



A REVIEW ON NOVEL APPROACH TO COS- MECEUTICALS

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ABSTRACT

Cosmeceuticals is an amalgamation of cosmetics, Pharmacy, and Chemistry with bioactive ingredients purposed to have medicinal benefits. Nanotechnology is a potentially beneficial and rapidly growing field that uses nanomaterials and has tremendous suggestions for society, industry, medicines, and cosmeceuticals. Cosmeceuticals are rapidly gaining momentousness in the sectors of skincare and wellness. The cosmetic industry was among the first to implement nanotechnology in product development. Nanotechnology shows a promising approach to designing a product with much better bioavailability, decreased toxicity, and a targeted drug delivery system. By overcoming certain drawbacks associated with the traditional system, Nanotechnology has been escalating in the field of cosmeceuticals. the use of nanocosmetics has risen over the years at a large scale. Nanocosmetics and nanocosmeceuticals have been broadly explored in skin, hair, nails, teeth, and lips, and the admittance of nanomaterials has been found to improve product efficacy and customer satisfaction.

This review tends to focus on the various novel nanocarriers, advantages, disadvantages characteristics, types, and methods of preparation of nanoparticles for their effective use in cosmeceuticals

KEYWORDS: Nanomaterials, Nanocarriers, Nanocosmetics, Bioavailability, Targeted Drug Delivery

INTRODUCTION

Nanoscience is the branch of science about the study of minute particles on an atomic or molecular scale whose size is measured in nanometres. A nanometer measures one billionth of a meter. Nanotechnology involves the use of particles on a nanoscale and is an emerging branch of engineering. Cosmetics producers use nanoparticles for better UV protection deeper skin penetration, long-lasting effect, and increased quality. micellar particles are one of the latest fields used in cosmetic products that is gaining importance and is largely commercialized in international markets. The ability of nanoemulsion to form micellar with greater surface area is playing a major role in effective formulations such as facial cleansers, anti-aging lotion, sunscreen, and other water-based formulations. The FDA has defined cosmetics as particles intended to be applied on the skin or other parts for the various purposes of cleaning beautifying or altering the appearance. In the Cosmetic arena, cosmeceuticals are popularly known as a cosmetic product that consists of biologically active ingredients having therapeutic properties and are used in the treatment of various dermatological conditions or for simply enhancing beauty. Cosmeceuticals are considered as a niche between pharmaceuticals and cosmetics where the products are infused with therapeutic ingredients. Smaller particles are more easily absorbed by the skin and repair damage more rapidly in the cosmetic industry. The expansion of the cosmeceutical industry is counted from skin to body to hair and other emerging tropical treatments for the improvement of skin conditions such as skin damage, hyperpigmentation photoaging, and hair damage have come into extensive profitable use. The global cosmetic industry has a lot of allegiance to Asian countries like Japan, China, and India which are expected to draw a lot of customers eventually. Nanocosmetics is promoted to make the fragrance last longer, sunscreen to protect the skin, antiaging therapies, and application

of moisturizers to keep the skin hydrated. Usage of nanotubes niosomes, fullerene, nanocrystals, and dendrimers show excellent and primary benefits in cosmeceutical manufacturing. Through this nanomaterial, the biologically active ingredients are targeted to the intended place and released in a regulatory manner for long-lasting impact

LITERATURE SURVEY

1. Nanotechnology in Cosmetics and Cosmeceuticals—A Review of Latest Advancement

Nanotechnology Lab, School of Pharmaceutical Education and Research (SPER), Jamia Hamdard University, New Delhi 110062, Delhi, India.

Smart Society Research Team, Faculty of Business and Economics, Mendel University, 61300 Brno, Czech Republic.

Department of Pharmaceutics, College of Pharmacy, Prince Sattam Bin Abdulaziz University, Alkharj 16278, Saudi Arabia

2. Shrishail M Ghurghure, Mahewash Sana Asadulla Pathan, Priyanka Ramesh Surwase-Nanosponges: A novel approach for targeted drug delivery system, International Journal of Chemistry Studies, Volume 2; Issue 6; November 2018; Page No. 15-23.

