



IJCSPUB PUBLICATION (IJCSPUB.ORG)

INTERNATIONAL JOURNAL OF CURRENT SCIENCE (IJCSPUB)

An International Open Access, Peer-reviewed, Refereed Journal

REVIEW ARTICLE: SKIN CARE WITH EXFOLIATION PROCESS

Shivani Behalpade^[1] Swati Gajbhiye^[2]

Department Of Cosmetic Technology

Lady Amritabai Daga College, Seminary Hills, 440006
Nagpur, India

Abstract:

Exfoliation is a process of removing dead skin cells from surface & makes skin look more soft, smooth & supple. It helps to improve the skin texture & enhances absorption and retention of moisturizing agents and restores the skin's own natural moisture factor. Exfoliative skin peeling is also the procedure which is preferred by dermatologist for the aged skin, photoaging, acne scars, and melasma. There are two types of exfoliation; mechanical & chemical. Mechanical exfoliation is a physical exfoliation process that can be achieved by using scrubs with small exfoliating grainy particles & chemical exfoliation achieved by AHAs & BHAs. Due to chronic exposure to ultraviolet (UV) light, it leads to photo damage of the skin, this causes extrinsic aging, or alteration of the skin due to environmental exposure. To reduce such effect of photo damaged skin, one can include alpha-hydroxy acids, antioxidants, moisturizers and exfoliant. Exfoliation is a cleansing formula and treatment that detoxifies the skin and stimulates its metabolism. Cosmetic preparation includes different raw material in formula of exfoliators in which natural and synthetic raw material gives instant result. In recent year the chemical exfoliators are gaining more popularity due to more effective results than physical scrubs.

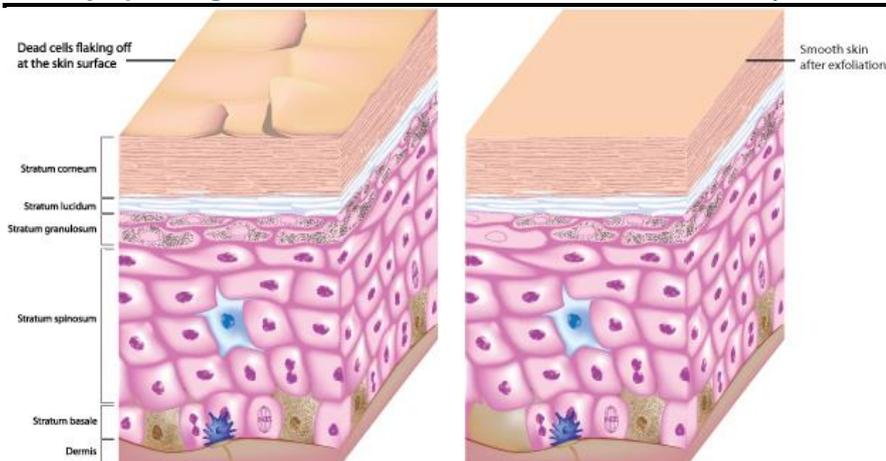
Index Terms:

Cosmetics, scrubs, mechanical exfoliation, chemical exfoliation, microdermabrasion, enzymes

I. INTRODUCTION

Cosmetics are an important part of our daily life; without any cosmetic product the skincare routine is incomplete. Exfoliating is necessary for every skin. While using soaps and face wash the pores are not completely cleansed and the dead skin cells are not removed, resulting in dry, flaky patches and clogged pores.⁽¹⁾

Exfoliation is a process that helps to remove the dead skin cells & makes skin soft and smooth by removing the dirt and oil from the skin surface it also helps to remove excess oil from skin pores. Exfoliation was introduced in Egypt, the ancient Egyptians used to practice the exfoliation technique with help of pumice stone, alabaster stone particles some of the scrubs were made from sand and plants. Asia and China were also using the exfoliation technique. In the middle ages, wine was used as a chemical exfoliating agent with tartaric acid. Scrubs and chemical peels are used to exfoliate the skin and some old ideas of exfoliating are replaced by cosmetic products. Some herbal and synthetics raw materials are used as exfoliating agent in cosmetic formulas. Scrubs are a cream-based formula that contains abrasive material. Chemical exfoliation is also known as chemical peeling which removes dead skin cells by using active chemicals.⁽²⁾



