

## NOVEL DELIVERY SYSTEMS: CURRENT TREND IN COSMETIC INDUSTRY

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**ABSTRACT**

Cosmetics now a days play an important role in our day to day life both in case of men and women. The use of cosmetics in our daily life make us feel confident, enhances the appearance which makes people to stay young and attractive. The usage of conventional delivery system has greatly been replaced by Novel delivery systems like liposomes, Transferosomes, Niosomes, Proniosomes, Nanoemulsions and cubosomes. The novel delivery system has the advantages of releasing the active ingredient to specific tissues in body for prolonged duration with controlled release which inturn reduces the amount as well as the frequency of the application. Adapting these techniques in the formulation of cosmetics, companies are coming up with innovative formulations. Thus this has resulted in economic Up liftment of cosmetic industry around the world. These Novel delivery techniques in cosmetics possess enormous potential as future generation effective carrier systems. In the present review, we will discuss about the genesis of innovative cosmetic preparations.

**KEYWORDS:** Novel delivery, cosmetics, Liposomes, etc.**INTRODUCTION**

Cosmetics are the products which meant for the application on the body for the purpose of cleansing, beautifying and enhancing appearance. The term Cosmetics was coined in the year 1961 by the founding member of US society of Cosmetic Chemists Raymond Reed.<sup>[1]</sup> In this present world, the consumers have become very conscious regarding the skin care because of the effect of pollution and other environmental effects like emission of harmful UV rays. To get protected from these effects the increasing interest has been developed on the use of cosmetics. Consumers around the world are looking for personal care products with multiple benefits. Both women and men are using cosmetics to enhance their features.

The origin of the use of cosmetics was first recorded by Egyptians, circa around 4000BC.<sup>[2]</sup> Later many other people like chinese, Romans, Greeks, Japnese, Europeans and Americans started using cosmetics. They used Khol as a protective for the eyes, Castor oil as protective Balm. The use of beeswax, olive oil, and rose water for skin creams was described by Romans. Roman women used to dye their hair with the mixture of boiled walnuts and leeks. In late 19th century, the women in western countries secretly wore make up made from mixtures of the household products, as make up was then deemed the domain of celebrities. The open use of these cosmetics came into picture in the 20th century. And then their use got exploited enormously in 21st century. As cosmetics have become essential for body care,

several companies have shown interest in the manufacture of these cosmetic preparations. Later on the development of cosmetics with health claims is rapid and expects the latest technology to be incorporated while manufacturing cosmetics for innovative formulations. By this the formulators are striving to develop innovative products with multiple effects.

Novel delivery system approach is helpful in developing a product innovatively. Analysing these new approaches lead us in obtaining the sophisticated cosmetic products. In cosmetics, the main aim is to reach the cutaneous cell. The vehicles used in the preparation exerts mainly five different type of effects on the skin like cleansing, decoration, care, hydration and protection.

Today the market of cosmetics has a different turn over when compared with the 20th century. Almost all major cosmetic manufacturers use novel delivery systems in their products. The world wide cosmetic and perfume industry currently generates an estimated annual turnover of US \$170 billion according to the report by Eurostat-May 2007. L'Oreal has a number of nanotechnology-related products in the market and holds number of patents. L'Oreal ranks 6th in US which allocate about \$600 million of its annual where \$17 billion revenues to the research purpose in the number of nanotech related patents.<sup>[3]</sup> The traditional use of cosmetics was by women but increasing interest in cosmetics by men was also observed and male grooming products are one of the fastest growing markets. The European Union imports

nearly \$8 billion worth cosmetics each year and exports \$32 billion. The ICCR (International Cooperation on Cosmetic Regulation) composed of public authorities from the USA, Canada, Japan and Europe continue to support increasing cooperation within the industry.<sup>[4]</sup>

The Novel delivery system in cosmetics include various delivery systems like Vesicular delivery (e.g. Liposomes, Niosomes, Proniosomes etc), Particulate Systems (e.g. Nanoparticles) Emulsion delivery System (Nanoemulsions,) and Other delivery systems (e.g. Nanocrystals). Thus the present article reviews the use of these delivery systems in cosmetics in getting the innovative formulations.