“There is plenty of room at the bottom,” and suggested that scaling down to the nano level and starting from the bottom was the key to future advancement in nanotechnology. Nanomaterials are defined as materials that have at least one dimension in the 1-100 nm range.

3. R.R. Bhagwat and I.S. Vaidhya- novel drug delivery systems: an overview, ijpsr, 2013; Vol. 4(3): 970-982

Evolution of an existing drug molecule from a conventional form to a novel delivery system can significantly improve its performance in terms of patient compliance, safety, and efficacy. In the form of a Novel Drug Delivery System an existing drug molecule can get a new life. An appropriately designed Novel Drug Delivery System can be a major advance for solving the problems related to the release of the drug at a specific site at a specific rate. Towards the release of the drug at a specific site at a specific rate.

4. Fundamentals of nanoparticles: Classification, Synthesis method, Properties and Characterization

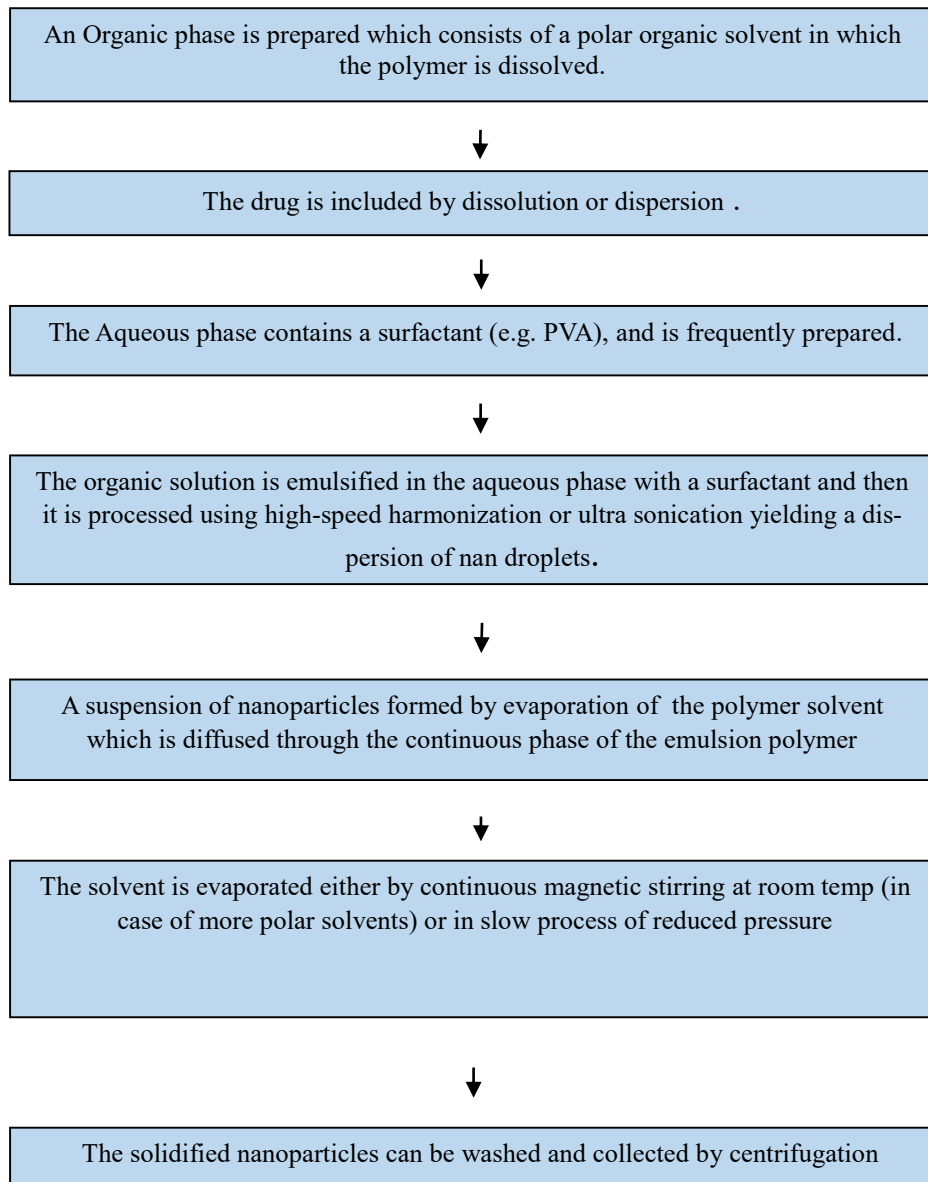
Ahmed Barhoum 2018 Helwan university (HU), Helwan, Cairo, Egypt Vrije Universiteit Brussel (VUB) Pleinlaan, Brussels, Belgium. **Abdel Salam Hamdy Makhlouf** Central metallurgical research and development institute, CMRDI, Cairo, Egypt

