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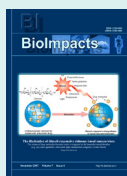
Nanocosmetics: benefits and risks

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Summary

Various nanomaterials/nanoparticles (NPs) have been used for the development of cosmetic products - a field so-called nanocosmetic formulations. These advanced materials offer some benefits, while their utilization in the cosmetic formulations may be associated with some risks. The main aim of this editorial is to highlight the benefits and risks of the nanomaterials used in the cosmetic products.

Authors' Biosketch

Professor J. Shokri has a PhD degree in Pharmaceutics (2001) from Tehran and Tabriz University of Medical Sciences. He has published two books and over 45 indexed research articles in novel drug delivery systems, Transdermal delivery systems and cosmetic sciences. He acts as the Head of the Dermatology and Dermopharmacy Research Team (DDRT) at Tabriz University of Medical Sciences (2013-present).



Background

Nanomaterials have been used in the development of cosmetics from hundreds of years ago. Gold and silver nanoparticles have been used by women as the nail colors. Further, liquid formulations containing gold nanoparticles have been used as anti-aging in the Middle Ages. But, in the recent years, nanoscaled materials have more extensively been used in the development of cosmetics.

Nanomaterials have been increasingly used in pharmaceutical industries for the formulation of cosmetics. The products containing these materials have contributed greatly to the pharmaceutical and cosmetics market worldwide. The quantity of sales of products containing nanomaterials in 2012 and 2015 were about \$155.8 and \$2.6 billion, respectively, which has been projected to reach over \$55.3 billion in 2022.^{1,2}

Types of nanomaterials used in cosmetics

Liposomes

Liposomes are bilayer vesicles mainly composed of natural or semisynthetic phospholipids that are considered as

safe materials in the formulation of cosmetic products. Liposomes have many advantages in delivery of cosmetic active ingredients such as vitamins, minerals, antioxidants, and anti-aging materials to biologic cells by their fusing to bilayer structures of skin. Other types of vesicles with improved skin penetrating ability were developed such as transferosomes, niosomes, and ethosomes.³

Nanometals

Nanometals, such as nanosilvers and nanogolds, have been used in the formulation of cosmetics, in large part because of their high efficiency and antibacterial effects in some cosmetics such as deodorants and toothpastes. These materials are widely used in other industries and thus, they have high market values among nanomaterials.

Solid lipid nanoparticles

Solid lipid nanoparticles (SLNs) are nanosized lipid droplets stabilized with suitable surfactants containing active ingredient(s). These nanostructures can protect the encapsulated active ingredients from degradation. SLNs



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can also be used for the formulation of controlled delivery of cosmetics and the improvement of the skin penetration of cosmetic active ingredients. Other advantages reported for SLNs include (a) improving of the skin hydration by cosmetic products and (b) increasing of the sunscreen efficiency for some chemical sunscreen active ingredients.⁴

Nanoemulsions

Nanoemulsions are nanoscaled droplets of a liquid uniformly dispersed in another liquid. These droplets provide a large contacting area with skin and can act as the carrier for cosmetic active ingredients. These products are considered safe for the formulation of cosmetic products. The smaller droplet size of the nanoemulsions provide higher efficiency and stability, as well as greater transparency.

Nanocapsules

Nanocapsules are nanostructures made of polymeric entities dispersed in an aqueous or oily phase. These formulations are considered as excellent carriers for some susceptible active agents such as vitamin D or potent cosmetic active ingredients.

Other types of nanocosmetics

Many other types of nanostructures have been used in the cosmetic formulations, including nanocrystals, dendrimers, cubosomes, hydrogels and buckyballs. Each of these nanomaterials has unique characteristics in terms of morphology, surface area and functional groups, and skin penetration potential.

Risks of using nanomaterials in cosmetics

Some researchers have reported the unwanted penetration of nanoparticles through the skin and systemic circulation. It is shown that zinc oxide and titanium dioxide nanoparticles ranging from 10 to 200 nm in the sunscreen products can penetrate the intact skin and impose inadvertent biological damage. Neurotoxicity of zinc oxide nanoparticles on the neural stem cells of mouse (NSCs) has also been demonstrated in vitro. Cytotoxicity of titanium dioxide nanoparticles has also been reported by some researchers. In a recent study, it has been showed that titanium dioxide nanoparticles have the potential to induce autophagy and necrosis in the sertoli cells and adversely affect the spermatogenic cells and testicular

morphology in Zebra fish. The penetration of these nanoparticles into deeper viable layers of the skin and general circulation significantly increases by the presence of eczema, acne, wound, psoriasis and UV damages in the skin.

Occupational expose to nanomaterials may occur during the production process, via products containing these entities, or during use, disposal, or recycling of these products. Nanomaterials have very higher toxicity compared to the micronized particles, in large part due to their higher penetration potential in tissues and living cells.

The main routs of exposure to nanomaterials are inhalation, ingestion, and dermal absorption. Nanomaterials also have some environmental risks. Release of nanomaterials to the water, air and soil with sufficient amounts during manufacture, use or disposal can cause some environmental issues. For example, the nanomaterials with antibacterial effects can interfere with the beneficial bacterial system in the natural ecosystems. Some of the nanomaterials can bind to the air pollutants such as cadmium or petrochemicals and transport them to long range distances. In conclusion, all these issues should be taken into consideration in the formulation, use and disposal of nanocosmetics.⁵

Ethical approval

There is none to be declared.

Competing interests

No competing interests to be disclosed.

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