### Liposomes

Liposomes are the vesicular structures with an aqueous core which are surrounded by a hydrophobic lipid bilayer, created by the extrusion of phospholipids. These phospholipids are GRAS (generally recognised as safe) ingredients which help in reducing the adverse effects.<sup>[5]</sup> Liposomes are frequently used as vehicles in pharmaceuticals and cosmetics for a optimized delivery to specific skin layers.<sup>[6]</sup> The lipid bilayers of liposomes promotes release of its contents, making them useful for drug delivery and cosmetic delivery applications. Liposomes can vary in size, from 15nm up to several  $\mu\text{m}$  and can have either a unilamellar or multilamellar structure.

One of the reasons for the widespread use of liposomes in the cosmetic industry is their ease of preparation and the ability to improve the absorption of active ingredients by skin. The ease of scale up made the widespread use of liposomes in cosmetics

Liposomes are unstable due to their susceptibility to oxidation and breakdown of liposomal structures. The formulations are more stable by optimising the storage conditions and adding chelators and antioxidants.<sup>[7]</sup> Liposomes have been formed that facilitate the continuous supply of agents into the cells over a sustained period of time, which make them an ideal candidate for delivery of vitamins and other molecules to regenerate the epidermis.

Several biomolecules like vitamin A and E and antioxidants like lycopene and carotenoids have been incorporated into liposomes to increase their delivery.<sup>[8]</sup> Phosphotidylcholine, main ingredients of liposomes have been widely used in skin care products and shampoos due to its softening and conditioning purpose.

### Mechanism of action of liposomes

The mode by which liposomes facilitate transfer of drug into living skin strata and beyond has been a topic of much interest. The hypothesis of liposomal action that accounts for a majority of these effects. For the effective liposomal formulation, especially for hydrophilic drugs, it is essential that the suspension undergo significant

dehydration. Since most studies reported the lipid concentration scarcely exceeds 100mg/ml, the bulk aqueous medium constitutes roughly 90% of formulation. Thus, without a high degree of dehydration, no advantages over simple aqueous solution can be governed by employing liposomal systems, especially if the drug action is anticipated to occur within few hours after application. The dehydration of liposomal suspension can either be complete or reach an equilibrium stage where in a certain amount of water is always held within bilayers.

The extent of dehydration of a liposomal suspension is controlled by two interdependent factors. They are

1. The first is the phase transition temperature ( $T_m$ ).
2. The second, often one that affects  $T_m$ , is the presence of components that either affect bilayer packing (e.g. cholesterol) or those that are humectants/cytoprotectants such as hydrophilic polymers or glycerol and sugars.

The combined effect of the two factors will determine how much water will be retained by the liposomal bilayers following dehydration under non - occluded conditions. In the absence of enhancer effects arising out of the action of lipid components of liposomal bilayer on skin, the extent and rate of dehydration of the liposomal bilayers control the extent and rate of transfer of drug, regardless of whether it is hydrophobic or hydrophilic into skin.<sup>[9]</sup>

### Liposomes used in cosmetics

A great interest of using the liposomes in skin gels or skin creams has been increased and generated in the field of cosmetics. Vegetable phospholipids are widely used for topical applications in cosmetics and dermatology because of their high content of esterified essential fatty acids, especially linoleic acid which increases the barrier function of the skin and decreases water loss within a short period of time after its application. Soya phospholipids and vegetable phospholipids are used as they have the ability to form liposomes and their surface activity. These are ideal source for the transport of linoleic acid into the skin.<sup>[10,11]</sup>

Lautenschlager et al. discussed the potential use of liposomes derived from soya bean phospholipids in cosmetics.<sup>[12]</sup>

Recently, water sensitive 20 to 30 micron -size microspheres of polymer structure have been developed for the delivery of fragrances, botanicals, and vitamins from anhydrous formulations, such as lipsticks, deodorants, antiperspirents and body sprays.<sup>[7]</sup>

Liposomes are also used in anti-aging creams, treatment of hair loss. Liposome technology offers great opportunities for several new cosmetic products and that cosmetic developer would now have to deal very interestingly with raw material selection, characterization

of raw and finished formulations, and clinical safety of these unique formulation.<sup>[12]</sup>

