



Review

Application of nanoparticles in percutaneous delivery of active ingredients in cosmetic preparations



Khadijeh Khezri^a, Majid Saeedi^{b,**}, Solmaz Maleki Dizaj^{c,d,*}

^a Faculty of Pharmacy, Mazandaran University of Medical Sciences, Sari, Iran

^b Department of Pharmaceutics, Faculty of Pharmacy, Mazandaran University of Medical Sciences, Sari, Iran

^c Dental and Periodontal Research Center, Tabriz University of Medical Sciences, Tabriz, Iran

^d Student Research Committee, Tabriz University of Medical Sciences, Tabriz, Iran

ARTICLE INFO

Keywords:

Nanoparticles
Percutaneous delivery
Cosmetic preparation
Lipid nanostructures
Solid lipid nanoparticles
Nanostructured lipid carriers

ABSTRACT

Developments in nanotechnology have expanded novel nanoparticles for several applications, including cosmetic topical preparation. The aim of this article was to review recent literature on percutaneous delivery of cosmetics active ingredient by nanoparticles. The main focus here, is on lipid based nanoparticles since they are of great importance in skin cargo delivery and have vast application in current cosmetic formulations. Data were collected via electronic databases using MeSH keywords, including nanoparticles, lipid particles, cosmetic, dermal delivery and combinations of these words. According to literature nanoparticles play a major role in improving the usefulness of cosmetics. They are able to improve the physiochemical stability of the skin based cosmetic products. Based on data, lipid nanostructures can be added to current cosmetic formulations without any significant problem due to their physical stability and compatibility with other ingredients. However, due to their basically risky nature of nanoparticles, their risk assessment should be taken into consideration.

1. Introduction

During the years, the traditional form of cosmetics has expanded by adapting to changes and is now recognized based on scientific and technological research. *in vivo* and *in vitro* studies verified the acceptability of cosmetic products and the cosmetic industry presents novel options to this tendency with numerous up-to-date skin products [1,2].

Such an ever-increasing development of new skin products requires more quality and scientific assessments. Efficacy of skin care products not only depends on the individual active agents, but also on the carrier employed [3]. It is recognized that a proper formulation of skin products adapted to the state of the skin may present many positive effects on hydration and stabilization of the epidermal barrier of the skin. The general formulation with interaction between carrier, active ingredient, and skin influences the preparation and the release of active ingredient as cargo [4,5].

Nanoparticles have been in the core of attention over the past few decades with their outstanding applications in different areas [6–8]. Their small particle size and high surface area convert them to ideal particles in many uses, especially as active ingredient carrier systems. A nanomaterial is defined as “a natural, incidental or manufactured

material containing particles, in an unbound state or as an aggregate or as an agglomerate and where, for 50% or more of the particles in the number size distribution, one or more external dimensions is in the size range 1–100 nm”. Furthermore, a material can also be placed in ‘nano’ classification if its specific surface area by volume is greater than 60 m²/cm³ [9].

Pharmaceutical nanoparticles are colloidal active ingredient-loaded particles with nano-range dimensions (10–1000 nm) made from basically any type of biocompatible substance and can favorably improve the properties of the material comparing to its bulk material [10–12]. An active ingredient or cargo delivery system based on nanoparticles lead to a special function associated with treating, preventing or diagnosing diseases. The main objectives for study of nanotechnologies in active ingredient/cosmetic delivery area include specific targeting, decreasing toxicity while maintaining beneficial effects, more safety and biocompatibility, and faster progress in new medicines [13,14]. Nanoparticles prepared from lipids are particularly attractive due to their improved biocompatibility related to the lipid content [15,16]. Evidence suggest that lipid nanoparticles influence the utility of cosmetics since they are safe. Moreover, these nanoparticles may improve the stability of the skin based cosmetics [17,18].

* Corresponding author at: Dental and Periodontal Research Center, Tabriz University of Medical Sciences, Tabriz, Iran.

** Corresponding author at: Faculty of Pharmacy, Mazandaran University of Medical Sciences, Sari, Iran.

E-mail addresses: msaeedi@mazums.ac.ir (M. Saeedi), maleki.s@tbzmed.ac.ir (S. Maleki Dizaj).