[3]

II. NATURAL PROCESS OF EXFOLIATION

Human skin consists of three layers, the epidermis, the dermis, & the subcutaneous. The process of exfoliation and skin cell renewal occurs in epidermis. The stratum corneum is the outermost layer of skin which prevents water loss also protects underlying tissue from infection, chemical and mechanical stress. Exfoliation occurs naturally as cell detached from skin. Replacement of corneum cells occurs by a self-renewal process as epidermal cells move upward from the basal layer, the stratum basalis, from the next two layers, the stratum spinosum and stratum, to succeed in the corneum. This process takes about four weeks, although it takes time in aging and other skin conditions. Normal peeling occurs invisibly as single corneocytes, or very small aggregates of them, detach from the skin's surface and starts to shed off.⁽⁴⁾

III. PROCESS OF COSMETIC EXFOLIATION

The slow and weak condition of exfoliation is seen with aging & with other skin conditions. The exfoliation of the skin surface can be renormalized by using cosmeceutical products. The cosmetic exfoliation process helps to remove the dead skin cells, keep the pores clear and remove dirt by providing deep cleansing which helps skin to look more youthful, healthy and soft⁽²⁾. Cosmetic exfoliation changes the appearance of the skin surface which also promotes epidermal regeneration.⁽³⁾

3.1. Cosmetic Exfoliation Achieved by Two Types:

- **Mechanical exfoliation**
- **Chemical exfoliation**

3.1.1 Mechanical exfoliation:

It is a physical exfoliation process that can be achieved by using scrubs with small exfoliating grainy particles such as pulverized walnut shells, apricot pits, pistachio shells, almond shells, salt crystals. Microfiber cloths, sheet mask, micro-bead facial scrubs, pumice stone, abrasive sponges and brushes. The abrasive particles help to exfoliate dead skin cells, loosen the outer corneocytes of the stratum corneum. The result will vary depending on the amount of friction and the nature of abrasive is used in cosmetic formulation. Gentle exfoliation can be achieved with microbead scrubs. Microbeads are made of polyethylene, polypropylene, polystyrene but microbeads can cause plastic particle water pollution and are dangerous for aquatic animals in the ocean and freshwater. Several countries have banned the use of microbeads in the personal care industry.⁽⁵⁾



[6]

Microdermabrasion:

It is a mechanical process in which light cosmetic procedures are used to remove the dead skin cells from the epidermis. It removes the stratum corneum which is the outermost layer of epidermis. It also affects epidermis and dermis deeper layers. Microdermabrasion causes a re-arrangement of melanosomes in epidermis basal layer, flattening of rete ridges at the dermal epidermal junction, increased in collagen fibre density at dermal epidermal junction, along with vascular ectasia in reticular dermis. It also results into upregulation of wound healing transcription factors and dermis matrix metalloproteinases.^[7] The procedure is performed in two parts. Some exfoliating material like crystal or diamond flakes are used and in other part machine-based suction gently lift up the skin during exfoliation. It is a simple, easy, painless, non-invasive skin rejuvenation procedure. The safest method of microdermabrasion involves the use of corundum or aluminium oxide crystals suspended in an antioxidant cream.⁽⁸⁾ Aluminium oxide crystal do not cause allergic reaction and it is chemically inert and is not absorbed by the skin. Moreover, it has got bactericidal properties which can be used for exfoliating acne prone skin.^[9]

Another method which is same as microdermabrasion is hydra dermabrasion. This method instead of exfoliating with propelled microcrystals it uses combination of oxygen and aqueous solution at supersonic speed which removes debris and dead cells which are then suctioned away results into hydration and cleansing of skin. These can be used on darker skin, aging skin, sensitive skin, oily as well as dry skin complexions. These procedure results into increased epidermal and papillary dermal thickness, improvement in elastic dermal tissue, collagen hyalinization, fibroblast density and reduction in fine lines, pore size, hyperpigmentation with overall improvement in skin quality.^[5]

3.1.2 Chemical Exfoliation:

Chemical exfoliation methods include acids, nonacid peels, enzymes, or other active chemicals. This exfoliation includes the use of creams, lotion, serums, and gels. They also include scrubs containing salicylic acid, glycolic acid, fruit enzymes, citric acid, or malic acid which may be applied in high concentrations by a dermatologist but now in many cosmetic preparations these actives are used at low concentration. Chemical exfoliation involves the use of products that contain alpha-hydroxy acid (AHAs) or beta hydroxy acid (BHAs). The enzymes help to loosen the glue-like substance that holds the cells together and allows them to shed off. Chemical exfoliation improves skin texture, reduces fine lines, hyperpigmentation and treats acne.

