

Cosmeceuticals – A New Approach for Treatment of Skin Problem

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Abstract: The word Cosmeceuticals is derived from two words cosmetic and pharmaceuticals. As their name suggest they have both property of cosmetic and pharmaceuticals. They are used as a beautifying agent with therapeutic value. They are neither place in category of pharmaceuticals nor in category of cosmetics. Like pharmaceuticals product they also possess active ingredient and additives which make them therapeutically effective. Various types of cosmeceuticals preparation available such as Hair cosmeceuticals, skin cosmeceuticals, nail cosmeceuticals etc. Cosmeceuticals preparation generally considered as dermatological preparation and presented in the form of lotion, cream, gel etc.

Keywords: Emulsion, Hydroxy acid, Ingredient, Peptides, Sugaramine, Vehicles, Vitamins.

1. Introduction

Cosmetics are defined as the product which is defined as the product which is used for the cleaning and beautifying of skin. Egyptians in 400 B.C recorded the first use of cosmetics (1). Cosmetics are made up of mixture of chemical compound derived from either natural source or synthetic source(2). Cosmetics are designed for both the personal care and skin care. It can be used to enhance someone natural features and enhance the colour of the body and face. It can also designed in manner to add fragrance to the body (3).

Pharmaceuticals are defined as the product which contain active ingredient and that are used to prevent, mitigate, treatment or cure of the disease by affecting the normal structure and functioning of the body.

The Term Cosmeceuticals is defined as the product which specify the both characteristics of cosmetics and pharmaceuticals but this is neither place under cosmetics nor in pharmaceuticals. It is positioned in between the both (4). The concept of cosmeceuticals was created by Raymond Reed, (Founder of U.S Society of Cosmetics chemist) and in late 1970's It was popularized by American dermatologist Albert Klingman. However, Health giving properties of cosmetics was first recognize by Egyptians. Cosmeceuticals was first launch in the market in 1996(5). Cosmeceuticals are one of the fastest growing sectors of the cosmetic care industry. The proposed claim of the cosmeceuticals of drug like effect is unproven and the term cosmeceuticals is neither recognized by US FDA nor by any other regulatory body.

FDA not categorize the term cosmeceuticals but it is used by skin scientist, Physicians and other skin care health professional to giving faith to consumer to continue buying product marketed by many manufacturers with scientific claims (6).

Cosmeceuticals are considered as dermatological preparation and are presented as lotion or cream and mainly targeted the dermatological tissue. Now, cosmeceuticals formulation have broader from skin to body to hair and a no. of topical cosmeceuticals product come into used in condition such as photoaging, hyperpigmentation, wrinkles, and hair damage(7). The contribution of cosmetics as a positive healing aid ignored until it's indictment in late 1970's by Klingman reawaken interest by developing formulation to improve the appearance of U.V damage and wrinkled skin using retinoid acid(8).

Classification of Cosmeceuticals:

The term cosmeceuticals can be used for many other terms but in all the definition the meaning is same. Cosmeceuticals preparation are neither pure dosage form nor pure cosmetics. It is placed in between cosmetics and pharmaceuticals product.

Cosmeceuticals can be classified into category:

Skin Cosmeceuticals products

e.g: Antiaging cream, Moisturizers, facial product, and lotion.

Hair Cosmeceuticals products

e.g: Gel and cream, Hair colorant and dyes, Shampoos.

Others

e.g: Lipsticks, Nail polish and tooth paste.

Cosmetics vs. Drug:

The Definition of both cosmetics and drug are totally different. But some confusions are always present. Cosmetics is defined as preparation of product that is used to enhance the appearance of the body but it is not meant for the treatment of any type's disease condition. Cosmetics are applied directly on the body to enhance its appearance without healing the damage skin surface.

The Definition of drug is more complicated, generally drug is a small entity which are used for the mitigation, prevention, and treatment of disease. Drug containing product work with well-known mechanism of the body (9).

Drug Can be basically categorized into 3-class.

1. OTC (Over the Counter) Drug.
2. Behind the Counter Drug: It must be dispensed by

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pharmacist but does not require the authority of doctor.

