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## **Needs of Nanotechnology in Global Scenario of Cosmeceuticals**

**Iqra Zai, Deepshikha, Neha Raina, Madhu Gupta\***

*Department of cosmeceuticals, School of Pharmaceutical Sciences, Delhi Pharmaceutical Sciences and Research University, Pushp Vihar Sector 3, MB Road, New Delhi -110017*

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### **ABSTRACT**

The desire to keep up a vernal image combined with the rising world market with income has driven the event of many new industries. The cosmeceutical business relies on the event and selling of merchandise that lie between cosmetics and prescription drugs. Nanotechnology manifests the progression in the arena of research and development, by increasing the efficacy of the product through the delivery of innovative solutions. The Cosmeceuticals area unit thought to be the quickest growing phase of the non-public care business and therefore the use has up drastically over the years. Nanocosmeceuticals used for skin, hair, nail, and lip care, for conditions like wrinkles, photoaging, hyperpigmentation, dandruff, and hair damage, have come into widespread use. This review also explains the huge contribution of herbal drugs to the global market. Nowadays plant-based cosmetics or cosmeceuticals are widely used in various skin problems in addition to their cosmetic effects, enhance antibacterial, antifungal, anti-carcinogenic, and anti-inflammatory biological actions. This review, based on engineering science which employed in cosmeceuticals, that highlights the assorted novel carriers, which are used for the delivery of cosmeceuticals and their positive-negative aspects too. It also emphasizes about marketed formulations and regulations of Nanocosmeceuticals.

**Keywords:** Cosmeceutical, Nanotechnology, The global cosmetic market, Penetration mechanism, Regulation of Nanocosmeceuticals.

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\*Corresponding Author Email: [madhugupta98@gmail.com](mailto:madhugupta98@gmail.com)

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## INTRODUCTION

The Cosmetic market is a significantly vital industry that is not necessarily in terms of its contribution to global GDP but its striking influence on the colorful in social lives of humans globally. The Cosmetic market is a mixture of chemicals mostly used to enhance the appearance or odor of the human body. Sun care, skin care, hair care, deodorants, makeup and color cosmetics, and fragrances are some of the cosmetic products that are mainly available and used by individuals. There is a considerable rise in disposable incomes over the past decade. The growth in global economies, changing lifestyles, rising demands of skin and sun care products due to varying climatic condition encourages the growth of the cosmetic market (*Annual growth rate of the cosmetics market worldwide, 2018 / Statistic*). A shift of preference towards natural, herbal and organic beauty products creates potential opportunities for manufacturers to innovate and develop new products in accordance with consumer preferences. In the last 20 years Global Beauty Market has grown by 4.5% a year on average (CAGR), with annual growth rates ranging from 3% to 5.5%(2).

### **Cosmetic:**

Cosmetic area unit substances or merchandise want to enhance or alter the looks of the face or fragrance and texture of the body. Many cosmetics are designed for the use of applying to the face or fragrance and texture of the body. They are generally mixtures of the chemical compound; some being derived from natural sources and some are the synthetic derivatives. The Food and Drug Administration (FDA), which regulates cosmetics, defines the cosmetics as “The substance which intended to applied to the human skin for cleansing, beautifying, promoting attractiveness, or altering the appearance without affecting the body’s structure or body functions”(3)

### **Cosmeceuticals**

Cosmeceuticals represent a brand new class of multifunction merchandise that accept science and technology to deliver clinically evidenced active ingredients to the skin. A cosmeceutical is a product which is categorized by the FDA, but this term is used by skin scientists, physicians, and skin care professionals, to encourage consumers for continue buying the cosmetics products. Cosmeceuticals are the cosmetics products with bioactive ingredients purported to have medical benefits. There aren't any legal necessities to prove that these merchandise live up to their claims. The name is derived from the combination of “cosmetic” and “pharmaceutics”(4). Cosmeceuticals are often formulated with pharmaceutical-type active compounds and

demonstrated to achieve multiple cell-protective effects for rebuilding healthy skin on a cellular level. Cosmeceutical formulation currently has dilated from skin to variety of topical application for the condition like photoaging, hyperpigmentation, wrinkles, and hair damage have come into widespread use(2). Cosmeceutical innovation is a rapidly growing area in personal care industry, which expands from facial products to skin and body products(5)(the global market for cosmeceuticals, 2018). Recent researches that specialize in cosmeceutical merchandise highlighted robust growth views within the returning years. Among the technologies used to develop an effective cosmeceuticals, nanotechnology finds a unique place. In recent years, a lot of work being done is based on nanotechnology.