5. Nanocosmetics and Nanomedicines New Approaches for Skin Care

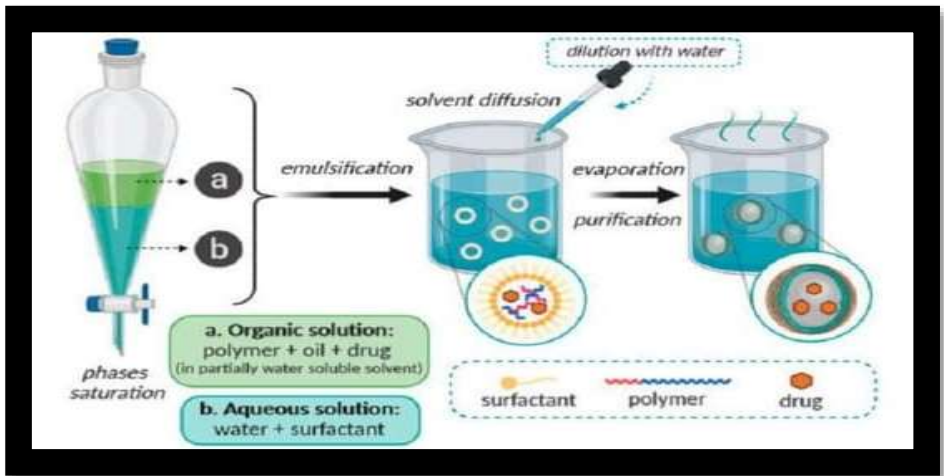
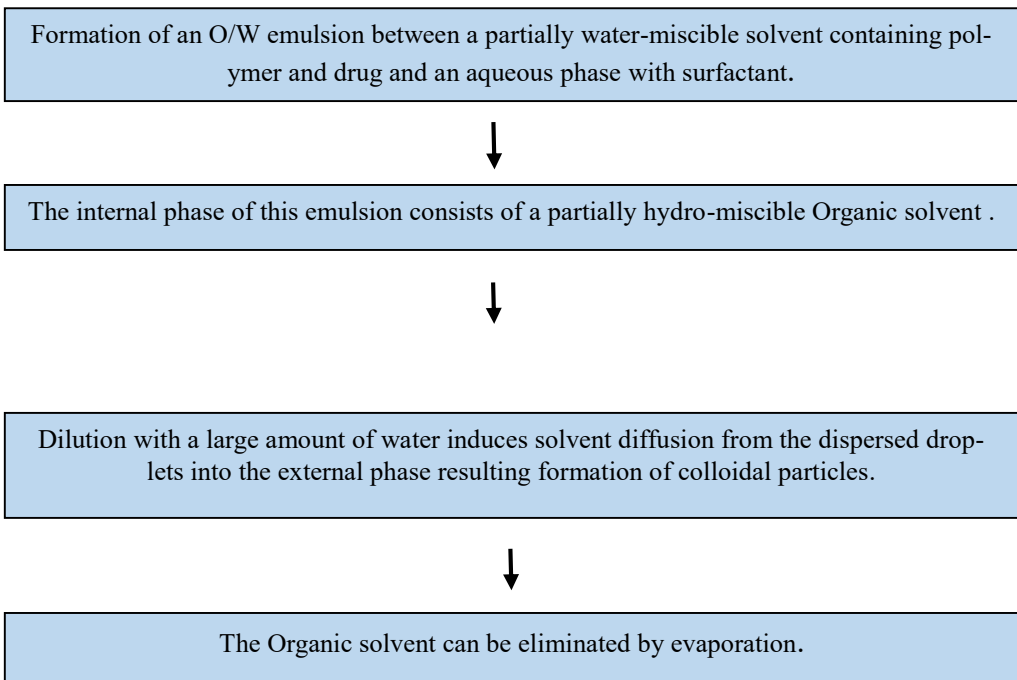
EDITORS -[Ruy Beck](#), [Silvia Guterres](#), [Adriana Pohlmann](#) First book on the subject "nanocosmetics". The authors belong to the "Brazilian Nanocosmetics Network" and have been working on this subject for the last decade. The book includes recent advances in the application of nanotechnology to treat skin disorders, such as the treatment of skin cancer, and cutaneous leishmaniasis, and to develop new sunscreen alternatives.