3. Prescription Only Medicine: It can be prescribed by a licensed medical professional.

Numerous Body that regulates drug present in the market.

- a) The medicine and Healthcare product regulatory agencies (MHRA): It is a government agency responsible for ensuring that medicine and medical device work safely.
- b) The National biological stand Board (NBSB): It is a non-departmental public body. It takes responsibility for safe guarding and advancing public health.

Cosmeceutical Vehicles:

Vehicle is a term used for that substance which act as carrier molecule to the active moiety or desired moiety. Cosmeceutical vehicles are defined as substance used to deliver active ingredient to the body (10).

Types of Cosmeceutical vehicles

Solution: It is the most fundamental cosmetic vehicles. Solution is prepared by dissolving solute into solvent/liquid.

Water, aromatic water, gargles mouthwashes, juices are typical of this vehicles type.

Solutions are of two types:

1. Aqueous solution which contains water as a major part.
2. Non-aqueous solution contain alcohol, glycerine and mineral oil.

Emulsion: Emulsion is used as vehicles in most of the skin care product. By definition, an emulsion is a system in which two immiscible liquids are placed. There is occurrence of two phase in emulsion one phase is called dispersed phase and other is called dispersion medium. Emulsifying agent are also incorporated due to incompatibility of material. The function of emulsifying agent is as a solubilize, dispersing agent, and spreading agent.

Different types of emulsion are used in cosmeceuticals vehicles like water in oil(w/o), oil in water(o/w), aqueous gel, silicone in water, multiple emulsion, hydrogel, hydrophobic gel, microemulsion, and nano-emulsion. Types of emulsion is determined by chemical properties of emulsifier. Emulsifier are basically surface-active agent; they reduce the surface tension between two phases of molecules. They are classified as anionic, cationic, amphoteric, non-ionic, lipophilic, hydrophilic, ethoxylated and non-ethoxylated (11).

Surfactant: Surfactant are the substance which lower the surface tension of the molecule and provide stability. Surfactant has many functions like wetting, emulsification, solubilization, etc. It also enhances the penetration of active ingredient into the skin.

In the formulation of vehicles, mild surfactant is used. Mostly anionic surfactant is selected but recently non-ionic and amphoteric surfactant are also used.

Anionic Surfactant are negatively charged in aqueous solution due to presence of sulphonate, sulfate, carboxylate, or phosphate group. It contains mixture of isomer with various alkyl chain length. Charged surfactant are known to alter the

structure of stratum corenum by reacting with positively charged site. Fatty acid soap, linear alkyl benzene sulfonate, alkyl ether sulfates, and alkyl sulfates are the important group of anionic surfactants (12).

Surfactant used in bath soap and hair product cosmeceutical are alkyl ether sulfates. It is considered to be less irritating than alkyl sulfates. The irritancy of alkyl ether sulfates is lower than other anionic surfactants. The potential of skin irritation tends to decrease with increasing the ethoxylation level (13).

Non-Ionic Surfactant does not contain any charge thus it should not interact with polar protein molecules. Hydrogen bond and hydrophobic bond are formed after interaction with skin lipid. Non-ionic surfactant emulsify sebum, which may enhance the activity of active constituent by permitting more effective skin penetration (14).

2. Cosmeceuticals Ingredient

1) *Vitamin-A*

Retinol, Retinyl ester, and retinaldehyde are the form of vitamin A, which is used cosmetically. By endogeneous enzymatic reaction these are converted to trans-retinoic acid, which is functional form of vitamin-A. Trans retinoic acid interact with nuclear receptor protein which resulting in increased or decreased expression of specific protein enzyme (15). Interaction of retinoic acid cause many gene expression change, some specific one that are likely relevant to skin aging effect.

Induced gene expression may lead to increase the epidermal proliferation and differentiation, increased production of epidermal ground substance(glycosaminoglycans) GAG and dermal matrix substance collagen. This causes thicker skin and likely contribute to diminish fine line and wrinkles appearance. GAG binds with water molecules and thus increasing epidermal hydration (16).