**Table 1: Classification of Cosmeceuticals.**

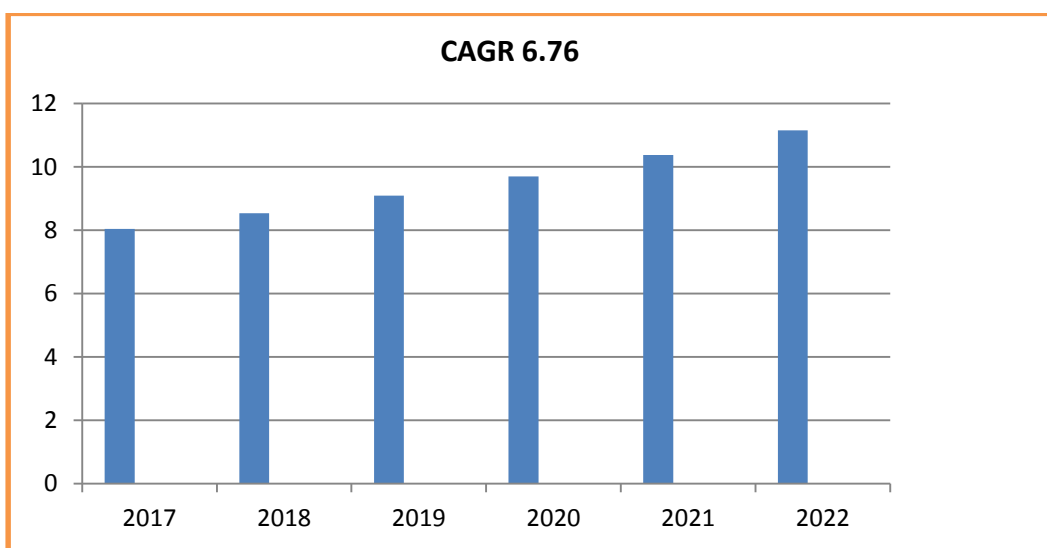
<b>Class</b>	<b>Products</b>	<b>Application</b>
Leave-on products	Deodorants, Antiperspirants.	Inhibit the bacterial metabolism responsible for the degradation of sweat and subsequent production of unpleasant body odor. Suppress the release of sweat and eliminates the bacteria responsible for unpleasant body odor production.
Rinse-off hair products	Anti-dandruff shampoo	Inhibit the yeast growth and eradicate dead cells adhering to the scalp.
Skin-care products	Antibacterial soap bar, Disinfectants, Antibacterial wipes.	Cleansing and bacterial reduction.
Face-care products	Acne products and antiseptic cuticle treatments.	Skincare, cleansing, and anti-acne treatments.
Oral care products	Toothpaste, Mouthwash	Prevention of bacterial growth and plaque formation.

## GLOBAL COSMETIC MARKET

Skincare leading category accounting for 36% of the cosmetic market followed by hair care 23%. Skincare forecast to remain the most profitable product category, its market value is projected to grow by 20.1 billion U.S. dollars between 2014 to 2019. The cosmetic marketing has benefited from the increasing quality of social media channels.(5)

India is known to have a long heritage of personal care products, beauty products, and cosmetics, as well as aesthetic makeup products. the Increasing influence of the western trends and international beauty pageants have brought personal care and cosmetic industry into the limelight in the country over the last couple of decades. India is one of the fastest growing consumer markets globally, with the transition from an unorganized market to an organized retail

marketplace being witness across major Indian cities as well as tier I and tier II cities. Cosmetics and personal care sector is one of the fastest growing consumer products sector with huge growth opportunities for international companies. The personal care, cosmeceutical, and cosmetic industry in India have shown consistent powerful growth over the last few decades. Over the past few years, women cosmetic market has been operate by the latest skincare products segment. The global skincare market has observed strong growth on account of the growing adoption of skincare products like anti-aging cream, anti-blemish creams, exfoliators, etc. Also, many new formulation have been introduced for different skin types. Moreover, with the rising popularity of desire to appear youthful among women, many products have been introduced that fight signs of fatigue, stress, and aging. There is one more additional factor which encourages demand for cosmetics and personal care products are the rising trends of celebrity endorsements.(6)



**Figure 1: India cosmeceutical, cosmetic & personal care market size, by value 2017-2022F (USD Billion)**

### Global Demand Of Herbal Products

The global ayurvedic market is anticipated to grow at a fast pace in the coming years. The usage of ayurvedic products is increasing both in developed as well as developing countries. Various non- governmental along with the ministry of health & family welfare are taking motivation to promote the use of ayurvedic products across the globe. China is the leading exporter and importer of the plant extracts, herbs, cosmetic, and species. Though India has a rich heritage of Ayurveda, it is still lagging behind the china. The ayurvedic products market accounts for around 7% penetration in India cosmeceutical, cosmetics & personal care market. The global market for cosmeceuticals will reach ~42 billion dollars and lead to a great demand in the near future. Even

though the various synthetic compound is currently available in the global market thus, increases the human toxicity with cosmeceuticals interference in certain treatments. Alternatively, plant-derived natural, bioactive compounds show increased beauty roles along with the therapeutic roles in conjunction with health advantages against diseases.(7) Nowadays plant-based cosmetics or cosmeceuticals are widely used in various skin problems in addition to their cosmetic effects, enhance antibacterial, antifungal, anti-carcinogenic, and anti-inflammatory biological actions (figure 1).

