Skin Delivery and Controlled Release of Active Ingredients Nanoencapsulated by Chitin Nanofibrils: a New Approach

Authors: Prof. P Morganti, Prof. P .Del Ciotto, Mavi S.r.l, Rome, Italy
Prof. Xing-Hua Gao, MD, Ph.D, No.1 Hospital of China Medical University, Shenyang, China

Abstract

Micro and nanoencapsulation processes are generally used for both isolating and protecting sensitive substances or bioactive molecules and facilitating their controlled release. Because of the hierarchical structure of the *stratum corneum*, consisting of corneocytes embedded in a multilamellar intercellular lipid-based matrix, trans-epidermal delivery of active ingredients is very difficult.

For delivering active ingredients into the skin we have exploited the possibility of interacting with the lipid lamellae by the use of electrically charged chitin-nanofibril nano encapsules (CN). By this new approach the CN polymer forms the polymeric matrix while encapsulating different active ingredients therein. This paper describes a new means of producing skin-penetrating and bio compatible nanocarriers capable of loading biologically active ingredients and selectively releasing them through the epidermis lipid layers.

Introduction

Traditional Chinese Medicine (TCM) such as the innovative NICE concept in nutricosmetics is facing headwinds as it looks to go global[1,2]. Whilst western medicinal principally treats symptoms, TCM puts priority on addressing the underlying causes of illnesses. TCM prescriptions are focused, in fact, more on the patient than the actual medical condition for which they are being prescribed to different patients with the same disease[3].

In the same way the NICE approach for nutricosmetics is looking to formulate innovative products that, by a local activity, may extend their influence on the entire body. From this scientific idea beauty and wellness outside-in is born, as a new concept for obtaining a new total-body skincare with an overlap between the use of food and cosmetics (Figure 1). Trying to better understand the mechanism of action of these NICE-Nutricosmetics, based on the contemporary activities addressed from Nervous, Immune, Cutaneous, and Endocrine systems, the relative signal connections interconnecting the skin NICE–cells with the whole body are being reviewed and controlled by *in vitro* and *in vivo* studies[4,5].

Based on these studies, a partnership cooperation with the prestigious medical institution of China Medical University, The Second University of Naples and the Nanoscience Centre of our company has been established. The first main topic was based on the activity that chitin nanofibrils (CN) have in complexing active ingredients, also highlighting their skin efficacy. CN has the ability, in fact, not only to form nanocapsules trapping different kinds of active ingredients, but also to increase their skin penetration. It is interesting to point out that in this process CN polymer forms the matrix while encapsulating the active ingredients therein[6]. It has also been observed that active ingredients, tightly trapped in the CN complex matrix, are released in an exponential and controllable manner, typical of diffusion-controlled behaviour[7-9]. The active molecules entrapped in CN are slowly and controllably released from the nanocapsules penetrating the *stratum corneum* (SC) lipid layers, as illustrated in Figure 2 (on page 2).

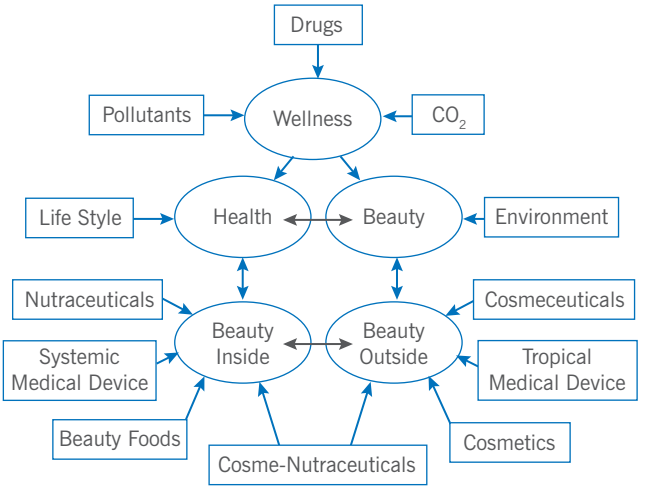

Figure 1. The Overlap Activity Between Food and Cosmetics is Under the Influence of the Environment and the Life Style of Living