METHODS OF PREPARATION OF NANOPARTICLES

1. SOLVENT EVAPORATION METHOD

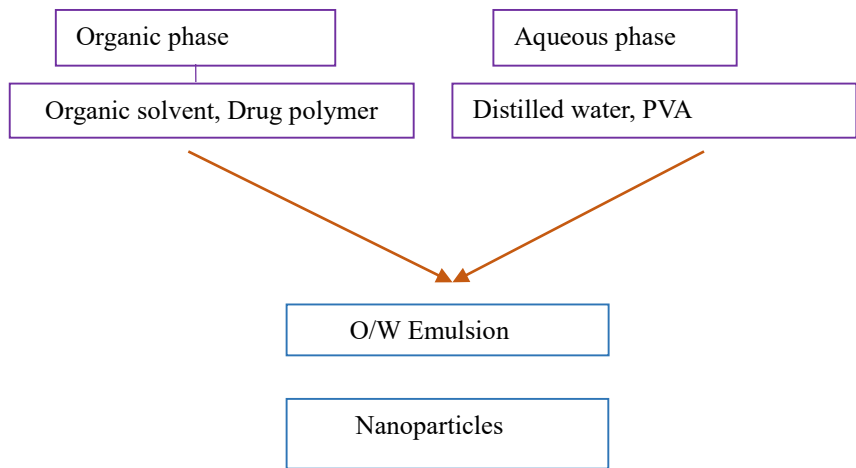


2. EMULSIFICATION/ SOLVENT DIFFUSION

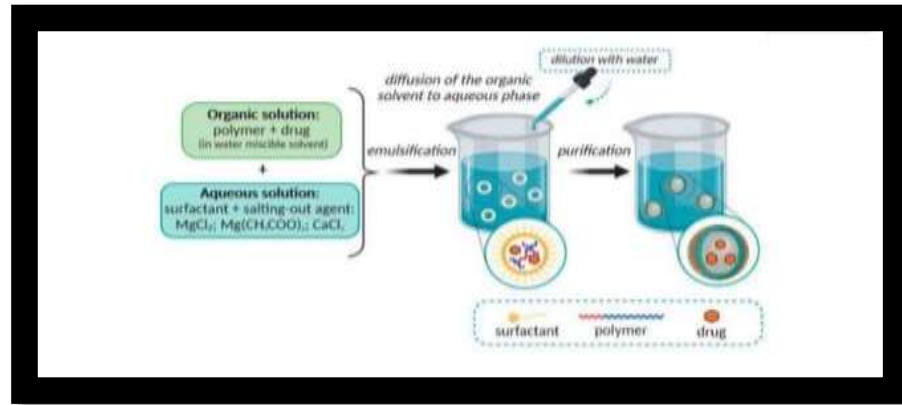


emulsification in the production of nanoparticles

3. SALTING OUT METHOD



This method is useful for drugs and molecules that are soluble in polar solvents such as acetone or ethanol. This method is based on the separation of hydro miscible solvents from aqueous solutions through the salting out method, which may result in the formation of nanospheres