**Table 2: Herbal ingredients used in cosmeceutical formulation.**

S.no	Ingredients/botanical name	Common action
1.	Aloe barbadensis	Rich in vitamins, minerals, enzymes, heals and soothes.
2.	Anthemis nobillis	Soothes, softens and calms skin.
3.	Citrus paradisi	Used in hair and skin care products to tone and purify skin and help reduce hair loss.
4.	Buxus chinensis	Protects, softens and gives skin a smooth, silky appearance.
5.	Citrus limonum	Purified and brightens dull skin
6.	Ammonium glycyrrhizate	Soothens, and help to control oil, in hair or skin.
7.	Citrus aurantium amara flower	Used as a delicate perfume, soothes and rebalances skin.
8.	Rosa damascena	Used as a delicate perfume, soothes and tones skin.

**Table 3: Top leading cosmetic brand in Indian market.**

S.no	Brands	Products	Description
1.	LAKME	<ul style="list-style-type: none"> <li>Lakme Absolute Argan Oil Lip Color.</li> <li>Lakme Eyeconic curling Mascara.</li> <li>Lakme 9 to 5 Mattifying super sunscreen SPF 50 etc.</li> </ul>	Lakme is the country's first cosmetic brand to introduce makeup to Indian women and takes pride in being the Indian beauty expert for over 65 years. The company is headed by Mr. Anil Chopra who is the CEO of the company. Lakme was founded in the year 1952 by JRD Tata. In 1996 the Tata group decided to sell off its stake in Lakme to Hindustanlever limited. This brand also sponsors the Lakme Fashion week (LKW) twice a year. It additionally launched the Lakme excellent Radiance and Lakme eyeconic Kajal that achieve important market share.
2.	BIOTIQUE	<ul style="list-style-type: none"> <li>Bio Neem Purifying Face Wash.</li> <li>Bio Coconut Whitening And Brightening Cream.</li> <li>Bio Seaweed Revitalizing Anti Fatigue Eye Gel etc.</li> </ul>	Biotique was start by Vinita join in the year 1984. This brand also manages to stick out in the world of synthetic-based cosmetics as it doesn't contain any artificial preservatives, synthetic fragrances. The ingredients used in the formulation are extracted directly from herbs. Moreover, the herbs/plants used for extracting raw material are also monitored from its budding stage hence the end product is organic in nature.
3.	LOTUS	<ul style="list-style-type: none"> <li>Lotus Herbal Sheamoist Moisturizer</li> <li>Lotus Herbal Safe Sun UV Screen Matte Gel,</li> <li>Lotus Herbals Colorstylo Chubby Lip Color etc.</li> </ul>	The company Lotus Herbals Ltd was set up two decades ago in the year 1993 by Kamal passi. This brand deal with the manufacturing and selling of various kinds of cosmetics. The list includes face cleansers, sunscreen, winter care, hair oils, and shampoos. Passi knew the importance of good packaging and made sure his products stand out in the design. He also priced his products at least 10-15% lowers than the contemporary brands in the segment. Lotus Herbal Ltd Company specializes in producing cosmetics that claim to have natural ingredients in their formulations. This