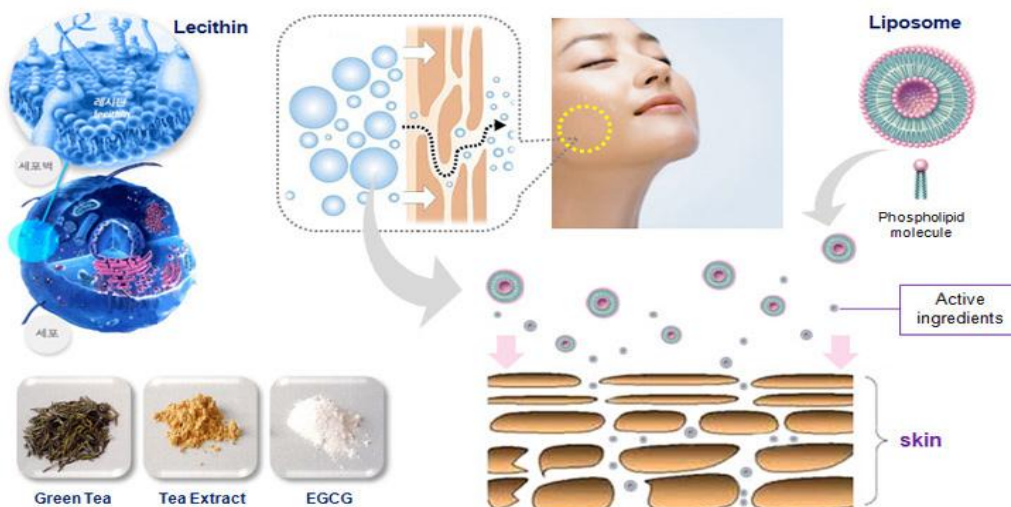
First marketed liposomal cosmetic product to appear in market was the anti-aging cream **CAPTURE™**. Other

products are like **Lipo-Gest™** Natural Balancing Cream<sup>[13]</sup>, **Regaine** which slows the hair loss<sup>[14]</sup> **Nanominox - MS** and many more products by various companies like Loreal, supreme, premier etc.

**Table 1: Marketed formulations of liposomes.**

Name of the product	Active ingredient	Company	Used as
Celadrin@ <sup>[15]</sup>	Fatty acids, benzyl alcohol, glycerin, lecithin, olive oil, menthol and peppermint oil, water, and other oils and alcohols.	Dr. Reddy's in India Trademark of Imagenetix.	Topical Liposome Lotion
Lipo CTM <sup>[16]</sup>	Active Vitamin C with Vitamin E and Zinc		Liposome

Fig A schematic diagram of the process of liposome formulations utilizing a variety of natural materials



**Fig. 1: A schematic diagram of the process of liposome formulation utilizing a variety of natural materials**

**Table 2: Formulations of various Liposome delivery systems and their Applications<sup>[17,18,19,20]</sup>**

Type of delivery system	Active ingredient	Formulation
Liposome	CoQ10, Avocado, Rosehip, Carrot Oil and with Vitamins A, B, C and E, Aloe	Antiwrinkle Cream
Liposome	Organic Aloe juice, Cocos mucifera	Deep Moisturizing Cream
Liposomes	Tyrocine, Aloe vera, $\alpha$ linoleic acid	Sunscreen cream
Liposomes	Minoxidil sulphate, propylene glycol	Nanominox-MS, for hair loss treatment

**Table 3: Trade names of some of the marketed novel preparations<sup>[21]</sup>**

Vesicular system	Marketed By	Liposomes and ingredients
<b>Capture™</b>	Christian Dior	Liposomes in gel with ingredients
<b>Plentitude™</b>	L'Oreal	Tanning agents in liposomes
<b>Dermosome™</b>	Microfluidics	Skin care, loaded liposomes
<b>Penta™</b>	Pentapharm	Humectant pentavitin R in liposomes
<b>Coatsome NCT™</b>	Nichiya Liposomes Co	Liposomes with humectants

**Specialised liposomes**

**Transferosomes**

Advanced type of liposomes are called as TRANSFEROSOMES. These are composed of two main aggregates namely, firstly, an ampiphillic ingredients (phosphotidyl choline), in which the aqueous solvents that self assembles into bilayer that closes into a simple

lipid vesicle and secondly, bilayer softening component that increases lipid bilayer flexibility and permeability. These have more elasticity when compared with the liposomes. The improved efficiency is seen in transferosomes. Transferosomes of size 200-300nm have ability to penetrate into the skin, which upon shows improved efficiency than in liposomes.<sup>[22]</sup> These are

capable of spontaneous penetration through stratum corneum via intracellular or transcellular routes and have potential applications in cosmetics and drug delivery.<sup>[23]</sup> Widely formulated transferosomes are made of curcuma longa which has anti wrinkle cream, anti aging, anti irritant, anti microbial and anti inflammation<sup>[24]</sup>

Other specialised liposomes are marinosomes, ultrasomes, phytosomes, ethosomes, AOCs liposomes, and yeast based liposomes.