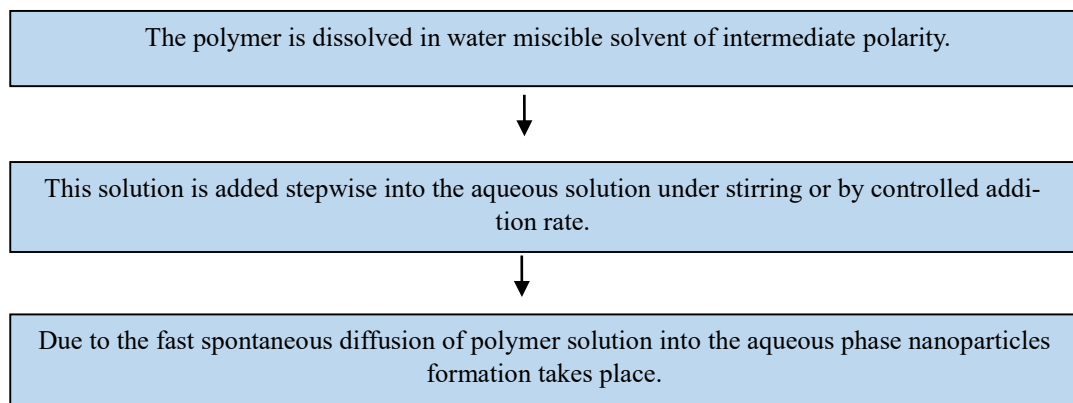


Salting out the method in the production of nanoparticles

4. NANOPRECIPIATION

Also called the ad displacement method, it requires two miscible solvents. The internal phase consists of a polymer dissolved in a miscible organic solvent such as acetone. Because of immiscibility in water, they can be easily removed by evaporation.

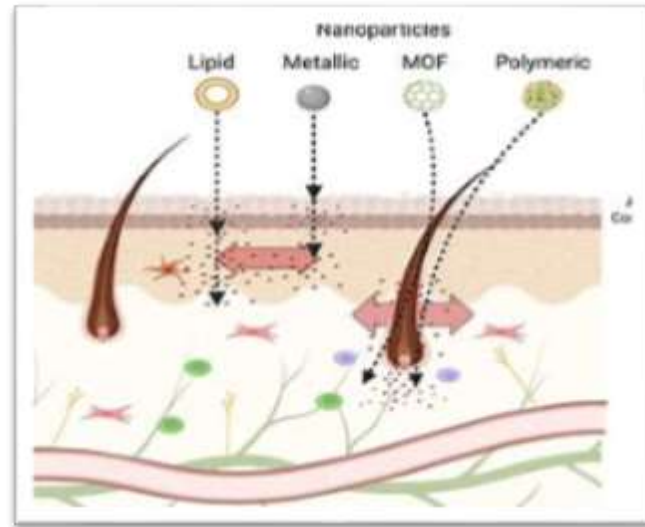
The interfacial deposition of a polymer after displacement of the organic solvent from a lipophilic solution to the aqueous phase



SKIN PENETRATION OF NANOPARTICLES

The principal function of the skin is to defend the body from the external environment in fact, it prevents the entrance of chemical and biological agents due to stratum corneum. Skin is made up of three layers namely epidermis, dermis, and hypodermis. The significance of the dermis resides in its capillary anastomoses which bring nutrients and oxygen to the epidermis and clear the dermis from cell metabolic products and penetrated foreign agents. The epidermis is the defensive mechanism.

