



## NANOMATERIALS IN COSMETIC PREPARATIONS

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**ABSTRACT** This review determines various nanomaterial based cosmeceuticals. And glance on the properties, types, techniques used for preparation of nanomaterials, their advantages & disadvantages and various marketed products. Cosmeceuticals are fastest growing segment in the personal care industry and their use has increased drastically over the past years. The nanocosmeceuticals are mainly used in the application of cosmetics in managing conditions of wrinkling, dehydrated & inelastic skin associated with aging and dispersed hyperpigmentation, with the use of nanosized materials. The nanosized materials are nano emulsions, liposomes, nanosomes, dendrimers, nanocapsules and solid lipid nano particles. These nanosized materials have an advantage in increasing skin penetration and they release the active substances in a controlled and sustained manner. They have a higher stability; can be site specific targeting and high entrapment efficacy. Researchers have indicated concern regarding the impact of increased use of nanosized materials in cosmeceuticals and there are some possibilities of nanosized material can penetrate into the skin and cause health hazards.

**KEYWORDS :** Nanocosmeceuticals, liposomes, dendrimers, nano capsule.

### INTRODUCTION:

Nanocosmeceuticals are defined as the cosmetic formulation that carries actives or other nano structured ingredients which has superior properties regarding its performances when compared with conventional products [1]. Cosmeceuticals is defined as the combination of cosmetics and pharmaceuticals that mainly contain biologically active ingredients that are beneficial to the humans [2]. Nano technology is considered as the part of science and technology which is used to develop or change the particles size ranging from 1 to 100nm [as shown in figure 1]. When nano technology is applied, cosmeceuticals offers numerous advantages like they will target the desired site by the active therapeutic component, they will provide greater skin retention, there will be improvement in the stability of the cosmetic formulation and they will show sustained release of active drug for long therapeutic effect[3]. Diverse form of novel and submicron sized drug delivery system used in the delivery of cosmeceuticals are, preparations like nanoemulsion, nanocapsules, dendrimers, liposomes, niosomes and solid lipid nano particles. These nanomaterials have large surface area so that there will be more efficient transport of ingredients through the skin. So, by use of nano materials we can deliver hydrophilic and lipophilic drugs. These nano materials are used in the preparation of antiwrinkle creams, skin whitening creams, hair repairing shampoos, conditioners and hair serums [4]. Several advantages and disadvantages of nano cosmeceuticals are shown in figure 2 and figure 3. For the delivery of the nano cosmeceuticals nano technology is used which offers smart delivery of active ingredients. Various nanomaterials based cosmeceuticals will be discussed in this review.

Cosmeceuticals.



Size reduction to nano scale.



Nanocosmeceuticals

Figure 1. Formation of nanocosmeceuticals.

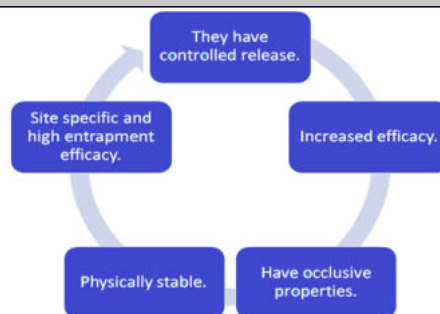


Figure 2. Advantages of nanocosmeceuticals.

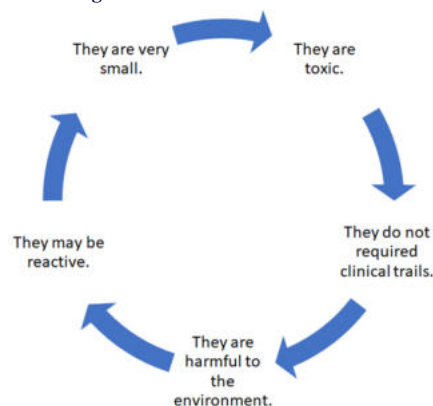


Figure3. Disadvantages of nanocosmeceuticals

### Properties of nanomaterials

Particle size mainly influences the properties of a given nanomaterial. Nanomaterial shows changed properties in terms of optical activity, solubility, colour, structural integrity, transparency and chemical reactivity. The optical activity and transparency of nanomaterials shows aesthetics in cosmetic formulations. This is particularly seen in creams and sunscreen preparation and they have high solid density property. Nano materials have an advantage in terms of low production cost as opposed to large size counterparts has also been noted as more reasons for taking option to use nano materials in cosmetic formulation and they also possess large surface area to mass or volume ratio compared with the larger particle size. Large surface area of nano materials also means surface irregularities which promotes good