			brand is strictly against the cruel practice of animal testing. It is growing at a rate of 35%-40% a year.
4.	LOREAL	<ul style="list-style-type: none"> <li>• L'Oreal Volume Million Lashes Mascara,</li> <li>• L'Oreal Paris Infallible Mono Eyeshadow,</li> <li>• L'Oreal Color Riche Nutri Shine Lipstick etc .</li> </ul>	L'Oreal is one of the most leading company in the cosmetic section within the world. Jean-Paul Agon is the chairman and CEO. The company has been present in India for about 20 years. Today, L'Oreal India may be a subsidiary of L'Oreal that is growing at a really quick rate. L'Oreal Paris is one in all the trademark brands of this company. In 2013 L'Oreal determined to speculate Rs.970 crores in India. Moreover, in the same year L'Oreal made its first acquisition in India-Cheryl's cosmeceuticals, thus entering the company grew at a commendable rate of 70%.
5.	REVLON INDIA	<ul style="list-style-type: none"> <li>• Revlon Super Lustrous Lipstick,</li> <li>• Revlon Color Brust Lip Butter,</li> <li>• Revlon Nail Enamel etc.</li> </ul>	Revlon was launched in 1995, due to the collaboration between Umesh K Modi along with Revlon Pvt Ltd in 1994. The Pricing is done for the mid-level consumers as it neither too high nor too low priced. The company owns about 20-25 look after the domestic color cosmetic market share.
6.	MAYBELLINE	<ul style="list-style-type: none"> <li>• Lash Sensatinal Mascara,</li> <li>• Color Sensatinal Creamy Matte Lipstick,</li> <li>• Lemonade Craze Eyeshadow Palette etc</li> </ul>	It was launched back in 1915 by T.L. It was later nonheritable by L'Oreal and in Asian nation, it was launched by its subsidiary, L'Oreal India. One of the major factors that have helped this brand to crave its niche is being reasonably priced in spite of having an international appeal.
7.	HIMALAYA	<ul style="list-style-type: none"> <li>• Himalaya active fresh,</li> <li>• Himalaya age defying hand cream,Hlimalaya almond and rose soap,body lotion.</li> </ul>	The Himalaya Drug Company was founded in the year 1930 by Mr.M.Manal who had the vision to make Ayurveda accessible to the world. Himalaya has been able to patent its sunscreen, Under-Eye Cream, Anti-Acne range Hair Loss cream among others from the United States Patent and Trademark Office. The business of Himalaya in Asian nation contributed hour of the brands sales of Rs one,200 crores in 2011. Himalaya is also an owner of popular face wash "purifying Neem" which is very popular in India which has atremendous effect on acne and oily skin problems.
8.	COLORBAR	<ul style="list-style-type: none"> <li>• Amino skin radiant foundation,cheek illusion blush,concealer ,colorbar sindoor.</li> </ul>	Colobar cosmetics is one of the leading brands of cosmetics in India. It was founded in 2004. The founder as well the managing director of the brands is Samir Modi. The brand is known for its bright peppy colors and has a number of products to add color to nails, eyes, lips, and face.

### Problem Associated With The Use Of Cosmetics

Cosmetic include a wide range of products. Some of these can cause health problems in some people, such as skin or eye irritation or allergic reactions. These types of problem are usually short-term and go away if the use of the product is stopped. Whether cosmetic or certain ingredients in them cause more subtle or long term health problems is not entirely clear. There has been a selling trend towards the sale of cosmetics lacking disputable ingredients, especially those derived from petroleum, sodium lauryl sulfate (SLS), and parabens (8). Numerous reports have raised concern over the safety of few surfactants, including, SLS may cause skin problem, including dermatitis. Contact dermatitis (CD) is a common skin condition characterized by itching, redness, cracks, dryness, and pain. Formaldehyde (FA) is a common cause of contact allergy.(8) However many products are preserved with formaldehyde releasers (FRs), which release FA by hydrolysis in the presence of water(9). Various problems are associated with the use of the different types of cosmetic products which are to be mention in table-4.

**Table 4: Associated problems with the use of cosmetic (FDA Survey)**

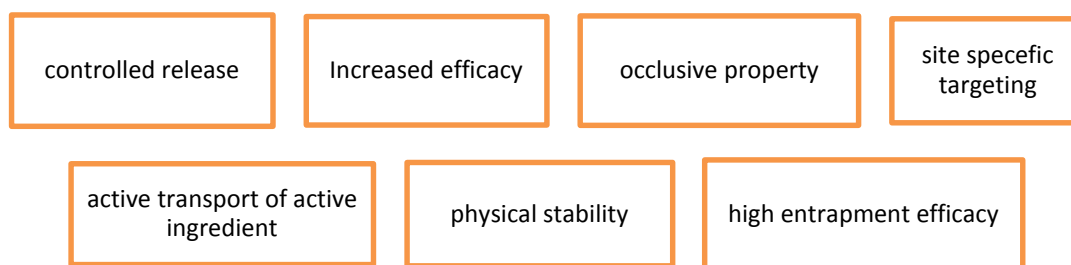
S.no	Products	Associated problems
1.	Hair conditioners	Hair loss, hair breakage, balding, itching, and rash, etc
2.	Hair smoothing products	Cause serious irritation of your eyes, nose, and lungs, etc.
3.	Hair dye	Causes eye injuries, including blindness, skin irritation and hair loss, etc.
4.	Lipstick	Due to the presence of lead content causing the lead poisoning which ultimately caused cancer etc.
5.	Eye cosmetics	Causing irritation, eye infection, redness, etc.
6.	Nail cosmetics	Causing the fungal infection, irritation, brittleness, striation, etc.
7.	soaps	Excessive dryness, itching, redness, rashes, premature aging, etc.
8.	perfumes	Sneezing wheezing to rash and headache.