Retinoic acid also has its inhibitory effects, it reduces the production of collagenase (17), and also inhibit production of excess ground substance in photoaged dermis (18). Reduction of GAG in photoaged dermis is important because it reduces the skin wrinkling (19). Retinoids also reduce expression of tyrosinase (20), it is a key enzyme in conversion of tyrosine to melanin (21).

Due to the dermal effect of trans retinoic acid, epidermal thickening occurs within a days after initiation of skin treatment and reduction of fine line on skin appear quickly (22). Reduction of deep wrinkles on skin take time because dermal matrix penetration takes times after treatment. (17)

2) *Vitamin B3*

Niacinamide, Nicotinic acid (nicotinamide), Nicotinate ester (tocopherol nicotinate) is the primary form of vitamin B that have been used in skin care product. Vitamin B3 is an essential vitamin, it acts as a precursor to a family of endogenous enzyme co-factor like nicotinamide adenine dinucleotide (NAD), it's phosphorylated NAD(P) and reduced form NAD(H), all these have antioxidant properties (23). Niacin has been used in medicine as cholesterol lowering agent.

Nicotinamide is the newest component of cosmeceutical product which is vitamin based. Many studies focus on its anti-

inflammatory and anti-acne action. (24)

It is said that it's anti-inflammatory property may improve skin appearance by inhibiting leucocyte peroxidase system that cause localized tissue damage (25). The use of topical nicotinamide is for improvement in the skin appearance and may be related to its action in the synthesis of sphingolipids, free fatty acids, cholesterol, and ceramide (26).

Collagen production in fibroblast culture is increased by nicotinamide and this effect may be responsible for improvement of skin elasticity and reduction of fine wrinkles. It is used in cosmeceuticals product in conc. Range from 3.5 to 5%. (27)

3) *Vitamin-C*

Vitamin C and L-ascorbic acid is the most useful antioxidant in human skin. Plants and animal have capacity of production of vitamin C. But human lost the ability of production of this vitamin due to loss of L-glunogamma-lactone oxidase enzyme, which is important for production of vitamin-C (28). Vitamin C is also obtained from diet source, even with the oral supplementation the conc. of vitamin C is increased very slowly. so, only topical application is a way to increasing vitamin in the skin. so, this is widely used in cosmeceutical product (29). Vitamin C act as free radical scavenger. It is water soluble vitamin and in aqueous compartment of cell it acts by donating electron and neutralizes free radical and protect intracellular structure from oxidation. (30) Free radical is considered as very reactive species. It can react very rapidly in cell DNA structure and cause mutation. L-Ascorbic acid is very important for production of collagen and it act as co-factor for prolyl and lysylhydroxylase, an important enzyme that hydroxylate proline and lysin in collagen. L-Ascorbic acid is very reactive to oxygen when it is exposed to atmosphere. For this reason, esterified derivatives of L-ascorbic acid are used in topical formulation to improve its stability. The most common derivatives are magnesium ascorbyl phosphate and ascorbyl 6-palmitate. (31) Daily application of 15% solution of L-Ascorbic acid increases ascorbic acid level 20 times and tissue level of the vitamin are saturated after 3 days. (32)

4) *Vitamin-E*

Tocopherol and tocopheryl are more common forms of vitamin E. several other esters are also used like succinate, nicotinate, linoleate, and phosphate. There are several isomers of natural tocopherol like alpha, beta, gamma and delta etc., that are differ in some of side chain and potency. Alpha tocopherol is most effective among these.

Vitamin E is an oil soluble vitamin and act as antioxidant. Oxygen free radical are major cause in many skin problem so, vitamin E has potency to prevent this by neutralize these free radical (33).

Topical vitamin E is effective in preventing UV induced skin redness, with topical 2% vitamin E providing a reduction of approximately 20% in redness value. Free tocopherol is very sensitive to hydrolysis so in spite of this tocopheryl acetate are used in formulation (34).