Now the physical scrubs are replaced by chemical peels. Chemical peels are applied on skin to peel away the dead skin cells and melanin. these are used to create an injury at the certain depth of the skin which stimulates the growth of new skin and thereby improve surface texture and the appearance. The exfoliative effect of chemical peel leads to epidermal growth and collagen stimulation along with the evenly distribution of melanin. They enhance the cell renewal process also increase the moisture content of the skin. Chemical peels are classified according to the depth of action which can be superficial, medium, and deep peels. After the application, the skin starts to flake off the dead skin cells. Peeling reveals healthy, smooth, and radiant skin. Chemical exfoliators dissolve the glue that holds dead skin cells together and penetrate the upper layer of skin for complete removal of flaky white skin.^[2,5,10]

IV. MECHANISM OF ACTION OF CHEMICAL PEELS

superficial peels penetrates to the epidermal layer only whereas medium depth peels can penetrate through entire epidermis and papillary dermis and deep peels are used to control tissue injury to the midreticular dermis and sometime to the subcutis also.^[11] as superficial peels acts on epidermis they stimulate keratinocyte renewal from the basal layer and results into inflammation in upper dermis which results into stimulation of nucleogenesis that activates fibroblast which results into synthesis of new collagen type I and IV along with elastin fiber. Glycolic acid peels tend to induce the release of interleukin-1 α in the epidermis. Active substance that are used for superficial peelings are α -hydroxy acids: glycolic acid (derived from cane sugar), lactic acid (derived from milk), malic acid (derived from apples), citric acid (derived from fruits), tartaric acid (derived from grapes). Acids with a higher molecular weight, such as mandelic acid and benzilic acid^[12]

Medium depth peels can penetrate papillary dermis up to the reticular dermis over the depth of 450 μ m. They are known to cause extensive protein precipitation that results in coagulative necrosis of cells and produce edema and homogenization of papillary dermis. Over 5 days desquamation occurs and gets normal after one week. trichloroacetic acid TCA (35-50%) is mostly used as medium depth peeling agent. This can also be used in 35% in combination with glycolic acid 70% along with jessner solution.^[13]

Deep peeling is rarely done because of the downtime required for healing and adverse effects. Deep peeling solution penetrates to the midreticular dermis and produce new collagen. These solutions

composed combination of croton oil and phenol in varying concentration. It can improve atrophic acne but needs monitoring.^[14] Majority of these peeling produce protein coagulation, epidermal regeneration and synthesis of collagen and elastin. these result persists for year once treatment is done.

V. ENZYME EXFOLIATION

Enzymes can be synthetic or from natural sources. They dissolve skin cells and break down the keratin (protein in dead skin cells) which promote the cell renewal process. Plant enzymes are different from AHAs and BHAs as they work by dissolving upper layer of dead skin cell. The enzymes are tiny molecules found in fruits like pumpkins, cherries, papaya, and pineapple. Papain from papaya, bromelain from pineapple and enzyme from pumpkin are proteolytic enzymes that stimulate exfoliation by digesting intercorneocyte cohesion and softening of skin^[5] They can be used as an alternative to acid peels which is safe for people with sensitivity who cannot tolerate chemical or acidic peels^[3,5] enzyme exfoliator are also known as enzymatic peels commonly referred as enzymocosmetics these are mostly cosmetic products with proteolytic enzymes which hydrolyses peptide bonds of proteins in stratum corneum. They promote biological exfoliation, faster skin regeneration, also helps in deep cleansing and helps in penetration of cosmetics actives. enzymatic peels are used for pigmentation, acne spot, oily skin and rough skin. These peels are generally comfortable and safer than chemical peels and can be used for sensitive skin.^[16] Recent study on another enzyme known as protease obtain from microorganism *Bacillus subtilis* acts as a keratolytic agent when applied topically. Along with this there are many bacteria that has the ability of keratin degradation that are mostly found by gram positive bacteria than gram negative bacteria such as *Bacillus licheniformis*, *B. pumilus*, *B. cereus*, *B. subtilis* and non-sporogenic bacteria *Stenotrophomonas* sp., *Fervidobacterium pennavorans*, *F. islandicum*, *Lysobacter* sp., *Nesterenkonia* sp. and *Kocuria* sp. and gram negative like *Vibrio* sp., *Xanthomonas* sp., *Thermoanaerobacter* sp., *Stenotrophomonas* sp. and *Chryseobacterium* sp. Descriptions of thermophilic and extremophilic keratinolytic representatives from genera *Fervidobacterium* sp., *Thermoanaerobacter* sp. and *Bacillus* sp. are also available.^[15,16]

