

Loss of the Skin Barrier after Dermal Application of the Low Molecular Methyl Siloxanes: Volatile Methyl Siloxanes, VMS Silicones

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Abstract : Introduction: The integrity of the outermost layer of skin (stratum corneum) is vital to the penetration of various compounds, including toxic substances. Barrier function of skin depends of its structure. The barrier function of the stratum corneum is provided by patterned lipid lamellae (binlayer). However, a lot of substances, including the low molecular methyl siloxanes (volatile methyl siloxanes, VMS) have an impact on alteration the skin barrier due to damage of stratum corneum structure. VMS belong to silicones. They are widely used in the pharmaceutical as well as cosmetic industry. Silicones fulfill the role of ingredient or excipient in medicinal products and the excipient in personal care products. Due to the significant human exposure to this group of compounds, an important aspect is toxicology of the compounds and safety assessment of products. Silicones in general opinion are considered as a non-toxic substances, but there are some data about their negative effect on living organisms through the inhaled or oral application. However, the transdermal route has not been described in the literature as a possible alternative route of penetration. The aim of the study was to verify the possibility of penetration of the stratum corneum, further permeation into the deeper layers of the skin (epidermis and dermis) as well as to the fluid acceptor by VMS. Methods: Research methodology was developed based on the OECD and WHO guidelines. In ex-vivo study, the fluorescence microscope and ATR FT-IR spectroscopy was used. The Franz- type diffusion cells were used to application of the VMS on the sample of human skin (A=0.65 cm) for 24h. The stratum corneum at the application site was tape-stripped. After separation of epidermis, relevant dyes: fluorescein, sulforhodamine B, rhodamine B hexyl ester were put on and observations were carried in the microscope. To confirm the penetration and permeation of the cyclic or linear VMS and thus the presence of silicone in the individual layers of the skin, spectra ATR FT-IR of the sample after application of silicone and H₂O (control sample) were recorded. The research included comparison of the intensity of bands in characteristic positions for silicones (1263 cm⁻¹, 1052 cm⁻¹ and 800 cm⁻¹). Results: and Conclusions The results present that cyclic and linear VMS are able to overcome the barrier of the skin. Influence of them on damage of corneocytes of the stratum corneum was observed. This phenomenon was due to distinct disturbances in the lipid structure of the stratum corneum. The presence of cyclic and linear VMS were identified in the stratum corneum, epidermis as well as in the dermis by both fluorescence microscope and ATR FT-IR spectroscopy. This confirms that the cyclic and linear VMS can penetrate to stratum corneum and permeate through the human skin layers. Apart from this they cause changes in the structure of the skin. Results show to possible absorption into the blood and lymphatic vessels by the VMS with linear and cyclic structure.

Keywords : low molecular methyl siloxanes, volatile methyl siloxanes, linear and cyclic siloxanes, skin penetration, skin permeation

Conference Title : ICT 2015 : International Conference on Toxicology

Conference Location : London, United Kingdom

Conference Dates : February 16-17, 2015