adhesion and supporting the vander waals attraction. Good adhesion to skin will achieve good cosmetic effect [5].

**Techniques used in preparation of nanomaterials**

1. High pressure homogenization
2. Hot homogenization
3. Cold homogenization
4. Micro homogenization
5. Ultrasonication [6].

**Nanomaterials classification**

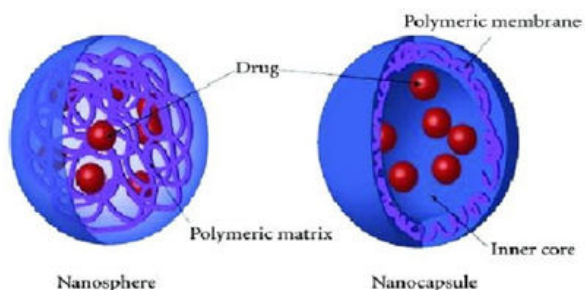
1. Nanosphere.
2. Nanocapsules

**1. Nanosphere**

These are the homogenous matrix system in which active compound are dispersed or dissolved on the surface within the polymeric matrix through the solid sphere.

**2. Nanocapsules**

These are the colloidal nanobubbles in which core is surrounded by a polymeric membrane [7].



**Figure 4. Nanosphere and Nanocapsule.**

**Nanomaterials based cosmeceuticals.**

**1. Nano emulsions** are defined as the dispersions of liquid in which oil phase and water are combined with an surface active agents. They are clear monophasic conventional type of emulsion that contains the particle size of 200nm [8]. Nano emulsion typically contains the oil and water phase. Due to the property of fine texture they are relatively stable and they possess good skin penetration and hydration power. In the formulation of skin care products the ingredients are encapsulated as nano emulsions to enhance the skin penetration. They can be used for the controlled delivery of various cosmeceuticals like deodorants, sunscreen, shampoos, lotions, nail enamels, conditioners and hair serums [9].

**2. Liposomes** are mainly spherical vesicles and they are biocompatible, bio-degradable, non-hazardous, flexible vesicles. They can encapsulate the active ingredients for delivery of both the hydrophobic and hydrophilic compounds [10]. Liposomes are mainly composed of cholesterol and natural phospholipids. These phospholipids may be in the form of saturated and unsaturated. The saturated phospholipids are more stable and have acyl chains, forming rigid impermeable bilayer structure, example dipalmitoyl phosphatidyl. The unsaturated phospholipid is less stable and more permeable, example is egg phosphatidyl. Liposomes are derived from the natural or synthetic phospholipids and they are similar to those in cellular plasma membrane. Phosphatidyl choline is the main component of the liposomes [11] and it has been used in various skin care formulations as nanocosmeceuticals like moisturizer creams, hair care products. Liposomes can also be used for the delivery of fragrances, botanicals, vitamins, antiperspirants, body sprays, deodorants, lipstick, antiaging creams, sunscreens, beauty creams and in the treatment of hair loss. In the clinical studies it has proven that flexible liposomes helps in the treatment of wrinkle reduction and shows effects like decrease of efflorescence in the acne treatment and an increase in skin smoothness. Cholesterol and ceramides are the lipophilic compounds that have been used in the topical skin creams and these can be easily incorporated in to the liposomes to improve skin hydration to make the skin smooth [12].

