

CHAPTER

6

**PRE-CLINICAL INSIGHTS
INTO MICELLAR
COSMETIC FORMULATIONS**

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6.1 INTRODUCTION

Aging skin is a progressively decline in physical function of the skin with changes in appearance; hyperpigmentation, sagging, dark spots, and wrinkles, aesthetic manifestations, and several skin diseases occur. Besides, it is biochemical, physiological, natural, and time-dependent process, that causes by complex interaction between intrinsic and extrinsic factors, resulting with deleterious changes in skin layers (Lee et al., 2021)

Intrinsic factors involve physiological and genetic changes, while extrinsic factors are determined by external stimuli, such as air pollution, ultraviolet (UV) radiation, diet, excessive alcohol and tobacco, toxins, bad lifestyles, and others (Tyrrel et al., 2021). Regulation of body temperature, loss of proteins and electrolytes, fluid balance, production of vitamin D, sensory perception, waste removal, immune response and skin barrier function are affected in physiological skin changes. Furthermore, the effect of skin appearance due to aging involves aesthetic effects such as wrinkles, loss of elasticity, skin spots, and

thinning, contributing to mental, psycho-social, and emotional problems (Cao et al., 2020).

Collagen is one of the most important protein compounds, which represents one-third of the total protein in human body that synthesized by dermal fibroblasts to produce its precursor, pro-collagen. Tremendous types of collagens are identified, but collagen Type I is the most important that constitutes 90% collagen located especially in the skin. It is considering as major structural component of dermis's extracellular matrix (ECM), a skin connective tissues that provide strength and resiliency (Shin et al., 2020). Besides, elastin is another protein structure with a function closely to collagen. The decline of these two proteins amounts can be associated with skin aging, weakening tissue strength and integrity.

Divergent collagen homeostasis is closely related to the present of matrix metalloproteinase (MMPs), the group of enzymes enable to break down structural ECM proteins and accelerated skin aging (Philips et al., 2022). Reactive oxygen species (ROS) are among the main contributing factors of increased MMPs in the skin, where the ROS can be generated from different sources, such as ultraviolet irradiation. Mitogen-activated protein kinase (MAPK) family produced during the present of ROS, leading to the transcription factor activator protein-1 (APatt-1) activation also the transforming growth factor (TGF)- β signalling, both which are contributed to transcriptional regulation of several MMPs (Bange et al., 2021)

The skin is considering as largest organ and functions to protect body against chemical and mechanical damages, enables body thermoregulation, provides adaptive and innate responses, and act as sensory organ (Supe et al., 2021). Moreover, for individual personal identity, self-esteem, physical appearance, and self-consistency are depending on skin healthy condition that define the consumption of cosmetics, skin care, personal care products, and other aesthetic products (Evangelista et al., 2022). Attributable to this, the global size of beauty and personal care industries amount to USD571.10 billion and expected to growth annually by 3.80%, cumulative annual growth rate

(CAGR) of 2023–2027. In the last few decades, cosmeceutical and pharmaceutical companies have dramatically increased their technologies, innovations, new, safe, and therapeutic materials to treat and prevent skin aging issues (Ma & Kwon, 2021).

Various approaches have been implemented to prevent skin aging-related diseases, including cosmeceutical skin care (Aguilar-Toalá et al., 2019), correct sun protection (Shanbhag et al., 2019), topical products (antioxidant and cell regulator properties (Nagula & Wairkar, 2019), invasive procedures (radio frequency, chemical peelings, fillers, injectable skin bio-stimulators, and among others) and systemic agents (anti-oxidant and hormone therapies) (Zarei & Abbaszadeh, 2019). Among these, topical cosmeceutical skin care products with anti-aging and antioxidant actives that potent to reduce skin aging ailments are becoming common choices by consumers.

Skin care from plant origin has been overshadowed by the emergence of new phytochemical compound synthesis, and new biotechnologies implementation, where plant biodiversity is widely known for its rich source of newly active constituents. The phytochemical compounds include different secondary metabolites compounds' groups: Flavonoids, tannins, polyphenols, anthocyanin, anthocyanidins, terpenoids, coumarins, stilbenes, and alkaloids compounds. These actives are revealed to be the main cause of controlling and preventing for the treatment of skin ailments, particularly the process of skin aging (Michalak, 2022; Zhang et al., 2022).

Nanotechnology is known as an inventive approach in cosmetic industry, which also as the most forthcoming technology of twenty-first century. Its definition represented production, design, characterization, and application in innovative science, where the particles can be manipulated in the ranges between 10 and 1000 nm (Aziz et al., 2019; Tangau et al., 2022). In cosmetic arena, incorporation of nanotechnology with active compounds for cosmetic purposes is known as nano-cosmeceutical. It aims to ensure stability, bioavailability, and therapeutic effects of the bioactive compounds (e.g., plant extracts), for high-rate penetration onto the skin and promote advanced products' effectiveness (Gupta et al., 2022).