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Nanomaterials in Cosmetology

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Abstract

The small particle size of the material has the potential to alter the distribution compared to a larger scale material with the same chemical composition with increased surface area and increased biological interactions. Nanomaterials found applications in the field of cosmetics and emerged as ***Nano cosmetics****. The enhanced properties attained by the particles at the Nano level include color change, transparency, solubility etc. The different types of nonmaterial based on their size in cosmetics include nanosomes, Liposomes, fullerenes, solid lipid nanoparticles etc. In this review, the emphasis is made on the types of nanomaterials used in cosmetology and cosmetics.*

Keywords*: - Nanotechnology, Nanomaterials, Cosmetology, Nano Cosmetics*

INTRODUCTION

Nanotechnology is an innovative science that includes the design, characterization, production and application of structures by controlling shape and size at the nanometer scale, which covers the size range from 1 nanometer to 100 nanometers (nm), where 1 nanometer is 1 billionth of a meter. The nanoparticles obtain newer properties that differ from the large-scale particles. These altered properties include color, transparency, solubility and chemical reactivity, making the nonmaterial attractive to the cosmetics and personal care industries. Cosmetics with nonmaterial are used to provide better UV protection, deeper skin penetration, long-lasting effects and increased Color and quality. Nanomaterials are also used in the production of nanocapsules (10 nm to 1000 nm) made up of a polymeric membrane in which an inner liquid core is

encapsulated at the Nanoscale level.[1] Different nanoparticles which are used in various cosmetics are reviewed in this article.

TYPES OF NANOMATERIALS USED IN COSMETICS:

The nanomaterials are further classified into Liposomes, nanocrystals, Dendrimers, solid lipid nanoparticles, Nanogold and nanosilver particles, Niosomes, and fullerenes.

1. ***Liposomes: (20 nm to few hundred micrometres):*** Liposomes can encapsulate into ingredients easily due to size and used in a variety of cosmetics because of biocompatible, biodegradable, non-toxic, and flexible vesicles. Liposomes protect the encapsulated drug from the external environment and can deliver hydrophobic and hydrophilic compounds. These characteristics make them ideal for the delivery of vitamins and other essential molecules to regenerate the epidermis. One of the main ingredients of liposome is Phosphatidylcholine, used in skincare products (moisturizer, lotions, creams, etc.) and hair care products (shampoo, conditioner) because of its softening and conditioning properties. Several active ingredients (e.g., vitamins A, E, and K) and antioxidants (e.g., carotenoids, lycopene, and CoQ10) are incorporated into Liposomes, which increases their physical and chemical stability when dispersed in water. To improve skin hydration and to make the skin texture softer and smoother. Lipophilic compounds such as cholesterol and ceramides are used in topical skin creams.

2. ***Solid Lipid Nanoparticles (50 to 1000 nm):*** SLNs are popular in cosmeceuticals because of their physiological and biodegradable and low toxic levels. The small size of SLNs ensures close contact with the stratum corneum and increases the penetration of active ingredients through the skin; SLNs provide occlusive properties that result in increased skin hydration the release of fragrance can be slowed down by incorporating SLNs to provide the prolonged effect.[2]

3. ***Nanocrystals (size range of 10–400 nm):*** Nanocrystals are used for the delivery of poorly soluble actives; the solubility of rutin was 500 times lower as compared to the water-soluble derivative in the aqueous

Nano suspension. despite the 500 times lower concentration, the nanosuspension was about 25% more effective in photoprotection and the concentration of actives formulated as nanocrystals in the skin was much higher compared to water-soluble by-product or using the active in traditional powder form.

4. ***Dendrimers (2 to 10 nm):*** Dendrimers are an exciting new class of macromolecular architecture and an important component in the area of nanotechnology-based cosmeceuticals to treat varieties of skin conditions; they are organic chemical entities with a semi polymeric tree-like structure.3 The terminals of the branches provide a rich source of nanoparticles surface functionality they provide good water resistance, sebum resistance, glossiness, tactile sensation, and/or adhesive properties to the hair and/or skin.

5. ***Nanogold and Nanosilver particles:*** Gold and silver nanoparticles are used in the cosmeceutical industry in products like deodorant, face pack, antiaging cream, etc. Due to their high antibacterial and antifungal properties.