VI. IDEAL PROPERTIES AND BENEFITS OF COSMETIC EXFOLIATORS.

6.1. Ideal Properties:

- Cosmetic exfoliators should be non-toxic.
- The formula should be non-sticky.
- The chemical used in exfoliator should be mild on the skin.
- They should be able to remove excess oil, impurities and dead skin.
- The formula should be formulated according to the skin type.
- Abrasives with irregular edges should be avoided in scrubs, cream and gels.^[2]

6.2. Benefits of Exfoliation to different Skin Types

Skins are of three types; oily skin, dry skin, and sensitive skin. Skin with different conditions requires a suitable solution. People with dry skin should use facial scrub which gives hydrating and moisturizing effects. Gentle exfoliation should be for sensitive skin. For people with oily skin conditions, it is essential to use products that exfoliate deeply to remove excess oil, prevent the pores from clogging and balance the oil production^[5]

Acne prone skin: The acne-prone skin is commonly oily, excess oil secretion leads to pore blockage and contribute towards breakouts. It can be also due to environmental factors, poor skin routine, genetic or bad diet. The acne-prone skin produces five times more dead skin cells than other skin conditions. Exfoliation helps to unclog the pores. Alpha hydroxy acids (AHAs) and beta hydroxy acids (BHAs) are effective to remove dead skin cells from clogging hair follicles. Scrubbing helps to remove dirt and impurities from pores.^[5] studies have confirmed that the use of superficial chemical peel therapy showed reduction of papules, pustules and comedones in active acne vulgaris. Though there were some minor adverse effect such as erythema, edema and post inflammatory hyper and hypo pigmentation which can be managed. With the new technology that are available for acne, chemical peeling is affordable and can be performed in the dermatologist's clinic. Studies have confirmed that the used of both glycolic acid (30-70%) and salicylic acid (30%) can effectively reduce the inflammatory lesions of acne.^[17]

Aged skin: In aging process, skin looks thinner, paler and clear. The thinning of the epidermis starts with aging. Blood vessels of the dermis become more delicate. The dermal tissue changes as the collagen fiber gradually organize in bundles. Blood circulation decreases in the skin's micro vessels. Reduction in oil production the pigmentation changes occur and lead towards age spots. Exfoliating will speed up the cell turnover also soften fine lines, wrinkles and slowly reduce hyperpigmentation. Skin complexion changes after the exfoliation process.[5]

Dehydrated Skin: Due to lack of moisture, the cellular barriers are fractured and leave skin dry, tight, flaky & stretched. Application of moisturizers makes skin duller and uneven. Dehydrated skin shows premature signs of aging, such as loss of elasticity and wrinkles. The exfoliation process helps to remove dying skin cells and helps the moisturizing and hydrating ingredients penetrate deeper into the skin.[5]

Hyperpigmentation: Hyperpigmentation is caused due to increase in melanin or melanocytes sometimes it can also happen due to the deposition of colored substances in the skin. The exfoliation process helps to reduce pigmented cells rapidly and lightens the age or acne spots from the skin.