### Nanotechnology

Nanotechnology is a science, engineering, and technology conducted at the nanoscale, which is about 1 to 100 nanometers. Nanotechnology involves imaging, measuring, modeling, and manipulating matter at this length scale. In the cosmetic area, it is believed that the nano particles are readily absorbed into the skin and repair damage skin easily and more efficiently(10). The Consolidation of nanotechnology in cosmeceuticals is aimed at making incense of perfumes last longer, sunscreen to protect the skin from photosensitivity, antiaging creams to fight the wrinkles and age spots, and moisturizers to maintain the hydration of the skin. Nanotechnology solves the most issue with higher protective and skin health-enhancing efficiency. Various technology strategies square measure concerned in active roles in beauty



sweetening. In the market, many synthetic derivatives are used in nano cosmeceuticals that cause toxicity and also leads to skin health issues. Therefore Natural phytochemicals are in greater demand due to their less toxicity. The primary blessings of victimization nanoparticles in cosmeceuticals embrace improvement within the stability of cosmetic ingredients (e.g. vitamin, unsaturated fatty acids, and antioxidants) by encapsulating within the nanoparticles; cosmeceuticals have high entrapment efficiency and good sensorial properties and are more stable than the convection cosmetics; most of the nanoparticles square measure appropriate for each oleophilic and hydrophilic drug delivery(11). Nanomaterials are widely used in the preparation of antiwrinkle creams, moisturizing cream, skin whitening cream, hair repairing shampoos, conditioners, and hair serum, ultimately targeting of active ingredient to the desired site and controlled release of active ingredients for prolonged effects.



**Figure 2: Positive aspects of nanotechnology.**

### NEEDS OF NANOTECHNOLOGY IN COSMECEUTICALS

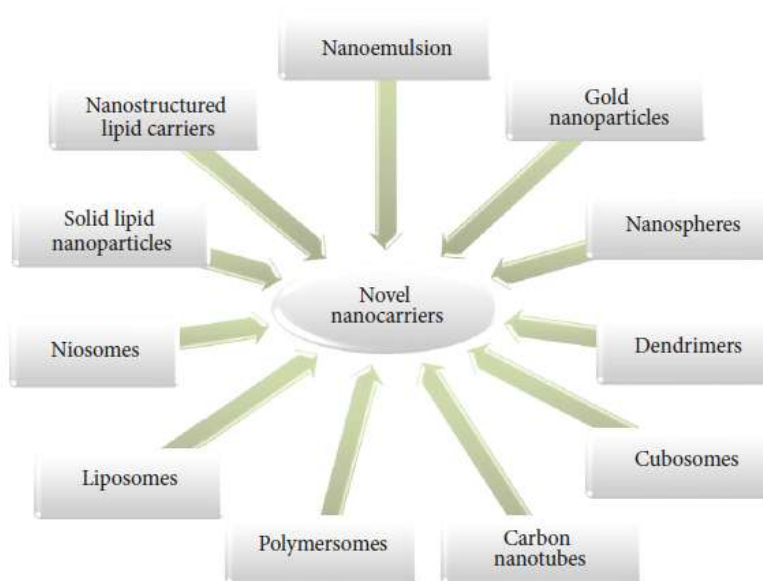
Among the technologies used to develop dignified and effective cosmeceuticals, nanotechnology finds a unique place. In the cosmetic arena, it is believed that smaller particles are readily absorbed into the skin and repair the damage easily and more efficiently(11). Incorporation of nanotechnology in cosmetics aimed at making formulation which have a high therapeutics advantages along with the superficial benefits(12).Some of the nanotechnology-based innovation are nanoemulsions (which are transparent and have distinctive tactile and texture properties), nanocapsules (which are used in skin care products), nanopigments (that are transparent and increase the efficacy of sunscreen formulation), liposomes formulations (which contain small vesicles consisting of standard cosmetic materials that protect oxygen and light sensitive cosmetic ingredients), niosomes, nanocrystals, solid lipid nanoparticles, carbon nanotubes, fullerenes, and dendrimers are some of the example of nanoparticles(13).The primary benefits of incorporation of nanoparticles in cosmeceuticals together with improvement within the stability

of the cosmetic ingredients (e.g.; vitamins, unsaturated fatty acids, and antioxidants) by encapsulating inside the nanoparticles; efficient protection of the skin from harmful ultraviolet (UV) rays; aesthetically pleasing products (e.g., in mineral sunscreens, using smaller particles of active mineral allows them to be applied without leaving a noticeable white cast); targeting of active ingredients to the desired site and controlled release of active ingredients for prolonged effect(14).