6. ***Cubosomes:*** Cubosome particles can be used as oil-in-water emulsion stabilizers and pollutant absorbents in cosmeceuticals. They are individually separate and distinct, submicron, nanostructured particles of the bicontinuous cubic liquid crystalline phase. Cubosome is used variedly from skincare to hair care and antiperspirants

7. ***Niosomes (100 nm to 2 µm in diameter):*** Niosomes are non-ionic surfactant vesicles, these vesicles possess high entrapment efficiency, improved chemical stability, and enhanced penetration, and cost of production is low compared to Liposomes. Niosomes enhance a residence, more efficient in topical and targeted delivery of active ingredients where therapeutic effect is desired.

8. ***Fullerene (30 to 3000 carbon atoms):*** Carbon fullerenes are used in some cosmetic products because of their anti-oxidative properties. They display potent scavenging capacities against radical oxygen species and are used in the preparation of skin rejuvenation cosmeceutical formulations.

Nanoparticles in various Cosmetics:

1. ***Moisturizers:*** To retain moisture and better appearance to the skin, Liposomes, Nanoemulsions, SLNs are mostly used in moisturizers due to their protract effects on the dehydration of the skin. For atopic dermatitis, psoriasis, and pruritus, cosmetics integrated with nanoparticles are considered to be the most useful.

2. ***Sunscreen Lotions:*** Sunscreen products using nanoparticles of ZnO or TiO_2 are transparent, less greasy, and less smelly and have increased aesthetic appeal and it is less irritating; they form a materialistic barrier on the skin, reflects UVA and UVB rays from penetrating down to the deeper layers of skin.

3. ***Anti-aging Products:*** Nanosomes of Pro-Retinol A instantly retautens the skin and reduces the appearance of wrinkles. Collagen plays an important role in skin rejuvenation and wrinkle reversal effect. The clinical benefits include a reduction in the appearance of fine lines and wrinkles and lightening of lentigines to renew the skin's healthy look.

4. ***Hair Care:*** Industries are using nanotechnology in hair care products. Unlike ordinary hair straightening products, Nanoemulsion in hair cosmetics does not destroy the outer structure of the hair fibers, called cuticles, to penetrate into the hair strands and research is ongoing to discover the ways of how nanoparticles can be used to prevent hair loss and to maintain shine, silkiness, and health of hairs., Sericin is an active area of hair cosmeceuticals that easily adhere to the surface of hair seal and treat the damaged cuticles.[4]

5. ***Skin Cleanser:*** Silver nanoparticles are used as skin disinfectants and decontamination. The skin is covered with a hydro-lipid film; this film provides a natural defense against pathogenic organisms but also attracts dirt and pollutants from the environment. Sometimes the microorganisms present on the skin surface act on components of the surface film and create undesirable by-products that create body odor; thus, periodic cleansing to remove debris, dirt, and odor is essential to maintain skin health Cleansing is also necessary to remove soil from the skin

surface that is acquired by incidental contact or by the intentional application.

6. ***Lip Care:*** Nanoparticles can be incorporated into lipstick and lip gloss, which soften the lips by preventing Transepidermal water loss. By mixing gold and silver nanoparticles in different compositions, a wide range of pigments can be prepared and whose color can be maintained for a long period of time. Silica nanoparticles used in lipsticks improve the even distribution of pigments and prevent them from migrating into the fine line of lips.

RESULTS AND DISCUSSION

Nanoparticles ranging from 10 to 200 nm in the sunscreen products can penetrate into the skin and impose unintended biological damage. The penetration of nanoparticles into deeper layers of the skin significantly increases by the presence of eczema, acne, wound, psoriasis etc. We get exposed to non-materials through inhalation, ingestion, and dermal absorption. Nanomaterials also have some environmental risks, the release of nanomaterial's into the water, air and soil with sufficient amounts during manufacture cause environmental issues, Various types of nanoparticles are continuously used in cosmetics, products like silver has anti-bacterial properties and it is good as a piece of jewellery, but when used in cosmetics, it could be harmful to human beings and the environment.[5, 6]

CONCLUSION

The usage of non-materials in cosmetics will improve the quality, but at the same time, it should be taken care of that they are not used in an overdose, which will lead to health hazards. Thus, nanocosmetics should be designed and sold in such a way that does not cause any harm to the health of consumers and the environment.[7]

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