**Table 4: List of various specialized liposomes**<sup>[25,26,27,28,]</sup>

Type of delivey system	Active ingredient	Formulation	Application
Photosomes	Ginkgo biloba Dimeric Flavonoids	Beauty Cream	Improves the absorption of the compounds exerting the biological activity and also increases duration of the activity
Nanosome	Vitamins	Anti-aging treatment serum	Enhanced performance designed to upgrade skin to a healthy and youthful looking state
Ultrasomes	coQ10	Stops wrinkle	To prevent the damage to collagen and elastin production
Phytosomes	DNA repair enzymes	Moisture SPF 15	Multi-purpose photoprotectant

### Niosomes

Niosomes are non-ionic surfactants based vehicles which are the similar structure to that of phospholipids vesicles like liposomes. These are used to encapsulate aqueous solutes and act as carriers for various drugs and cosmetic formulations. These are also formed by assembling themselves with non-ionic surfactants in aqueous media. The application of heat or physical agitation helps niosomes to attain a closed bilayer structure.

The hydrphobic parts in the niosomal structure are shielded from aqueous solvent while the hydrophilic part in structure acts like a head portion and will be in contact with it. The advantages of using niosomes in cosmetics and skin care applications include their ability to increase the stability of entrapped ingredients, improved bioavailability of poorly absorbed ingredients and enhanced skin penetration.

As these don't contain GRAS components they are known to be more irritating than liposomes. The niosomes encapsulated estradiol was delivered through the stratum corneum, which is highly impermeable through protective barrier was reported. Niosomes that are composed of a novel surfactant (Bola Surfactant), found to show high effectiveness for percutaneous drug delivery applications which found to be non toxic and improve percutaneous passage through stratum corneum and epidermis.<sup>[29]</sup>

### Niosomes In Cosmetics

In the year 1970 L'Oreal researchers made a research and they developed synthetic liposomes called NIOSOMES for the first time. Niosomes were developed under the trade name Lancome and patented by L'Oreal in 1987.<sup>[30,31]</sup>



**LANCÔME FOUNDATION CREAM NIOSOME**

**Fig. 2: Marketed Niosomal Products**<sup>[32][33]</sup>

### Specialised niosomes

#### Proniosomes

Proniosomes are non-ionic based surfactant vesicles, which may be hydrated immediately before use to yield aqueous niosome dispersions.<sup>[34]</sup> Proniosomes are nowadays used to enhance drug delivery in addition to conventional niosomes. They are converted into

niosomes respectively upon simple hydration or by the hydration of skin itself after application.

Proniosomes exists in two forms, i.e. semisolid liquid crystal gel and dry granular powder, depending on their method of preparation. Out of these two forms, the proniosome gel is mainly used for topical/transdermal applications. Preparation of proniosome gel was adopted

by the method given by Perrett S, *et al.* which was then modified and used for preparation of proniosomal gel.<sup>[35]</sup>

### Nanoemulsions

Nanoemulsion are referred as the thermodynamically stable and isotropically clear dispersion of two immiscible liquids i.e. an oil phase and a water phase in combination with a surfactant.

The dispersed phase typically comprises small particles or droplets, with a size range of 5nm -200nm, and has very low oil/water interfacial tension.<sup>[36]</sup> General preparation methods for nanoemulsion are High Pressure Homogenization and Microfluidization.

### Nanoemulsion In Cosmetics

Nanoemulsion are group of dispersed particles which are generally used in the pharmaceutical and biomedical aids and vehicles that show great benefit for the future of cosmetics. These are generally defined as oil in water emulsion with mean droplet diameter which ranges between 50-100nm.