The interaction of the NP penetration through the outermost rate-limiting barrier of the stratum corneum. Some authors hypothesized that NPs may hold in the lipid matrix of the skin (Zhang et al., 2008; Zhang and Monteiro-Riviere, 2008) or in skin annexes (Rancan et al., 2012) and latterly can be slowly released into the deeper skin layer. Concerning this theory, some characteristics such as NP size, shape, charge, and surface properties have to be further investigated to understand better which of them, and eventually to which degree, can affect skin penetration. The interaction of NPs with the skin is yet a topic of consideration by researchers since its seen that some NPs can penetrate the outer stratum corneum layer of the skin, while few can permeate into the deeper dermal layer and reach up to the systemic circulation



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APPLICATION OF NANOMATERIALS IN COSMETIC FORMULATION

1. SUNSCREENS

Sunscreen is used to give protection to our skin from the harmful UVA and UVB rays. TiO₂ and ZnO is the foremost effective approved mineral-based ingredients that protect the skin from sun damage. This mineral is known to form a materialistic barrier on the skin reflecting both UVA and UVB rays from penetrating right down to the deep layers of skin and maybe a smaller amount irritating, the most common drawback of traditional or conventional sunscreen is that, a white chalky layer on the skin. Improved sunscreen is just one of the varied innovative uses of nanotechnology. Sunscreen products using nanoparticles of titanium and zinc are less greasy, transparent, and less smelly and have an increased aesthetic appearance



2. MOISTURIZER

Moisturizers are used as agents to provide hydration to the skin. They are applied topically to the skin. The primary barrier of the skin is the corneum, whose main purpose is to remain inside in, and out of doors. Dehydration is led because the water from the skin is often averted by using moisturizer which gives flexibility to the skin

When moisturizer is applied to the skin, a skinny film of humectants is made which retains moisture and provides a better appearance to the skin.

Nanoemulsions and liposomes are widely used moisturizing formulations that have a prolonged effect. Moisturizers can be used to control various dermatological conditions such as atopic dermatitis, psoriasis, pruritus

3. ANTI-AGING PRODUCTS

Skin aging can be caused by various factors like stress, abrasion, irradiation from UV rays, and infrared sources. Collagen plays an important role in skin rejuvenation and wrinkle-reversible effects. The quality of collagen inside the skin decreases with increase in age. The aging of the skin manifests itself: thinning drying out, damaged barrier function, loss of elasticity, and texture, the appearance of spots, wrinkles, and modification of surface lines isotope. Most of the cosmeceuticals are developed that claim to firm the skin and anti-

wrinkle, lift, moisture, and whiten, and have skin toning activity.

Brands like Loreal have employed nanotechnology in products like nanosomes of pro retinol A contain Revitalift anti-wrinkle creams and claim that it immediately reattunes the I am in and reduces the appearance of wrinkles. Lancôme introduces Hydra zen creams to renew the skin's healthy look which contain nano-encapsulated Trice amide



4. HAIR CARE

Hair care is another promising field that uses nanotechnology. Companies are utilizing nanotechnology in hair care products and are continuously developing methods on how NP can be used to prevent hair loss and to take care of silliness, shine, and health of hair. Nano emulsion in hair products does not damage the hair to penetrate inside the hair strand Sericin composed of cationic sericin nanoparticles is a lively area of hair cosmeceuticals. Studies have shown that sericin particles in hair products easily adhere to the surface or earless seal and treat the damaged cuticles



5. SKIN CLEANERS

A hydrophilic film is present on the outer surface of the skin. The film provides a natural defence against pathogenic organisms but also attracts environmental pollutants and dirt. Sometimes the microorganisms present on the skin surface act on components of the surface film and make undesirable by-products. This periodic cleansing to obviate dirt, debris, and odor is significant to need care of skin health, Cleansing is additionally necessary to obviate soil which may include bacteria from the skin surface that is acquired by accidental contact.