5) *Peptides*

Like vitamin, peptides are also used in cosmeceuticals products for desired action. Peptide are sequences of amino

acid; few peptides are interest to the incorporation in cosmetics industry because they have a property of healing. e.g. of some peptide that are used in cosmeceuticals are palmitoyl-lysine-threonine-threonine-lysine-serine (pal-KTTKS), acetyl-glutamate-glutamate-methionine-glutamine-arginine-arginine (AC-EEMQRR) and tripeptide copper glycine-histidine (cu-GHK).

Pal-KTTKS peptides are fragment of dermal layer and it stimulates new collagen production so, that has been proposed for wound healing (35). At very low level, about part per billion (ppb) in culture pal-KTTKS reduces excess dermal GAG. (36) it is discussed in under vitamin A section.

Like KTTKS, GHK is also fragment of dermal collagen (37). Enzyme lysyl oxidase is important for collagen synthesis, copper is required factor for its activity (38).

The complex of the two (cu-GHK) has stimulated wound healing by production of dermal matrix component such as collagen and matrix metalloproteinase (39).

6) *Panthenol*

Panthenol is also known as provitamin B5 and panthothenyl alcohol. Dexpanthenol is considered as D optical isomer of panthenol, it is precursor of pantothenic acid. Panthothenic acid is a component of co-enzyme A, it has critical role in cellular metabolism like biosynthesis of fatty acid biosynthesis and gluconeogenesis (40). Panthenol also promote proliferation of fibroblast and epidermal reepithelization, this effect promotes wound healing (41). Panthenol is water soluble and hydroscopic, it has skin moisturization potential especially when combined with the widely used moisturizing agent glycerol (42).

7) *Hydroxy Acid*

In this group various compound are included like α -hydroxy acid (AHA) such as glycolic, malic, tartaric, lactic and citric acid. Polyhydroxy acid like gluconolactone, lactobionic acid and β -hydroxy acid such as salicylic acid etc. Compound of this group involves exfoliation of stratum corneum, it occur due to chelation of the calcium involved in cell-cell cohesion. This accelerated exfoliation results in improvement on skin texture and color appearance. (43-46)

8) *Sugar Amine*

Widely known material in this group are hexose amine and N-acetyl glucosamine (NAG). Hexose amine and NAG is an important precursor for hialuronic acid. Hyaluronic acid is a important water binding structure component of skin in the epidermis and the dermis. It improves moisturization and also fine lines/wrinkles appearance by generating skin structural matrix (45). Glucosamine inhibits the production of melanin by inhibiting activation of protyrosinase to the active enzyme tyrosinase (47). In glucosamine product production the challenging step is the stability of product because it readily undergoes maillard reaction leading to form brown polymeric product (48).

9) *Ceramides*

Ceramides are lipid compound and it is essential for stratum corneum water barrier. Cholesterol and fatty acids are other key lipid component of barrier. All these are required in equimolar mixture in intercellular space in stratum corneum (49).

Externally applied to the skin cause incorporation into intercellular lipid and replace the depletion that occur with aging and environmental damage (50).

10) Metals

In cosmetic product metal like zinc, copper, selenium, strontium, magnesium, magnase are used. Metals have specific function in skin, they are act as co-factor in the activity of metalloenzyme and therefore the mechanism associated with each individual metaks are varied. (51)Certain metal organic compound complexes are functional in their own right. e.g: pyrithione-zinc and selenium sulfide are antifungal agents that are effective as antidandruff agents. Copper act as co-factor for many proteins including lysyl oxidase and prolyl hydroxylase, enzyme that is important in collagen synthesis. (52)

3. Conclusion

The uses of cosmeceuticals have drastically increased in recent years, which in turn has increased the spectrum of physician to broaden their range of product to enhance the problem of patient that are associated with skin. Many cosmeceuticals ingredient is used in the cosmetic industry. A well-designed vehicle promotes entry of topically applied substance into the stratum corneum. The ideal vehicles will enhance permeability of the active ingredient for desired effect of products. Growth of cosmeceuticals industry is increased day by day as the cosmeceuticals market is highly diversified with product coming from major and small manufacturers.

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