Recently Nanoemulsions became increasingly important as potential vehicles for optimized dispersion of active ingredients in particular to skin layers. Because of their lipophilic interior, Nanoemulsions are more suitable for the transport of lipophilic compounds than liposomes. Like that of liposomes, these Nanoemulsions support the skin penetration of active ingredients and thus increase their concentration in the skin.

The small sized droplet with its high surface area allows effective transport of the active ingredients to the skin. These NEs have shown great interest because of their own bioactive effects. This may reduce the trans-epidermal water loss (TEWL), indicating that the barrier function of the skin is strengthened.

These are acceptable in cosmetics because there are no inherent creaming sedimentation, flocculation, or coalescence that are observed with macro emulsion.

A great advancement in the Nanoemulsions was reported in case of cosmetics. Scientists have invented PEG- free emulsions because consumers increasingly prefer natural ingredients in cosmetics. The new process is called a Phase Inversion Concentration Technology where the heating or stirring is not required.

Tego Wipe System represents the best example for this kind of technology which are long term stable emulsions with very fine particle size. These cosmetic wet wipes are particularly useful for make-up removal, face care, body care & baby care products. It is also highlighted that it helps to give skin care formulations a good skin feel, an increasingly important characteristic for formulators.

Nanoemulsions have attracted considerable attention in recent years for application in personal care products as potential vehicles for the controlled delivery of cosmetics and the optimized dispersion of active ingredients in particular skin layers.

Some Patented Nanoemulsion Application and Commercial Products L'Oreal is holding two US patents on Nanoemulsion technique.<sup>[37][38]</sup>

Some commercially available but not mass produced examples include Nanogel by Kemira and Alginate - based "pearls" containing antiaging ingredients by Capsum.<sup>[39]</sup>

### Marketed Formulations

Red Vine Hair Sunscreen<sup>[40]</sup>

Nano cream from Sinegra<sup>[41]</sup>

**Table 5: Applications of nano emulsions based cosmetic preparations**

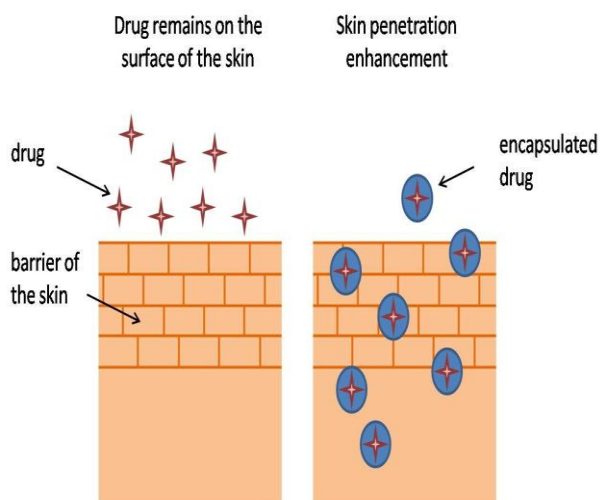
Formulation type	Active ingredeint	Application
Nanoemulsion <sup>[42]</sup>	Oxyalkylene glycols and selected oils, protein adherent	Nail lacqures reportedly adhere well to nails. Has glossiness and good water resistance.
Nanoemulsion <sup>[43]</sup>	Polymers with hydroxylsubstituted aromatic groups	To increase the adhesiveness and durability of nail polish.
Nanoemulsion <sup>[44]</sup>	Nitrocellulose	Nail enamel, keeps nails in good condition.

### Solid Lipid Nanoparticles

Solid lipid nanoparticles (SLNs) are nanometre sized particles with a solid lipid matrix. These are typically spherically designed with the diameter of 10-1000nm. SLNs have properties like enhancing the skin hydration, protection against degradation, active penetration enhancements, and controlled - release properties.<sup>[45]</sup>

SLNs are oil droplets of lipids usually which are in solid form at body temperature. Stabilisation of SLNs can be achieved by the use of surfactants. Process of production of these SLNs is simple which involves the liquid lipid i.e. oil in a nanoemulsion is exchanged by solid lipids.<sup>[46]</sup>

This process doesnot require organic solvents.