Silver nanoparticles are used as skin decontamination and disinfectant. Nano cyclic pink soap cleanser which is the perfect blend of nanosilver and natural ingredients and claims to cleanse the skin from within

6. NAIL CARE

In comparison to the conventional products used for application on nails, nanotechnology-based products have shown a greater advantage. According to a study conducted nail care products containing nanosized particles improved resistance, and increased toughness of the mammalian nails. Most nail paints are formulated for people suffering from fungal infections by incorporating nanoparticles having an antifungal activity like silver and oxides. Nanolabs was awarded a provisional patent for its original nano nail polish and lacquer which dries up quickly. Its single coat is enough to provide hardness and toughness to the nails which prevents cracks and infections

7. RHEOLOGY MODIFIERS

To make a cosmetic product viscous or to impart thickness, improve their sensory perception, and give the consumers a sense of quality, Rheology modifiers are used. They are mostly made up of Clay or silica Np. The chemical inertness of Silica makes it a suitable rheology modifier. Besides acting as thickeners Silica nanoparticles also provide an opaque finish and exhibit skin protection properties as they can absorb harmful substances.

8. NANOPARTICLES AS CARRIERS

Nanoparticles are used as delivery systems to improve the function of various bioactive ingredients. They are used to overcome the stability, bioavailability, low solubility, and less penetration issues of many active ingredients. The encapsulation of many bioactive products can also help to prevent them from degradation. Moreover, the increased penetration of products elevates the effectiveness and hence helps obtain desired effects.



9. ANTIOXIDANTS

Antioxidants as the name suggests prevent the damage caused due to oxidation reactions by inhibiting the reaction and thus prevent the formation of free radicals.

They are frequently added to cosmetic materials to increase their usable lifetimes. AOs can also protect against DNA damage caused by the presence of ROS generated after a stimulus. This ROS is responsible for aging and cancer and is highly produced when skin is exposed to UV radiation. Hence AOs are used to increase the photoprotective activities of sunscreens. AOs suffer from stability limits when applied tropically and many nanocarriers are employed to help tackle this issue

10. IMPROVED ACTIVE AGENTS

In addition to the UV filter property of nanoparticles, they may also help to increase the bioactive properties of many ingredients. The issues of low solubility as well as an inappropriate texture and odour can be improved with the help of nanocrystals

The poor solubility of a product may hamper its homogeneity and limit its absorption, surprisingly when the same particles are transformed into nanocrystals it shows better performance

11.

12. LIP CARE

Lip care is another application of nanotechnology. Different nanoparticles can be incorporated into many products which might be used to soothe or soften the lips but prevent trans-epidermal water loss. Biotechnology holds a patent that describes that it is possible to organize the pigments exhibiting a wide selection of nanoparticles but mixing in various compositional ratios and whose color is often maintained for an extended period.

13. PEPTIDES

Another group of biomolecules which is widely used in cosmeceuticals. peptides are mostly used in anti-aging creams. Different types of peptides are employed which include carrier peptides, signal peptides, neurotransmitter inhibitor peptides, and enzyme inhibitor peptides. Tropical peptides may benefit from nanoformulations. The Infinitec company has developed technology for peptides based on the use of NPs comprised of Nobel metals or precious stones.

REGULATIONS AND REQUIREMENTS

1. Under the FD and C Act, cosmetics must not be adulterated or misbranded
2. No pre-marketed approval of cosmetics except color additives
3. Manufacturer is responsible for the Safety of marketed products.
4. Manufacturer or distributor should have obtained all data and information needed to substantiate the safety of the product before marketing
5. FDA-regulated products, not Technology
6. Cosmetics manufactured using nanotechnology are subjected to the same legal considerations as any other cosmetics
7. As new scientific information is presented for FDA consideration agency policy changes may be considered
8. Nanomaterials are engineered materials or end products that have at least one dimension in the nanoscale range of roughly 1nm to 100
9. This extremely small size leads to unique properties different from those of conventional products.
10. These unique properties may affect the function, quality, safety, and effectiveness of a product

NANOPARTICLES TOXICITY

The toxicological impacts of nanoformulated nanocosmetics are seen when nanoparticles penetrate through the SC to different organs with systematic circulation. Their toxic effects can be seen once they enter the bloodstream. Nanoparticles are less toxic due to their lower diffusion compared to soluble nanomaterials. Still, their use has always raised a concern as they are widely used in cosmetic and skincare products.