Photo Damaged Skin: Excessive sun exposure can increase the risk of skin cancer; sunlight can damage skin, even without cancer development. This damage is known as photo damage. The epidermis, dermis are exposed to sunlight, UV radiation causes photo damage also create acute and chronic changes in DNA, protein, lipid building blocks. UV radiation Damages the collagen which results in a loss of skin elasticity due to that early appearance of wrinkles and other age marks appear. In such case TCA which is a chemical peeling agent can be used as a promising modality for photoaging like actinic keratosis as it treats larger skin surface in one session and improve the appearances. This is cost effective treatment with excellent cosmetic results. It also improves the overall skin condition such as elasticity, hydration, hyperpigmentation, fine lines with repeated treatments. Side effect such as burning and stinging sensation can be easily control. Skin priming with topical retinoic acid before the treatment can be done to prepare the skin for the treatment. Combination of microneedle FRF treatment prior the peeling result into deeper peel effect which passes the chemical agent to the transdermal delivery and shows better result.[5]

VII. Synthetic & Herbal Exfoliating Raw Material Used in Cosmetic Formulation

7.1. Herbal Exfoliators:

Papaya: One of the active enzymes in papaya, papain, has antimicrobial as well as exfoliating properties. Papaya extract exfoliates the skin, but can also help reduce edema and promote wound healing^[18] Papain is very beneficial for preventing and treating acne. It is rich in vitamins A and C, which have antioxidant benefits also skin-cleansing properties.[5]

Pineapple: The extract of pineapple will promote skin elasticity while removing damaged and dead cells from the skin. It also helps to improve moisture and hydration of the skin and produces a clear complexion. A variety of ingredients, including enzymes such as bromelain found in pineapple, are responsible for this action. Bromelain also has anti-inflammatory properties Pineapple contains AHAs (Alpha Hydroxy Acids) which exfoliates dead skin cells in the most efficient manner. The dead skin cells of skin will be removed and give supple fresh-looking skin.[5]

Walnut Shell: The walnut shell contains antioxidants. The natural exfoliating grains can be used for formulating exfoliating face and body scrubs they can gently peel away the dead cells from the epidermis and restore the skin's natural soft texture. The walnut shell can be also used as an abrasive, binder in different cosmetic preparation. the walnut shell powder is sometimes not tolerated by sensitive skin due to the particle structure. It is very harsh on the skin can replaced by different minute particles and chemical exfoliators.[5]

Grapefruit Seed Extract: This extract together with essential oils boosts the immune system and creates a purifying environment for the skin. This helps oily, overactive skin to normalize itself^[18]

Lemon Oil: Lemon oil (Citrus peel oil) this is obtained from the peel of the fruit and contains citro flavonoids that affect vascular permeability and improve circulation and tones capillaries and veins. It is

an essential oil with anti-inflammatory and antioxidant properties that contains vitamin C it is also used as a natural fragrance [5]

Apricot Shell: Finely ground pieces of the apricot seed shell are used as a gentle exfoliator in scrubs. The scrub combines the moisturizing benefits of the apricot extract with the exfoliating properties of finely ground apricot seeds. This advanced formula in face and body scrub helps to exfoliate dead skin cells and leave the skin feeling fresh and smooth [5]

Mung dal (Phaseolus mungo seed): This traditional exfoliant is used widely in herbal cosmetology, since it helps to remove dead skin cells, retain a smooth skin texture and maintain healthy glowing skin [5]

Cucumber Extract: The juice of the fruit acts as a moisturizer, soothing and tightening of the skin, and also has anti-inflammatory properties. It nourishes and softens the skin and when used in a scrub, helps to remove impurities, dead skin cells and dirt by gently unclogging pores. Thus, helps the skin stay fresh, healthy, clean, hydrated and blemish-free [5]

Green tea:

Extensive research has shown that this botanical extract not only has amazing antioxidant and cell protective qualities, but also protects the collagen by inhibiting collagenase. It is easily absorbed by the skin and protects the DNA and cells in general, which helps the skin fight inflammation that may cause premature aging. It has excellent astringent qualities which promotes the elasticity and firmness of the skin. It protects the cells in the skin from premature cell death, due to radiation or excessive free radicals [5].

Advantages of Herbal Exfoliators

Herbal exfoliators are beneficial to all skin types. They help to improve the texture of the skin also make the skin healthy and more radiant. They reduce the appearance of wrinkles and fine lines, prevent acne, prevent aging of the skin and helps to promote collagen-building. Herbal exfoliator cleans clogged pores, improve skin's thickness, reduces brown spots, improve skin cell renewal also removes the dead skin layer, which allows the active ingredient in skincare products to reach the inner layers of the skin to vitalize them. They are biodegradable, affordable and safe.[1,2,5]

Disadvantages

Abrasive material can irritate the skin they contain rough, irregular edges. These can cause micro-scratches on the skin's surface increase the chances of infection and irritation.[2,5]

