New drug delivery systems have to overcome the skin barrier without causing irritation. Thus, knowledge of the skin composition is essential to obtain reliable data about the impact of dermal products. Besides the formulations’ physicochemical properties and stability, its influence on skin physiology is an important aspect in the development of new dermal drug delivery systems. We have recently developed novel concentrated water-in-oil (W/O) emulsions based on a non-ionic silicone surfactant. The aim of this study was to assess the effect of these formulations on physiological skin parameters of healthy volunteers after repeated application. To this end, confocal Raman spectroscopy (CRS) and classical biophysical techniques were used.

**Experimental Methods**

**Study design**

The study was conducted with approval from the Ethics Committee of the Medical University of Vienna. Two selected formulations (Tab. 1) were applied daily on the volar forearm of ten randomly chosen participants (27 ± 3 years of age). The other forearm was left as the untreated control. Over a period of four weeks, the skin composition was characterised in regular intervals.

**Measurement of physiological skin parameters**

The transepidermal water loss (TEWL) was measured with the closed-chamber device AquaFlux® (Biox Ltd., UK). The condensed-chamber probe measures the water evaporating from the skin in g/m²/h; in this way, increased skin water loss, indicating barrier damage, can be detected [1,2]. The capacitance devices Corneometer® CM 825 (C+K electronic GmbH, DE) and Epsilon® (Biox Ltd., UK) were used for the evaluation of skin hydration. The sebum amount at the skin surface was measured with a Sebumeter® (C+K electronic GmbH, DE) and the skin surface pH value was determined with a Skin-pH-Meter PH 905 (C+K electronic GmbH, DE).

In vivo CRS experiments were carried out using a confocal Raman spectrometer (gen2 Skin Composition Analyzer, River Diagnostics, NL) with two incorporated lasers (671 nm and 785 nm). All spectra collected were analysed using SkinTools® software version 2.0. For the calculation of the depth concentration profiles of the natural moisturizing factor (NMF) and urea, a least-squares fitting algorithm based on the endogenous skin components was used. Water profiles were generated by calculating the water content from Eq. (1), including the control values of the untreated forearm.

**Calculation of parameter changes**

The influence of the emulsions on the skin parameters was calculated after Eq. (1), including the control values of the untreated forearm.

\[
\text{Parameter changes} \% = \left( \frac{T_2 - T_0}{C_2 - C_0} \right) \times 100
\]

Tab. 1: Composition of the investigated W/O emulsions in % (w/w).

<table>
<thead>
<tr>
<th>Emulsifier 10</th>
<th>2</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insaponifiable</td>
<td>14</td>
<td>16</td>
</tr>
<tr>
<td>Silicone gel</td>
<td>60</td>
<td>60</td>
</tr>
</tbody>
</table>

**Results**

Fig. 1 shows the effect of regular treatment on the TEWL, skin hydration and skin permittivity. A trend towards slightly decreased mean TEWL values was observed for both formulations. Continuous treatment led to a change of skin hydration towards higher Corneometer values. Skin permeability mapping with the fingerprint sensor Epsilon® revealed similar trends to the Corneometer capacitance measurements. In Fig. 2, representative skin permittivity maps are presented.

**References**