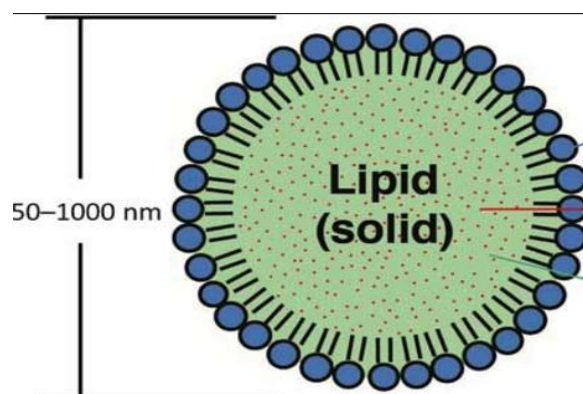
**Fig. 3** Diagram that illustrates the penetration of the Active ingredient through the skin of SLNs<sup>[47]</sup>

**Solid Lipid Nanoparticles In Cosmetics**

SLNs show greater advantage for cosmetic products as they protect encapsulated ingredients from degradation. Various compounds including coenzymes like Q10 and retinol can remain stable for long period of time in SLNs. Controlled release of cosmetic agents for a prolonged period of time can be achieved by these SLNs which also improve the penetration of active agents into stratum corneum.

The above mentioned unique properties make this SLNs ideal for potential use in day creams. Reported In-vivo studies have shown that formulation made up of SLNs showed more efficiency in skin hydration.<sup>[48]</sup> Also showed UV resistant properties when molecular sunscreen was incorporated and tested. Enhanced UV blocking by 3,4,5 trimethoxybenzoylchitin which is a good UV absorber was formulated into SLNs.<sup>[49]</sup>

SLNs were also used in perfume formulations as they delayed the release of perfume over longer period of time.<sup>[50]</sup> This delayed release was also found desirable for insect repellents.



**Fig. 4:** Structure of a Solid lipid nanoparticles [SLNs]

**Table 6: Marketed formulations of SLNs.**

TYPE OF DELIVERY SYSTEM	FORMULATION	MARKETED NAME	MARKETED BY
Solid Lipid Nanoparticles	Perfume	Allure	Chanel
Solid Lipid Nanoparticles	Body Cream	Allure	Chanel
Solid Lipid Nanoparticles	Liquid Suspension	NanoLipid Restore CLR	Chemisches Laboratorium



**Chanel Allure Perfume**



**Chanel Allure Body Cream**

**Fig. 5: Marketed formulations of Solid lipid nanoparticles**

Though these have promising benefits in the cosmetic field, they even have draw backs. The production process of these SLNs requires improvement to increase loading capability and stop expulsion of the contents during storage. These problems are caused by the tendency for the particle matrix to form a perfect crystal lattice when solid lipids are used.

**Nanostructure Lipid Carriers**

To overcome the above mentioned draw backs that are associated with the SLNs, a second generation of lipid particles were developed by mixing solid lipids with liquid lipids which are known as NANOSTRUCTURED LIPID CARRIERS (NLCs). When both SLNs and NLCs are compared NLCs have a disorted structure which makes the matrix structure imperfect and creates spaces

to accommodate active compounds. The properties like high loading capacity and long term stability offered by the NLCs make them superior to SLNs in many cosmetic formulations.

NLCs are also capable of preventing the active compounds from chemical degradation which similar to that of SLNs. These also possess a high occlusion factor and high level of adherence properties. The adhesion of particles to the skin forms a thin layer which prevents dehydration. As the size of the particle decreases the occlusion factor increases.<sup>[51]</sup> Because of this property NLCs offer the possibility of controlling occlusion without altering the properties.

The release profile of active compound can be manipulated by changing the matrix structure of

nanoparticle. The lipid nanoparticles have increased penetration capacity of active compounds when compared with microparticles.<sup>[52]</sup> The properties like lubricating effect and mechanical barrier of lipid nanoparticles are considered in skin care products to reduce irritation and allergic reactions.

Formulating product into lipid nanoparticles make product to appear in white colour than in yellow which is more acceptable by consumers.<sup>[53]</sup>

The first product with Lipid nanoparticle was marketed in 2005 which offered increased skin penetration by Dr. Rimpler GmbH, Germany.

More than 30 products containing NLCs are currently available worldwide. Found more in south Korea.

