birch, SA's structure was discovered in the 19th century, enabling laboratory synthesis. Its lipophilic nature allows easy penetration into the epidermis and sebaceous glands, making it effective for exfoliation, acne treatment, and skin renewal. However, SA's effectiveness is pH-dependent, requiring formulation near its pKa of 2.98. To minimize irritation, ionic surfactants can be used to control the rate of SA permeation into the skin. Overall, SA's unique properties make it a valuable ingredient in dermatological treatments.

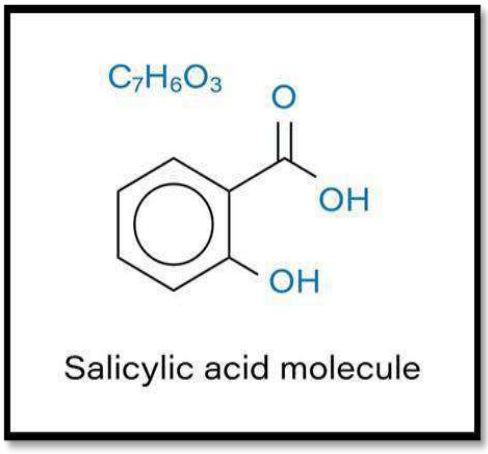

Fig no .10Structure of Salicylic acid

➢ **Properties:**

- Lipophilic nature: Easily penetrates the epidermis and sebaceous glands.
- Superficial effect: Limited to the superficial epidermis, reducing side effects.
- pH-dependent activity: Most effective at a pH near its pKa (2.98).

➢ **Formulation Considerations:**

- Irritation control: Using ionic surfactants can reduce irritancy.

- pH balance: Formulating at the right pH ensures optimal activity

➢ **Used for:**

- Exfoliation : Helps remove dead skin cells.
- Acne treatment : Unclogs pores and reduces acne.
- Skin renewal : Promotes skin health and appearance.(22)

❖ **Glycolic acid:**

Alpha-hydroxy acids (AHAs) are a family of carboxylic acids found naturally in foods like fruits, sugar cane, and milk. Glycolic acid (GA) is a well-studied AHA that offers therapeutic benefits in skincare. With only 2 carbon molecules, GA is stable, water-soluble, and less toxic. AHAs function as keratolytics, detaching keratinocytes and smoothing skin texture. GA's efficacy is pH-dependent, working best between pH 3 and 3.8. In clinical applications, GA can be used in various concentrations, with buffered formulations like GA 10% at a pH >3 being effective for daily use. Overall, GA is a versatile ingredient for promoting skin renewal and rejuvenation. (23,24,25) GA has been studied for its ability to treat photodamaged skin, promoting dermal nucleogenesis and improving skin texture. An 8% GA cream significantly reduced photodamage, sallowness, and mottled pigmentation. Long-term use of GA may improve skin texture, providing a more youthful appearance.

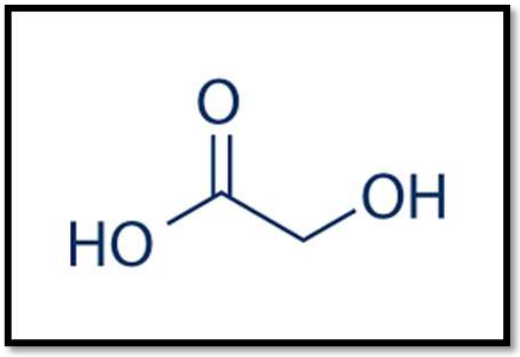

Fig No .11 Structure of Glycolic Acid

Additional use

- Stretch mark improvement: GA 20% combined with other ingredients showed up to 68% clinical improvement.
- Skin texture enhancement: Daily use of GA 5% for 3 months led to significant improvements. (26,27,28,29,30,31,32)

Hyaluronic acid:

Hyaluronic acid's ability to attract and retain moisture is one of its primary mechanisms of action in cosmeceuticals. HA molecules form a hydrophilic gel-like structure that binds water molecules, leading to significant improvements in skin hydration and elasticity. This hydrating effect leads to a plumper, smoother appearance while minimizing the visibility of fine lines and wrinkles.(33)In addition to its hydration properties, plays a crucial role in maintaining the skin's barrier function. The skin barrier is essential for protecting against environmental stressors, pathogens, and transepidermal water loss. HA contributes to the synthesis of other extracellular matrix components, such as collagen and elastin, which are vital for maintaining skin integrity and elasticity. By supporting the structure and function of the skin barrier, HA helps enhance overall skin health .

➢ **Hyaluronic Acid's Mechanisms in Skincare**

- Cellular Signalling Pathways Hyaluronic acid (HA) plays a crucial role in skin health by:
- Stimulating fibroblast proliferation and migration for collagen synthesis and tissue repair.
- Activating toll-like receptors (TLRs) on immune cells, initiating inflammatory responses for wound healing
- Regulation of HA Levels

HA levels are influenced by hyaluronidases, enzymes that degrade HA. Factors like aging and environmental stressors can increase hyaluronidase activity, reducing HA levels and compromising skin health.

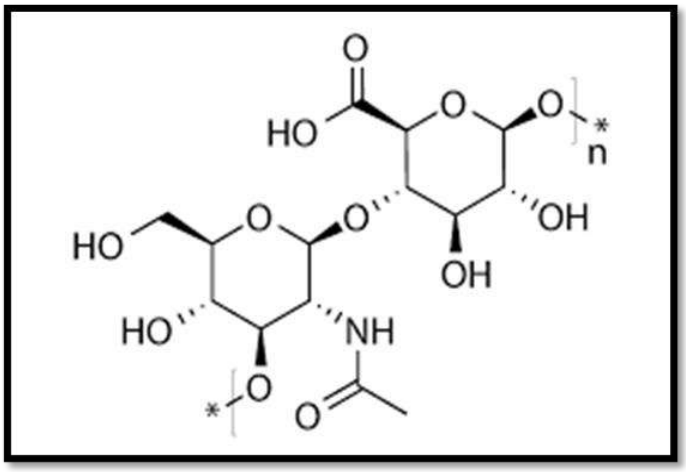

Fig No. 12 Structure of Hyaluronic Acid

Antioxidant Properties:

HA has been shown to:

- Scavenge free radicals, reducing oxidative damage.
- Promote healthier skin by modulating oxidative stress.

➢ **Importance in Skincare**

HA's multifaceted use make it a valuable ingredient in cosmeceuticals, supporting:

- Wound healing
- Skin health
- Anti-aging
- To counteract aging and environmental damage.
- Cosmetics play a vital role in maintaining skin health and appearance.

CONCLUSIONS:

Choosing the right skincare products is key to achieving healthy, radiant skin. By understanding skin structure and ingredients, individuals can select products that address specific concerns like acne, aging, or dryness. Natural ingredients like hyaluronic acid, aloe vera, turmeric, and neem offer antioxidant, anti-inflammatory, and antimicrobial, anti-aging, anti-wrinkle benefits, while synthetic ingredients like salicylic acid and glycolic acid target specific skin issues. A well-crafted skincare routine can boost confidence, improve skin texture and tone, and reduce signs of aging. By combining the right products and consistent care, individuals can enjoy healthy, glowing skin and enhanced overall well-being. Effective skincare empowers individuals to feel confident and comfortable in their own skin.

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