



# Nanotechnology in Cosmeceuticals

Advances, Challenges and Future Perspectives

Edited by  
**Chin Wei Lai and Paul Thomas**



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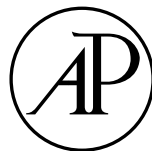
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14.3.2	Solid lipid nanoparticles	246		
14.3.3	Nanocapsules	247		
14.3.4	Dendrimers	247		
14.3.5	Nanoemulsions and nanocrystals	247		
<b>14.4</b>	<b>Application of nanodrug delivery systems in various cosmetic products</b>	247		
14.4.1	Skincare—moisturizer, face cream, sunscreen, etc.	247		
14.4.2	Antiaging products	248		
14.4.3	Hair care products	249		
14.4.4	Tooth care products	249		
<b>14.5</b>	<b>Risk associated with nanodrug delivery systems in cosmetics</b>	250		
14.5.1	In health	250		
14.5.2	In environment	251		
<b>14.6</b>	<b>Regulatory guidelines</b>	251		
14.6.1	European regulations	251		
14.6.2	US regulations	252		
14.6.3	Regulations in other countries	252		
<b>14.7</b>	<b>The global market for nanodrug delivery in cosmetics</b>	253		
<b>14.8</b>	<b>Future perspectives and challenges</b>	253		
<b>14.9</b>	<b>Conclusion</b>	257		
	<b>Acknowledgment</b>	257		
	<b>References</b>	257		
<b>15.</b>	<b>Nanoliposomes in skincare products</b>			
	<i>Sandra Simões, Aleksandra Jovanović, Nsrein Ali, Ana R. Ribeiro, Catarina Pereira-Leite, Edlira Aruci, Helen E. Colley and Sofia Lima</i>			
15.1	Introduction	263		
15.2	Nanoliposome basic components	263		
15.3	Classification of nanoliposomes	266		
15.3.1	Classification based on the structural parameters	266		
15.3.2	Classification based on the preparation method	266		
15.3.3	Classification based on the type of application	267		
<b>15.4</b>	<b>Liposome–skin interactions: dermal and transdermal delivery</b>	268		
15.4.1	Dermal and transdermal delivery	268		
<b>15.5</b>	<b>Applications in skin care products</b>	269		
<b>15.6</b>	<b>Cosmetic and pharmaceutical development</b>	271		
<b>15.7</b>	<b>Future perspectives</b>	272		
	<b>Acknowledgments</b>	272		
	<b>References</b>	273		
<b>16.</b>	<b>Prospectus and applications of nanocapsules in cosmeceuticals</b>			
	<i>Vineet Kumar Rai, Jitu Halder, Guru Prasanna Sahoo, Sudhanshu Ranjan Rout, Goutam Ghosh, Goutam Rath and Harshika Khanna</i>			
<b>16.1</b>	<b>Introduction</b>	279		
<b>16.2</b>	<b>Nanotechnology in cosmeceuticals</b>	279		
<b>16.3</b>	<b>Nano-capsules: design and fabrication</b>	280		
16.3.1	Types of nano-capsules	280		
16.3.2	Methods of preparation	281		
16.3.3	Recent advances in preparing nano-capsules-based cosmeceuticals	281		
16.3.4	Major advantages of nanoencapsulation in cosmetic application	283		
16.3.5	Nanocapsule-associated challenges in cosmetics	283		
<b>16.4</b>	<b>Applications of nano-capsules in cosmeceuticals</b>	284		
16.4.1	Skin care products	284		
16.4.2	Hair care products	288		
16.4.3	Make-up products	289		
<b>16.5</b>	<b>Recent advances and innovations</b>	289		
16.5.1	Smart nano-capsules for targeted delivery	289		
16.5.2	Stimuli-responsive nano-capsules	290		
16.5.3	Biogenic and biodegradable polymers-based nano-capsules	290		
16.5.4	Nano-capsules for personalized cosmeceuticals	290		
<b>16.6</b>	<b>Future research directions</b>	290		
<b>16.7</b>	<b>Potential challenges and solutions</b>	291		
<b>16.8</b>	<b>Conclusion</b>	291		
	<b>References</b>	291		
<b>17.</b>	<b>Nanoparticles and emerging technologies in modern hair care products</b>			
	<i>Vineet Kumar Rai, Chandan Das, Priyanka Dash, Ajit Mishra, Biswakanth Kar, Tushar Kanti Rajwar, Amit Sharma, Narayan Prasad Yadav, Anant Kumar and Goutam Rath</i>			
<b>17.1</b>	<b>Introduction</b>	295		
<b>17.2</b>	<b>Nanotechnology in hair care: key principles and technologies</b>	296		
<b>17.3</b>	<b>Applications of nanotechnology in hair care products</b>	299		

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# Nanoliposomes in skincare products

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## 15.1 Introduction

Skin is the largest human organ, and topical formulations have been applied to the skin for centuries for cosmetic and therapeutic purposes. Topical formulations active ingredients can be easily administered with a minimal invasion, leading to an increased compliance. Advanced topical formulations have been developed to stabilize active molecules, but mostly for increasing the depth of penetration within the skin.

The skin acts as an extraordinary barrier for actives' delivery (Dragicevic & Maibach, 2024). The outermost skin layer, the *stratum corneum* (SC), is the major permeation obstacle for most molecules, especially for hydrophilic ones, due to SC structure that has been described as a “brick and mortar model,” representing the corneocytes and the surrounding intercellular lipids (El Maghraby et al., 2008).

Liposomes were the first lipid vesicles introduced by Bangham and Horne in 1964 (Bangham & Horne, 1964) considered for drug delivery. These vesicles have been used as models of biological membranes and, later, as carriers of bioactive agents in different areas such as therapeutics, cosmetics, vaccines, tissue engineering, imaging, and food technology (Akbarzadeh et al., 2013). Several generations of liposomes can be considered. The designation of nanoliposome became popular; however, it contains a redundancy, as liposomes are, by definition, nanostructured vesicular systems. In this work, the term nanoliposomes will be used for describing the different types of phospholipid nanosized vesicles or liposome-like structures composed of at least one bilayer that encloses a number of spherical aqueous compartments.

For therapeutic purposes, liposomes have evolved strategies to escape from capture by the mononuclear phagocytic system (MPS) upon parenteral administration or to the vectorization for cellular or extracellular compartments. In parallel, for skin care, the strategy followed the incorporation of molecules able to destabilize the lipid bilayer to modify the deformability of the vesicles and change the vesicles interaction with the skin. Conventional liposomes are nondeformable structures, and once applied to the skin, they fuse and create an occlusive layer, increasing skin hydration and promoting the permeation of active molecules. In 1992, a new type of vesicle called elastic or (ultra)deformable liposomes/vesicles was developed where the lipid bilayer can be doped with a surfactant or an edge activator (Cevc & Blume, 1992) that destabilizes the vesicle, making it deformable. After that, many other deformable vesicles have been proposed. Some of these technological approaches have reached the cosmetic market, and many active molecules have been studied to be transported to the skin by means of such modified liposomes.

## 15.2 Nanoliposome basic components

Nanoliposomes are primarily composed of phospholipids that assemble into a lipid bilayer, closely resembling the biological membranes that encase an internal vacuole. These phospholipids can be either synthetic, such as