### **Nanotechnology drug delivery system in cosmetics and dermatology:**

The various types of nanotechnology drug delivery systems used in cosmetics and dermatology are presented in Fig.(3). Liposomes are globular, closed-colloidal vesicles comprising a lipid bilayer that usually contains phosphatidylcholine-enriched phospholipids that surround the central aqueous space. One of the major ingredients of liposome is phosphatidyl choline which has been employed in numerous skin and hair care products owing to its emollient and conditioning properties. Nano-liposomes are employed in cosmeceuticals such as anti-aging, sun-block; hair creams as well as a skin moisturizer, which contains synthetic as well as phytoactive compounds(15). Solid lipid nanoparticles are oily droplets of lipids stabilized by surfactants and are solid at body temperature. They have widely used for the delivery of both lipophilic as well as hydrophilic substances. Nano-structured lipid carrier particles are prepared by the fusion of solid lipids with oils and have increased the loading capacity of active ingredient(16). Nano crystalline aggregates specially formulated for the delivery of poorly soluble active ingredients and possess acrySTALLINE cluster of thousands of atoms of size 10 to 400 nm. Cubosomes are discrete, nanostructured particles of bicontinuous cubic liquid crystalline phase packed in a cube-like fashion and are used as oil-in-water emulsion stabilizers and absorbents for pollutants in cosmetics. Virosomes consist of viral hybrid liposomes and proteins which are used in vaccines against certain viruses. Microsponges consist of microporous beads designed for the controlled release of topical actives(17). Dendrimers are extremely minute, organic chemical entities with semi polymeric tree like structure having dimensions in the range of 2-10 nm. In a patent on cosmetic formulation comprising carbo-siloxane dendrimer, produced decent water resistance, better shininess, perceptible sensation, and better adhesive properties for skin and hair care(18). Niosomes are smaller, unilamellar nanostructures in size range of 10-100nm, made up of a central aqueous cavity which is surrounded by layers of non-ionic surfactant in lamellar phase. Niosomes are acceptably employed to deliver antioxidants such as ascorbic acid, resveratrol, and ellagic acid through the skin(19). A slightly larger niosomes in the size range of 471-565 nm comprising phyto-derived antioxidants such as resveratrol, alpha-

tocopherol, and curcumin which showed increased antioxidant activity to the skin with enhanced skin permeation activity for cosmeceuticals applications(20). Fullerenes are spherical molecules of carbon atoms measuring about 1nm in diameter. Recently, some researchers developed a fullerene nanocapsule with ascorbic acid and vitamin E which showed increases skin protective activity against premature aging by its antioxidant activities(21). The nanocapsule is a nano-scale shell vesicular system made from a non-toxic polymeric membrane which encapsulates an inner liquid core at the nanoscale. The nanocapsules based on cosmetic product for potential dermatological use was introduced by the French company L'Oreal in 1995 in order to improve the impact of their cosmetics(22). Silver and gold nanoparticles have been reported for their strong antibacterial and anti-fungal properties. They have been extensively used in cosmeceuticals products in the preparation of deodorants, face packs, and anti-aging creams. Silver nanoparticles are now employed in toothpaste, soaps, face creams, food packaging, clothing, household appliances, disinfectants and wound dressings. Carbon nanotubes are novel technology recently used in cosmeceuticals sectors specially for skin care. Similar to fullerene, carbon nano-tubes alone act as an antioxidant(23)

