

ABSTRACT

Transdermal drug delivery system is in the centre of attention in recent years. For efficient dermal drug delivery the drug has to overcome the barrier of the outermost layer of the skin, the stratum corneum. For facilitating dermal drug transport, the barrier properties of the stratum corneum can be varied by applying chemical penetration enhancers.

The aim of this work was to characterize various penetration enhancers and investigate their mechanism of action. We combined well established techniques like differential scanning calorimetry (DSC) and infrared spectroscopy (IR) with confocal Raman microscopy (CRM) as an upcoming technique in skin research. CRM offers the possibility of label-free and non-destructive, chemically selective analysis of stratum corneum lipids and proteins.

We used isolated human stratum corneum for incubation with the penetration enhancers. As a novel approach, the samples of treated stratum corneum were freeze dried to avoid any discrepancies which might come up with differences in the hydration state of stratum corneum (SC). Furthermore, the structure of lipids and proteins in the stratum corneum was analyzed.

In our study, stratum corneum was treated with dimethyl sulphoxide, propylene glycol, ethylene glycol, ethylene glycol-d₄ and oleic acid. We observed that enhancers like oleic acid mainly acted on lipid constitution, whereas others, for example DMSO caused changes in protein conformation. Finally the potential synergistic effect was investigated by a mixture of penetration enhancers with different mechanism of action.

To sum up, different analytical techniques were successfully combined and offered a comprehensive insight into various penetration enhancers' mechanism of action. Differential scanning calorimetry offered the possibility of monitoring changes in lipid structure and barrier properties of stratum corneum. With infrared spectroscopy the disruption of lipid and protein part was detectable but the spectra of protein peaks were similar for most of penetration enhancers. Raman spectroscopy was a suitable tool for investigation changes in protein conformation of stratum corneum while the detection of lipid changes needs further investigation.