7.2.Synthetic Exfoliators:

7.2.1. Hydroxy Acids:

Hydroxy acids (HAs) have been widely used in a number of cosmetic and therapeutic formulations to achieve a variety of beneficial effects for the skin. They are of two types, alpha-hydroxy acids and beta-hydroxy acids. The hydroxy acids are used for treating acne, ichthyosis, keratoses, warts, psoriasis, photo aged skin, pigmentation, wrinkles, and fine lines. In the last three years, α -hydroxy acids (α HAs) have been widely incorporated into a variety of cosmetic products for daily use over long periods of time. Currently, glycolic acid, lactic acid, and Salicylic acid are commonly used in cosmetics preparation as chemical peeling agents.[2,11,13]

Alpha hydroxy acid (AHAs) and Beta hydroxy acids (BHAs): Alpha hydroxy acids (AHA) constitute a family of carboxylic acids with a hydroxyl attached at the alpha position of the carboxyl group. They are derived from fruit like apples (malic acid), grapes (tartaric acid), lemons and oranges (citric acid), sugar cane (glycolic acid), and milk (lactic acid) [13]

Hydroxy acids are of two chemical types, alpha-hydroxy acids and beta-hydroxy acids. Alpha-hydroxy acids (AHAs) may be obtained from synthetic sources or from natural sources. Natural botanical sources are often preferred by users for tolerability and gentleness. AHAs are gentle and effective desquamation agents. They act on the skin's outer surface but also can penetrate to some depth in the epidermis to facilitate a somewhat deeper exfoliation. This can also stimulate skin renewal and shortens epithelial regeneration time, thus more closely approximating younger physiology. Collagen synthesis can also be stimulated by AHAs. Along with it lactic acid & glycolic are common peeling agent

used in cosmetic formulation[19] GA has anti-inflammatory, antioxidant, and keratolytic effects on skin it also targets the corneosome by enhancing breakdown and decreasing cohesiveness, causing desquamation [16] . Lactic acid helps improve the rate of cell regeneration in the skin also exfoliate the surface of the skin. Removal of skin cells helps promote the production of natural elastin and collagen in the skin. This, in turn, helps reduce the appearance of wrinkles and fine lines [18]

Salicylic acid is a beta-hydroxy acid (BHA) that can be derived synthetically or obtained botanically. It is also anti-inflammatory and thereby provides other benefits for a variety of skin conditions. Many skin conditions, including aging, activate inflammatory pathways; salicylic acid has wide applicability and use. BHAs have the unique characteristic of being oil soluble. AHAs acids do not share this quality. Oil or lipid solubility allows penetration of BHAs into sebum and therefore facilitates a deep cleansing of the pore of the pilosebaceous unit and hair follicle. Since the sebaceous unit is an important structure in the development of acne, BHAs are particularly beneficial in this disorder. Deep pore cleansing is also important post-procedure to prevent the formation of milia and reduce pore size for aesthetics and skin health.[11] Enlarged pores are the dilated openings of pilosebaceous follicles. These may appear either as conical openings or plug with debris in comedones. Many factors contribute to enlarged facial pores including ethnic background, environmental factors like humidity, temperature, hormonal fluctuations, and aging. Chemical exfoliation helps to reduce these skin conditions.[1,3,4]

VIII.EFFECTS OF OVER-EXFOLIATION

Mechanical or chemical exfoliation promotes skin resulting in the excessive stratum corneum thinning, shininess, irritation, redness, sensitivity, and telangiectasias (dilated blood vessels). Products and procedures must be carefully chosen according to skin condition to avoid this “over-processed” look. Due to repeated over-exfoliation, barrier function is diminished and dehydration occurs in addition to many other potential problems like minor cuts on the skin.[3]

IX. CONCLUSION

Exfoliation helps to remove the outer layer, reveal glowing and healthy skin. due to many environmental factors like harmful UV radiation, pollution , changes in climatic conditions give rise to unhealthy effects on the skin. Overexposure of skin to many cosmetic products disturbs the natural composition of the skin. Sometimes the pores are blocked due to dirt and toxins. Our body has a natural mechanism of excretion which works on the toxic components and removes them from our body through the skin pore and builds up the dead skin cells. That's why exfoliation is necessary with gentle creams, scrubs, peel-off masks; chemical exfoliators which help in new cell regeneration also decrease the surface buildup of dead skin cells. Every individual has a different skin type and that type differs the tolerance level of cosmetic exfoliation.