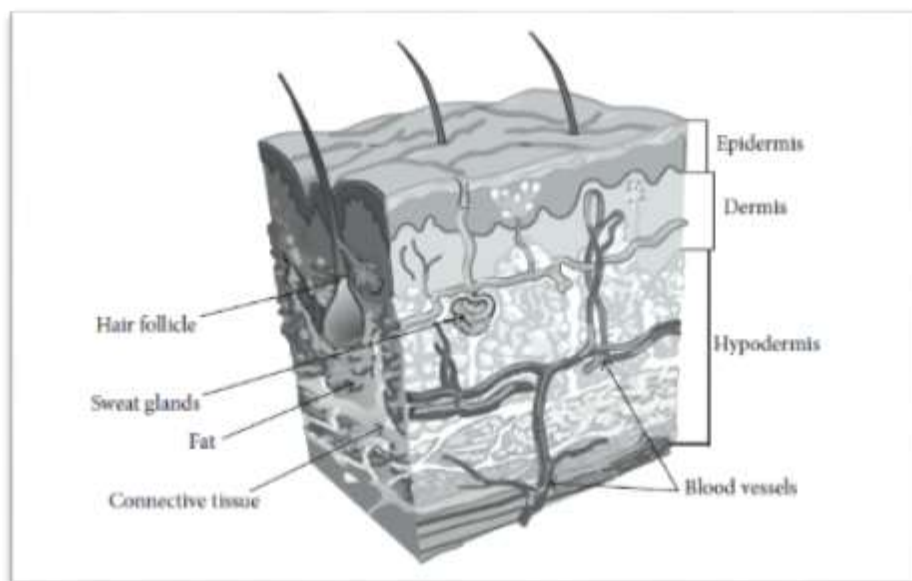


**Figure 3: Nanotechnology delivery system.**

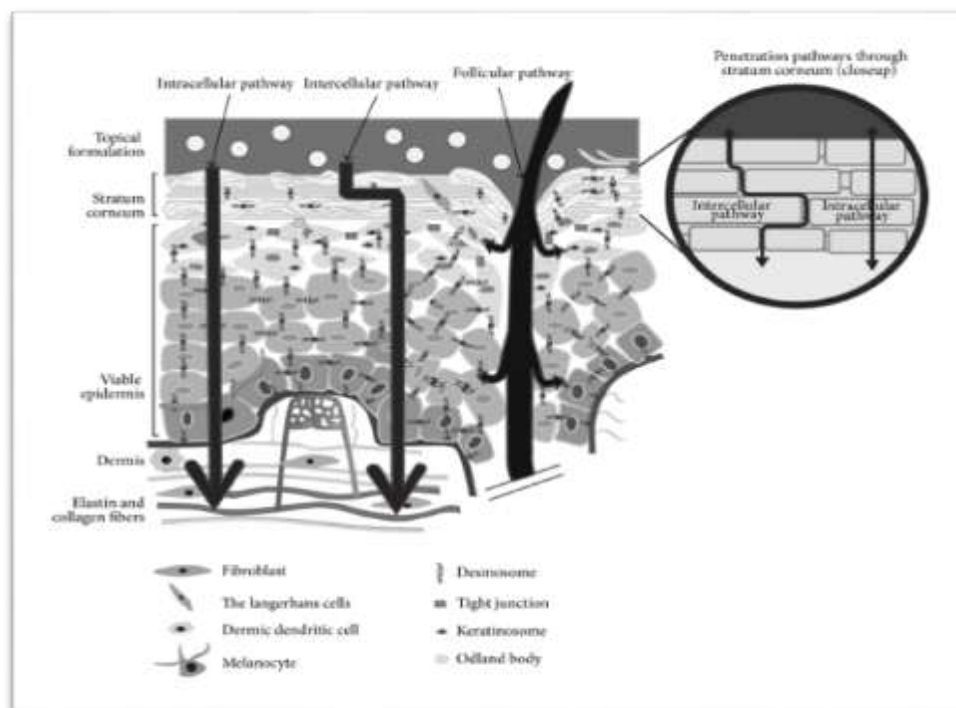
### SKIN PENETRATION OF NANOPARTICLES

The skin is the largest organ of the human body. It is made up of three layers(Figure 4): human skin is an extremely complicated tissue defined as a three-tiered structure, epidermis, the outermost layer, the dermis, and the deepest hypodermis. The epidermis is divided into several layers and its outermost layer, the stratum corneum, is responsible for the barrier function of the

skin due to its lipophilicity and high cohesion between cells. Passive routes by which a molecule can cross the stratum corneum are intercellular, transcellular, and appendage routes (Figure 5)(24). The transport of nanoparticles through the skin are based on the chemical properties of the nanoparticles, vehicles, the nature of the substance, and the conditions of the skin(25)



**Figure 4: Skin structure**



**Figure 5: Skin penetration pathway.**

**Table 5: List of Nanocosmeceutical products along with their marketed claim.(5)**

Product	Proposed use	Marketing claim
Hydra Flash Bronzer Daily Face moisturizer	Moisturizer	Nanocapsules of pure vitamin E provide powerful antioxidant protection. A light touch of self-tanner ensures a natural, healthy glowing skin.
Hydra Zen Cream	Moisturizer	Containing Nanoencapsulated Triceramides, Hydra Zen helps restore perfect comfort and softness and renew the skin's healthy look. Protected from signs of daily stress and fully hydrated, your skin is beautifully soft and smooth all day long.
Revitalift Double Lifting	Antiwrinkle	It contains nanosomes of Pro-Retinol A. RevitaLift Double Lifting is a unique dual action treatment that instantly re-tightens skin and effectively fights wrinkles.
Nano Gold Firming Treatment	Antiaging	Infinitely small nanoparticles of pure gold are bound to silk microfibers to firm and tone skin while delivering incredible anti-inflammatory, healing, and age-defying power.
Zelens Fullerene C-60 Night Cream	Antiaging	Fullerene C-60 is a naturally occurring microscopic form of carbon which was found to have remarkable antioxidant properties.
Dior Snow Pure UV Base SPF 50	sunscreen	It Contains nano-UV filters for ultra-protection against the damaging effects of UVA and UVB rays.
Fresh As A Daisy Body Lotion	Body lotion	This lotion uses nanospheres to quickly penetrate, moisturized and nourish all types of skin.
Cosil Whitening Mask	Face mask	Made up of nanocolloidal silver which is used for the effect of getting rid of germs from your face, compressing pores, soothing the skin, and keeping the skin radiant and soft.
Lip Tender	Lip moisturizer	Ten bioactive ingredients are precisely calculated to work within liposomes, delivering a 4-in-1 formula and bringing long-lasting hydration for fast and dramatic lip repair.