Metal oxide NPs- Metals like ZnO are of great importance as they are formulated on a large scale in sunscreens. Some of the toxicity of zinc NPs is related to the release of zinc ions which can penetrate to the deepest layers. The mechanism responsible seems to be the production of ROS. Deepest impact was observed in SC and keratinocytes

Silver and gold NPs -Ag nanoparticles are used as antimicrobial agents. They provide lethal activity against bacteria. But silver has also been associated with lethal effects on keratinocytes and fibroblasts. Au NPs on the other hand are toxic due to the coating material used on them for stability in solutions. Dermal fibroblasts are also a target for Au NPs.

Silica NPs- Its toxic effect is associated with the generation of ROS, a common response of cells exposed to silica nanoparticles. It is associated with a wide range of autoimmune diseases including scleroderma. The nanoparticles might perpetrate the skin and end up in systemic circulation which will result in toxicity.

ADVANTAGES AND DISADVANTAGES OF NP

Different nanoparticles show different advantages and are incorporated accordingly into formulations.



Polymeric nanoparticles	Lipid-based nanoparticles	Inorganic nanoparticles
Advantages <ul style="list-style-type: none"> • Biodegradable • Adjustable surface modifications • Use for hydrophilic and hydrophobic cargo Limitations <ul style="list-style-type: none"> • Self-aggregation may impact brain delivery 	Advantages <ul style="list-style-type: none"> • Use for hydrophilic and lipophilic cargo • Ease of ligand conjugation to improve blood circulation Limitations <ul style="list-style-type: none"> • Potential cytotoxicity caused by non-specific uptake 	Advantages <ul style="list-style-type: none"> • Small size • Increased uptake due to ionic interaction with BBB Limitations <ul style="list-style-type: none"> • Potential toxicity due to the metal accumulation

CONCLUSION

Nanotechnology has a vast list of applications in the cosmeceuticals industry. It is the most revolutionizing industry. Nanomaterials carry and deliver various formulations across the skin by diverse mechanisms and impart several functions beneficial for the skin. Over the last decades, it has been used and is beneficial in the fields of dermatology, cosmetics, and biomedical applications as well. With the increase in the use of cosmeceuticals, the conventional delivery system has been greatly replaced by a novel drug delivery system. Meticulous studies on the safety of nanoparticles must be employed to prevent health hazards. Clinical trials are not necessary for formulating cosmeceuticals and hence enjoy fewer regulations as compared to pharmaceuticals. A special program should be established to educate people on the use of products containing nanomaterials. Nanomaterials should be manufactured in such a way that they add to the health of consumers

FUTURE ASPECT

Today, these cosmetics are indispensable parts of daily routine further the addition of nanotechnology has made it more acceptable among users around the world. The introduction of newer advancements and novel systems make cosmeceuticals more popular among people with greater market shares. The production of cosmetics is now harnessed to nanotechnology, but the future of the industry will be greatly affected by the technological advances offered by omics science which in combination with big data analysis and machine learning approaches will allow us to better evaluate the biological responses to Specific cosmetic formulations and bioactive compounds at the tissue and cellular level. In the context of suitable and healthy cosmeceuticals nanotechnology can be useful for the development of biomimetic particles that can translocate natural metabolites to the cellular target of interest along with that the size, shape, and structure of NPs can allow for control over the efficiency of transcutaneous penetration through the diverse dermal and epidermal layers.

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