**Table 7: Marketed formulations of NLCs.**

TYPE OF DELIVERY SYSTEM	FORMULATION	MARKETED NAME	MARKETED BY
NanoStructured Lipid Carriers	Cream and Serum	Nanorepair	Dr. Rimpler GmbH, Germany
NanoStructured Lipid Carriers	Cream	Nanovital	Dr. Rimpler GmbH, Germany



**Fig. 6: Marketed Nanostructure Lipid Carriers**

### Nanocrystals

Nanocrystals aggregates ranges between the size of 10-400nm and they exhibit physical and chemical properties somewhere between that of bulk solids and molecules. These aggregates comprising several hundred to ten of thousands of atoms that combine into a "cluster". Crystalline structure, melting temperature, charge conductivity can be altered by controlling the size.

In 2007 first cosmetic product appeared in the market. They are Juvena (rutin) and LaPrairie (hesperidin) which are two poorly soluble, plant glycosides antioxidants which were not used for skin earlier. These formulated nanocrystals were protected by patents.<sup>[54]</sup>

### Nanotechnology For UV Care

The application of nanotechnology in cosmeceuticals aimed in preparation of sunscreens, antiaging creams,

moisturizers and for the long lasting fragrance of perfumes. The purpose of use of these nanoparticles in cosmetics is for these reasons

1. Stability improvement in cosmetics as the active ingredients are encapsulated within the nanoparticles.
2. It can protect the skin from harmful ultra violet rays.
3. These help in targeting of the active ingredients to desired site and for controlled release for prolonged release.<sup>[55,56]</sup>

### Nanotechnology in Sunscreens

Sunscreens are used to protect the skin from exposure to harmful effects of the sun rays. The conventional sunscreen which were used earlier showed white chalky layer on the skin which didn't give aesthetic appearance to the skin. This was overcome by formulating them into

nanoparticles. Most widely used ingredients in sunscreens are Zinc oxide and titanium dioxide which are most effective approved minerals in protecting skin damage by penetrating deep into skin layers and making than less irritating.

Improved sunscreens are one among the many innovations of nanotechnology. These sunscreens using ZnO or TiO<sub>2</sub> are less greasy, transparent with good aesthetic appeal. Many sunscreen moisturisers are commercially available which are manufactured by the various cosmetic companies like Avon, The Body Shop, L'Oreal, Nivea etc.

The product called UV Pearls™ came into market which contained UV filter encapsulated in silica shells which are kept on the top layers of skin to block UV rays. Cool Pearls™ encapsulated benzoyl peroxide crystals in silica shells for acne treatment.

### Nanotechnology in Lip Care

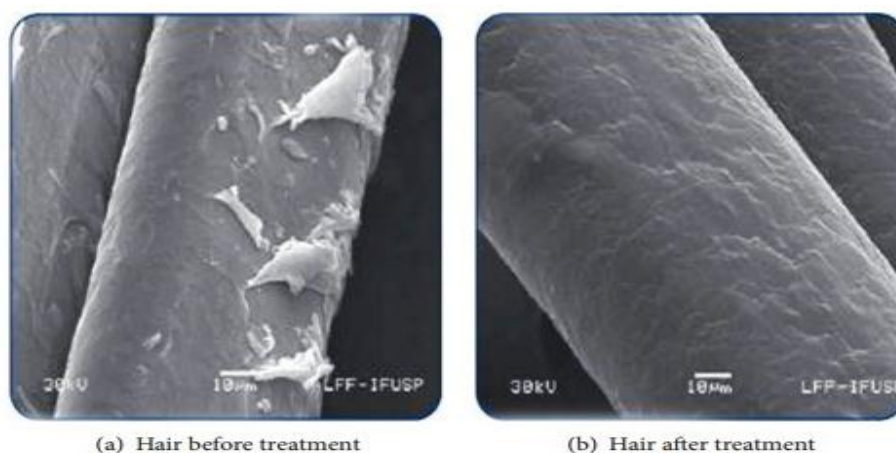
Another interesting class of cosmeceuticals are lip care agents. Different nanoparticles were incorporated into the lipsticks and lip gloss to soften the lips by TEWL. Silica nanoparticles used in lipsticks gives homogenous distribution of pigments.<sup>[57]</sup>

### Nanotechnology in Nail Care

Nanotechnology has the greater advancement in nail care cosmetics like nail polishes when compared with the conventional ones. The nail polish formulated based on these technology have properties like improved toughness, mar resistance and impact resistance of mammalian nails.<sup>[58]</sup> the other new strategy which has great potential in cosmetics is that, the incorporation of nanoparticles of silver and metal oxides having anti fungal activity in nail polish to treat fungal infections associated with toe nails.