### GLOBAL SCENARIO OF NANOCOSMECEUTICAL

In recent years, the safety and quality of nano-cosmeceuticals remained a topic of debate due to the fact that the nanocosmetics may show harmful effects due to irritation of skin sensitization or inhibition of Vitamin D synthesis(26). Drugs are subjected to the demanding scrutiny necessities obligatory by Food and Drug Administration for his or her approval however there aren't any such necessities for cosmetics. Many cosmeceuticals change the physiological processes in the skin, but manufactures avoid holding clinical trials and making the specific claims to avoid subjecting their products to an expensive and lengthy approval process by the FDA. New and unfamiliar challenges are being faced by the cosmetic industry(27)

Table 6: The Global scenario of nanocosmeceuticals.(28)

S. No.	Country	Regulatory Authority	Remarks
1.	United States	Food and Drug Administration (FDA)	<ul style="list-style-type: none"> <li>• There are 3 categories in the US: namely, cosmetics, drugs, and OTC drugs.</li> <li>• There is no legal definition of cosmeceuticals according to USFDA.</li> <li>• Classification in USFDA depends on the claims of the products.</li> <li>• Regulatory guidelines for industries released in June, 2014 for safety aspects of various nano-cosmeceuticals.</li> <li>• FDA informs industries about unsafe nano-cosmeceuticals to control their use in nano-cosmetics.</li> <li>• Environmental Protection Agency also regulates the effects of nano cosmeceuticals.</li> <li>• It is not mandatory to disclose nano-material on the label of nanocosmetic.</li> </ul>
2.	Australia	National Industrial Chemicals Notification and Assessment Scheme (NICNAS)	<ul style="list-style-type: none"> <li>• NICNAS guidelines implemented in Jan 2011 and the main objective of these guidelines is the identification of nano-materials (either nanomaterial of an existing compound or a novel compound).</li> <li>• Nano-materials of novel compounds require approval followed by the evaluation performed by NICNAS and self-analysis carried out by producers is not acceptable.</li> <li>• However, nanomaterials of existing chemicals do not require any permission/assessment by NICNAS.</li> </ul>
3.	European Countries	European Union (EU)	<ul style="list-style-type: none"> <li>• In 1976, the EU framed its regulatory guidelines for the safety of cosmetics and amended in 2007; and pre-market evaluation is required for cosmetics.</li> <li>• EU regulatory guidelines for the safety of nano-cosmetics were released in 2009 and amended in 2012.</li> <li>• As per EU regulatory guidelines, unstable molecules (such as liposomes) are not considered nano-cosmeceuticals.</li> <li>• It is mandatory to provide safety data of 6 months in advance of getting approval for any new nano-cosmetic.</li> <li>• It is necessary to state word “nano” on the label if any nano cosmeceutical is used for the formulation of cosmetic.</li> </ul>

4.	Japan	Ministry of Economy, Trade and Industry (METI) and National Institute of Occupational Safety and Health Japan (JNIOSH)	<ul style="list-style-type: none"><li>• METI observes safety assessment of nanomaterials at the industrial level in Japan, since 2008.</li><li>• JNIOSH published the reports and updated on a series of guidance on safety issues of nano-materials.</li></ul>
5.	China	National Steering Committee for Nanoscience and Nanotechnology (NSCNN)	<ul style="list-style-type: none"><li>• NSCNN was established in 2010 by the Ministry of Science and Technology for the regulation of nanotechnology products in China.</li><li>• Nanotechnology standards are reviewed by the National Nanotechnology Standardization Technical Committee, and the Technical Committee 279, under the Standardization Administration of China.</li></ul>
6.	Canada	Health Canada and Environment Canada	<ul style="list-style-type: none"><li>• Delivered a working definition of nano-materials; means of collecting information on use, characteristics and safety issues of the nanomaterials reaching the market.</li><li>• Established the “Interim Policy Statement on Canada's Working Definition for Nanomaterial”, a gathered information for the safe use of nanomaterials in cosmetics.</li></ul>

## CONCLUSION

The Growth of the cosmeceutical industry is increasing day by day as the cosmeceutical market is highly expand, with products coming from major and small manufacturers and local companies across the world. Nanotechnology represents the key technologies of the 21st century, offering excellent opportunities for both research as well as business. The rapid spread and commercialization of nanotechnology in cosmeceuticals has given rise to great technical and economic desire but also question about the emerging risk to health and safety of consumer after the application of these advanced nanocosmeceuticals. Thus, cosmeceutical product supported engineering science and nanotechnology technique should be designed and sold in an exceedingly approach that totally respects the health of customers and environment.

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