Due to variations in skin type and different condition the physical or chemical exfoliators are chosen. Nowadays chemical exfoliators are gaining more importance due to their instant effect. The natural raw materials used as cosmetic exfoliators are safer to use than synthetic raw materials.

REFERENCES

1. Prathyusha, J., Yamani, N. S., Santhosh, G., Aravind, A., & Naresh, B. (2019). Formulation and Evaluation of Polyherbal Face Scrubber for Oily Skin in Gel Form.
2. Ghadage, P. K., Mahamuni, S. S., Kachare, D. S., & Kachare, M. D. (2021). Formulation and evaluation of herbal scrub using tamarind peel. *Research Journal of Topical and Cosmetic Sciences*, 12(1), 39-42.
3. DeHaven, C. (2015). Mechanisms of exfoliation. *Science of Skincare*.
4. Understanding the difference between AHA and BHA for skin. <https://www.medicalnewstoday.com/articles/aha-vs-bha>
5. Packianathan, N., & Kandasamy, R. (2011). Skin care with herbal exfoliants. *Functional Plant Science and Biotechnology*, 5(1), 94-97.
6. Chattopadhyay, P. K. (2005). Herbal cosmetics and ayurvedic medicines. *National Institute of Industrial Research*, 1, 45-50.
7. Kumar, N. S., & Devi, P. (2017). The surprising health benefits of papaya seeds: A. *Journal of Pharmacognosy and Phytochemistry*, 6(1), 424-429.
8. Freedman, B. M., Rueda-Pedraza, E., & Waddell, S. P. (2001). The epidermal and dermal changes associated with microdermabrasion. *Dermatologic surgery*, 27(12), 1031-1034.

9. Sachs, D. C. C. N., & Sachs, A. (1997). The authoritative guide to grapefruit seed extract. *LifeRhythm*.
10. Gozali, M. V., & Zhou, B. (2015). Effective treatments of atrophic acne scars. *The Journal of clinical and aesthetic dermatology*, 8(5), 33–40.
11. Gonçalves S. Use of enzymes in cosmetics: proposed enzymatic peel procedure. *Cos ACTIVE J*. 2021;1:29–35
12. Loesch, M. M., Somani, A. K., Kingsley, M. M., Travers, J. B., & Spandau, D. F. (2014). Skin resurfacing procedures: new and emerging options. *Clinical, cosmetic and investigational dermatology*, 7, 231–241. <https://doi.org/10.2147/CCID.S50367>
13. Savardekar P. Microdermabrasion. *Indian J Dermatol Venereol Leprol* 2007;73:277-279.
14. Vidmar, B., & Vodovnik, M. (2018). Microbial Keratinases: Enzymes with Promising Biotechnological Applications. *Food technology and biotechnology*, 56(3), 312–328.
15. Tang, S. C., & Yang, J. H. (2018). Dual effects of alpha-hydroxy acids on the skin. *Molecules*, 23(4), 863.
16. Sharad, J. (2013). Glycolic acid peel therapy—a current review. *Clinical, cosmetic and investigational dermatology*, 6, 281.
17. Shah M, Crane JS. Microdermabrasion. [Updated 2021 Jul 18]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK535383/>
18. Abd Alsaheb, R. A., Aladdin, A., Othman, N. Z., Abd Malek, R., Leng, O. M., Aziz, R., & El Enshasy, H. A. (2015). Lactic acid applications in pharmaceutical and cosmeceutical industries. *Journal of Chemical and Pharmaceutical Research*, 7(10), 729-735.
19. Soleymani, T., Lanoue, J., & Rahman, Z. (2018). A practical approach to chemical peels: a review of fundamentals and step-by-step algorithmic protocol for treatment. *The Journal of clinical and aesthetic dermatology*, 11(8), 21.
20. Ganceviciene, R., Liakou, A. I., Theodoridis, A., Makrantonaki, E., & Zouboulis, C. C. (2012). Skin anti-aging strategies. *Dermato-endocrinology*, 4(3), 308-319.



IJCS PUBLICATION (IJCSPUB.ORG)