### Nanotechnology in Hair Care

This is another interesting area of nanotechnology in cosmeceuticals. Nanotechnology is used to study the mechanical strength and properties of the hair. Companies involved in the production of hair care products now show interest in nanotechnology to research and discover how nanoparticles help preventing the hair loss, and in maintaining the silkiness and shine of the hair. on comparison of conventional hair straightening products and the nanobased hair care products, nanoemulsion in hair cosmetics don't destroy the actual structure of hair cuticles to penetrate into hair strands. Sericin nanoparticles are of great interest in hair cosmeceuticals. Various studies on this have shown that sericin nanoparticles can adhere easily on to the surface of hair which seal and treat the hair damage.



**Fig. 7: Effect of sericin nanoparticles on hair cuticle. Increased hair gloss (b) obtained in damaged hair (a) after treating with sericin nanoparticles<sup>[59]</sup>**

### Other novel technique under research

#### Cubosomes

Cubosomes are the advanced nanostructured particles of bicontinuous cubic liquid crystalline phase which are optically clear and very viscous material that has unique structure on nano scale. These are formed by the self assembled structures of liquid crystalline particles of certain surfactants when mixed with water and a microstructure at a certain ratio.<sup>[60]</sup>

cubosomes have large surface area, low viscosity which exist in any level of dilute solutions. These can carry both hydrophilic and hydrophobic molecules and have high stability to the heat.<sup>[61]</sup>

Companies like L'Oreal, Nivea, Gamble and other are investigating the use of cubosomes in cosmetics.<sup>[62-63]</sup> cubosome use in personal care product areas as varied as skin care, haircare, cosmetics, and antiperspirants.<sup>[64,65,66,67,68]</sup>



**Table 8: List of different novel products available in market.**

Product	Proposed use	Manufacturer	Marketing claims
Hydra Flash Bronzer Daily Face moisturizer	Moisturizer	Lancome	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	Lancome	Contains Nanoencapsulated triceramides, Hydra Zen helps restore perfect comfort and softness and renew skin's health look. Protected from signs of daily stress and fully hydrated, your skin is beautifully soft and smooth all day long.
Nano-In Hand and Nail Moisturizing Serum and Foot Moisturizing Serum	Moisturizer	Nano-Infinity Nanotech	Fine crystals of ZnO nanoparticles will go straight into skin tissue to prevent hand and nails from being hurt and restore skin health
Lancome Renegie Microlift	Antiwrinkle	Lancome	Formulated with colloidal silica and soy protein nanoparticles to provide the closest possible face-lift effect
Revitalift Double Lifting	Antiwrinkle	L'Oreal	It contains nanosomes of Pro Retinol A. Revitalift Double Lifting is a unique dual action treatment that instantly retightens skin and effectively fights wrinkles.
Nano Gold Firming Treatment	Antiaging	Chantecaille	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
DiorSnow Pure UV Base SPF 50	Sunscreen	Dior	Contains nano-UV filters for ultraprotection against the damaging effects of UVA and UVB rays
Primordiale Optimum Lip	Lip treatment	Lancome	Deliver 100% botanically pure vitamin E via nanocapsule technology to reduce lip bleeding and feathering due to fine lines and wrinkles.
Cosil Nano Beauty Soap	Cleanser	Natural Korea	Silver nanoparticles are highly effective as disinfectant and guarantee protection of skin.

## CONCLUSION

A great advancement was shown in the use of the technology in cosmetics. Scientists have invented new technologies and Novel delivery systems which have become current trend in the manufacture of cosmetics to the formulators. The increase in the use of cosmetics have attracted considerable attention in recent years which replaced the use of conventional delivery system to the Novel delivery system. Novel delivery systems in cosmetics have a good potential in achieving various aspects like prolonged action and site specificity etc. Thus the use of these technique led to the up lift of cosmetic industries in various parts around the world. So, these techniques act as a future generation effective carrier systems.

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