**3. Dendrimers**, the term dendrimer is derived from the Greek word which means tree part. They are unlike linear polymers and are monodispersed macromolecules produced by the specifically controlled polymerization method. Dendrimers are mainly high

branched star shaped large molecules with nano meter scale dimensions and they are suitable for the multi functionalization because they contain large number of external groups. The structure of the dendrimers can be explained in three components.

They are

1. Central core
2. Interior dendrites' (branched)
3. Exterior surface (having functional surface groups)

They are extremely small with diameter size ranging from 2-20nm. They are used for various cosmeceuticals like skin care, hair care, nailcare and they are also used in various cosmetic products like shampoos, sunscreen, hair styling gels and anti-acne products. A patent formulation containing carbo siloxane dendrimer claimed that it can provide good water resistance, sebum resistant, glossiness, tactile sensation and it can provide good adhesive properties to both skin and hair [5].

**4. Nanocapsules** are polymeric nano particles containing shell and a hollow space with dimensions from 10-1000nm. Retinol has been delivered in to the deeper layer of the skin by Loreal using polymer nano capsules. Lancome had manufactured using nano capsule technology to deliver 100% botanically pure vitamin E to overcome the conditions like lip bleeding and feathering [13].

**5. Niosomes** are the nanosized vesicles made up of non ionic surfactant and cholesterol. They are used to deliver both the lipophilic and hydrophilic drugs as well as poorly water soluble drugs. Niosomes sizes are ranging from 100nm to 2µm in diameter. Niosomes have more stability than liposomes [14]. Niosomes were introduced in 1987 the first product is Lancome by company Loreal. Niosomes are used in cosmetic and skin care applications, as penetration of ingredients is increased because of the property of reversibility, reducing the barrier resistance of the horny layer. They are controlled and target drug delivery and non-immunogenic, non-toxic, biocompatible and biodegradable and they are used for parenteral, oral as well as topical routes. They may exhibit fusion, leaching, hydrolysis of entrapped drugs which limits the shelf life and physically instability. There are various niosomes cosmeceutical preparations in the market wrinkle creams, skin whitening creams, moisturizing creams, hair repairing shampoos and conditioners [7].

**6. Solid lipid nano particles** are made from the solid lipids of nano size and dispersed in aqueous phase. Based upon the composition they are categorized as emulsions because the solid lipid nano particles forms oil phase, some of the researchers concluded them as solidified oil in water emulsion. Typically they have a spherical shape with an average diameter of 50-100 nm and they are nontoxic and biocompatible [9]. Solid lipid nano particles have inherent properties such as controlled release, reduced size which warrants close contact with the skin low toxicity and enhanced skin penetration [14]. Solid lipid nano particles are popular in cosmeceuticals and also in pharmaceuticals as they are composed of biodegradable and physiological lipids that exhibit low toxicity. The size of the solid lipid nanoparticles is small because of this they have an close contact with the stratum corneum, increases the penetration of active ingredients through the skin, they release the active moieties in a controlled manner, they will increase the bioavailability of entrapped bioactivity, they have better stability of unstable active ingredients and excellent biocompatibility. They have wide variety of application versatility. Main disadvantages are they have poor loading capacity of hydrophilic drugs due to partitioning effects and high water content and they will be chance of burst [1].

**Table 1: Nanomaterial based cosmeceuticals [1]**

S. No	Trade Name	Proposed use	Manufacture	Type of Nanotechnology used
1	Nano cream	Wet wipes	Sinerga	Nanoemulsion
2	Vital nano emulsion A-VC	Nutrition and miniaturization	Marie louice	Nano emulsion
3	Capture TOTALE	Removes the wrinkles and dark spots and radiance effect with sunscreen	DIOR	liposomes

4	Dermosome	moisturizer	Marie louice	Liposomes
5	Niosome+	Foundation cream	Lancome	Niosomes
6	Anti Age response cream	Anti wrinkle	Simply man match	Niosomes
7	Allure body cream	Body moisturizer	Chanel	Solid lipid nano particles
8	Allure perfume	Perfume	Chanel	Solid lipid nano particles
9	Lip tender	Lip tender	Kara vita	Nanosphere

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