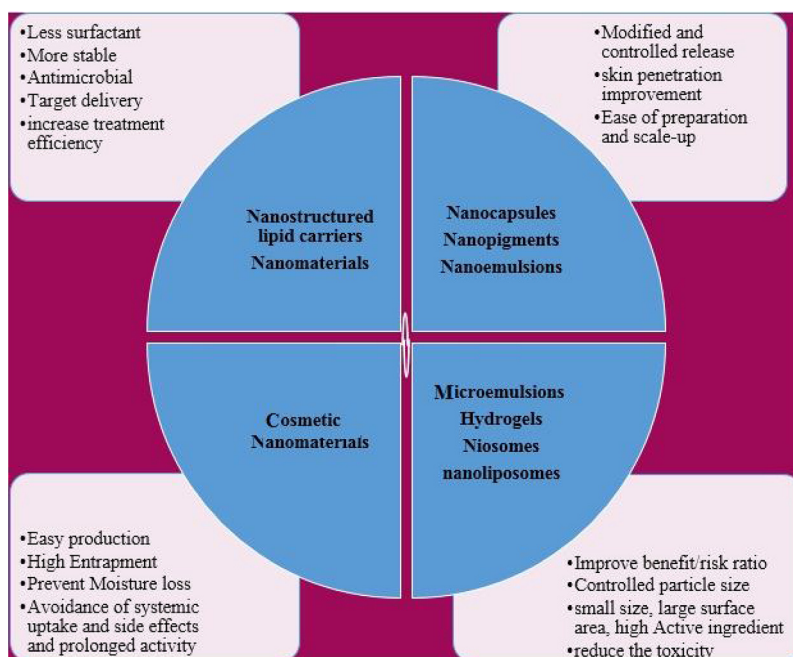


Fig. 1. Application of nanomaterials in cosmetics.

The aim of current study was to review recent literature about skin-related delivery of cosmetics by nanoparticles. Our main focus was on lipid based nanoparticles due to their importance in skin cargo delivery as well as their vast application in current cosmetic formulations. Data were collected from electronic databases using MeSH keywords such as nanoparticles, lipid particles, cosmetic, dermal delivery, and combinations of these words.

2. Current classes of nanoparticles used in cosmetic preparation

Recent developments in nanotechnology introduced new methods to produce expanded nanoparticles for many applications. Nanoparticles based active ingredient delivery systems have gained much interest in recent years because of their distinctive properties. These delivery systems can be defined as particles with dimensions of 1–1000 nm and can be prepared from principally any type of biocompatible material. A wide range of nanoparticles from lipid nanostructures to metal nanoparticles, nanocrystalline and polymeric nanoparticles have been examined as active ingredient delivery systems in different *in vivo* models with outstanding outcomes that promise a huge commercialization in future years. Their small size, ability to functionalize and proper loading capabilities add new pharmacological possessions to nanoparticles. They can have special internalization routes, selectivity, targeting, and delayed clearance [19].

The use of nanoparticles is reported to be of excessive benefit in many dermatological applications. Nano-based active ingredient delivery systems yield advantage of enhanced skin penetration possessions, depot consequence with sustained active ingredient release and the ability of surface functionalization letting specific targeting into cellular and subcellular sections. Delivery of pharmaceutical agents to skin using nanoparticles could revolutionize the treatment of some skin disorders [20]. Cosmeceutical industry and its marketing could potentially change public insight. In fact, nanotechnology provides outstanding opportunities for such researches and commercial purposes.

Topically applied nano-formulations include sunscreens, cosmetics, and personal care products. Common formulations of sunscreens based on micron-sized ZnO or TiO₂ materials enhance reflection and show a fairly low refractive index compared with nano-sized materials. So, modern sunscreens containing ZnO or TiO₂ nanoparticles are relatively

muddy and clear compared with micron-sized formulations that remained bright white after utilizing. This leads to an increased cosmetic request of these products without sacrificing their effectiveness [21].

Nanoemulsions as ultrafine emulsions are recently involved in researches to be used in skin care products or as controlled delivery systems. A wide use of these formulations are in deodorants, sunscreens, and in skin and hair care products. Their remarkable properties like rapid penetration, merging textures and their biophysical properties especially, hydrating power make them to be appropriate candidates for skin delivery of cosmetics [22].

Microemulsions are commonly defined as nano-sized emulsions of water oil and amphiphile, an optically isotropic and thermodynamically stable liquid. Lilly et al. presented a patent for a w/o microemulsion that was stable, non-irritating moisturizing composition that promoted the penetration of moisturizers into the skin with little residue on the skin surface. Microemulsions are broadly used (mainly w/o types) in many cosmetics like skin care and hair products [23].

Hydrogels are polymeric networks containing chemical or physical cross-links with the ability to swell in water or other biological fluids without dissolving. They can be used as delivery systems for skin-related cosmetic ingredients due to high capacity and other outstanding properties. They have the ability to present future changes in their property accordingly to the need of new products [24].

Niosomes as vesicle-form structures are composed of nonionic surfactants. Higher chemical stability of surfactant leads to good storage as well as no purity problems and low manufacturing costs for niosomes. Some advantages of niosomes related to skin products comprise their ability to improve the stability of entrapped active ingredients, enhanced bioavailability of poorly absorbed ingredients, and improved skin penetration [25].

Lipid based nanostructures have a significant role on improving the effectiveness of cosmetics. These nanoparticles are developed to improve the physicochemical stability of the skin system and to incorporate the active ingredients in cosmetic products. These structures can be added to existing cosmetic formulations without any significant problems due to their physical stability and compatibility with other ingredients [26]. Due to their importance in skin cargo delivery and their vast application in current cosmetic formulations, we separately focus on lipid based nanoparticles in the next section. Fig. 1 shows a general

Download English Version:

<https://daneshyari.com/en/article/8524658>

Download Persian Version:

<https://daneshyari.com/article/8524658>

[Daneshyari.com](https://daneshyari.com)