Artificial corneocyte model as skin surrogate to monitor the effect of hydration

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The stratum corneum (SC) is comprised of corneocytes (approx. 80% (w/w) being embedded in a lipid matrix (approx. 20% (w/w) [1]. Skin hydration can cause a swelling of the SC, that can also result in a swelling of corneocytes. Previous studies already demonstrated that a swelling of corneocytes can alter the dermal penetration efficacy of active ingredients [3,4]. In this study, we investigated the influence of hydration on SC and corneocytes in more detail by using three different strategies. First, it was proven that corneocytes contain water that leaks out when mechanical pressure is applied to the skin. This was done by removing parts of the stratum corneum form porcine skin that were than analyzed by inverted epifluorescence microscopy (Fig. 1). Results demonstrate that corneocytes act like sponges that hold water. The water can be squeezed out by applying mechanical stress (massage) to the corneocytes. The second step investigated the effect of hydrazination time on the stratum corneum thickness (SCT). For this, fresh porcine skin was covered with a wet tissue and punch biopsies were taken at different time points (0-6h). Vertical skin cuts were obtained from the punches and imaged with inverted epifluorescence microscopy. From the images obtained the SCT was determined (Fig. 2). Interestingly, it was found that the SCT increases during the first hour of hydration and then starts to decrease, indicating that the degree of skin hydration cannot be maintained over longer periods of time. As the corneocytes were found to act like sponges that can hold water in the first part of the study, it was now speculated that the changes in SC hydration over time might be associated to changes in the water holding capacity of the corneocytes. Therefore, the last part of the study investigated the effect of hydration and time on the size of corneocytes. For this artificial corneocytes were produced and dispersed in water. The size of the artificial corneocytes was determined at different time points by laser diffraction and light microscopy. Results show that corneocytes swell, reaching about 122% of their original size. After 1h, the size starts to decline and after 24h hydration time, the size of the corneocytes is about 22% smaller than the original size. The observations suggest that the corneocytes within the SC can be considered as a fluctuating water reservoir that can absorb and desorb water. With this functionality, corneocytes can be considered to play an important role in the regulation of the skin hydration. Further research is now needed to understand these findings in more detail. Studies that investigate the influence of chemical compounds on the oscillating water holding capacity of corneocytes are also needed to enable the development of effective and long-lasting skin hydrating topical formulations.

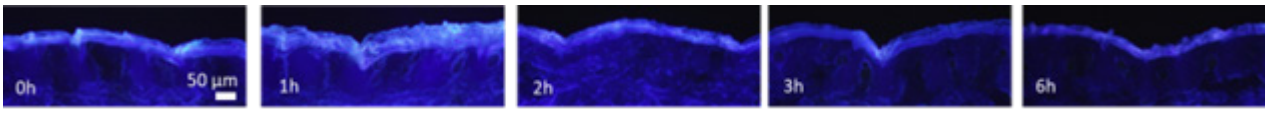

Figure 1: Time-dependent changes in stratum corneum thickness during coverage of skin with water-soaked tissue.

References:
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