INTRODUCTION:

The efficacy of a cosmetic product depends largely on the properties and concentration of the active ingredients it contains but also on their ability to reach the biological targets. Increasing product efficacy in order to obtain faster and better clinical results is the challenge of all cosmetic products. However, the physico-chemical properties of active ingredients and the skin barrier are two crucial parameters impacting the efficacy of cosmetic products.

The stratum corneum (SC) is the major obstacle to the penetration of hydrophilic active molecules. Thereby, delivery systems are widely used to overcome this barrier. Due to their biocompatibility with skin composition, liposomes have been largely used in the cosmetic industry since the eighties. However, various cosmetic ingredients such as electrolytes and surfactants decrease the stability of liposomes and therefore their efficacy to deliver active ingredients. A new generation of liposomes was developed to be more resistant in cosmetic formulations using hydrophobized polysaccharides which surrounded the phospholipid sphere (coated liposome). The ability of those coated liposomes to improve the skin delivery and the clinical efficacy of active ingredients was evaluated.

RESULTS AND DISCUSSION:

Coated liposomes were developed through a proprietary process using phospholipids and polysaccharides-fatty acid complex (Stearoyl Inulin). Actives molecules (caffeine or hexapeptide) were then entrapped into the non-coated and the coated liposome in order to follow: 1) the resistance of the coated liposome into cosmetic formulations; 2) the skin delivery; 3) the clinical efficacy.

As shown in figure 1, microscope pictures revealed that the coating procedure of liposomes did not modify the vesicular structure and the morphology of the vesicles. Furthermore, we demonstrated that coated and non-coated liposomes are more resistant to nonionic surfactants than to ionic ones (data not shown). However, whatever the kind of surfactant, the coating process improved the stability of liposomes.

The bioavailability studies, using Franz cells, allowed us to demonstrate that 2 actives (caffeine and hexapeptide) have a better cutaneous absorption in all skin compartments, when they are encapsulated in coated and non-coated liposomes compared to the non-encapsulated actives in solution.

The bioavailable compartments consist of epidermis, dermis and receptor fluid (that corresponds to the hypodermis).
As shown in figure 2, after 24h of incubation, the bioavailability of caffeine was improved by 2.4 fold using liposomes and by 3.6 fold using coated liposomes. Figure 3 demonstrated that after 24h of incubation, the bioavailability of hexapeptide was improved by 2.5 fold using liposomes and by 3.1 fold using coated liposomes.

The penetration enhancer effect of liposomes is mainly due to the phospholipids properties which composed liposomes. Phospholipids penetrate the skin surface modifying the polarity of the SC and then its permeability. On the other hands, El Marghraby et al., demonstrated that the penetration enhancing effect of liposomes is not only linked to their components (phospholipids) but also to their vesicular form. In our cutaneous diffusion studies, coated liposomes improved the bioavailability of caffeine and hexapeptide better than classical liposomes. This difference could be linked to the use of stearoyl inulin, an hydrophobized polysaccharide which could interact with the lipid domains of the SC, modify its structure and then its permeability, facilitating the diffusion of hydrophilic molecules.

In order to clinically demonstrated the benefits of using coated liposomes for skin delivery, we developed an ingredient composed of L-ornithine encapsulated into coated liposomes (figure 4). We first demonstrated the in vitro efficacy of our active ingredient to stimulate HIF-1α and induce adipocyte anabolism activation. Then, L-ornithine encapsulated in a coated liposome was clinically evaluated to test the delivery of the active ingredient in the adipose tissue.

In order to confirm the in vitro data and the capacity of the active ingredient to reach the hypodermis level, an in vivo test on nasogenian fold was conducted. As seen in figure 5, the nasogenian fold was successfully reduced after 1 month treatment with a significant decrease in depth (-9.5%) and roughness (-5.9%), confirming the capacity of the coated liposome to deliver the active ingredient to the hypodermis.

CONCLUSION

The development of new delivery system through the coating of polysaccharides on liposomes brings new opportunities in terms of cosmetic formulations: better stability, higher skin absorption and more efficient bioavailability. Taking together, results on this new delivery system bring the evidence of the active ingredient efficacy improvement in order to address several complexes skin condition such as anti-aging, slimming, etc.

REFERENCES