ABSTRACT

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Title of Diploma Thesis: The effect of ceramide structure on the behavior of thin films modeling the skin barrier

The skin barrier is essential for human survival on dry land, it is located in the uppermost layer of the skin, in the *stratum corneum* (SC). SC consists of corneocytes that are surrounded by an oligolamellar lipid matrix. The main components of the SC lipids are ceramides (Cer), fatty acids (FFA) and cholesterol (Chol). They are found in the SC in a ratio of 1:1:1. This ratio is essential for epidermal homeostasis. Any change in this ratio may lead to disruption of the barrier function, e.g. to the development of atopic dermatitis or psoriasis. These lipids prevent excessive loss of water from the body and the entry of undesired substances from the external environment into the body.

The lipid matrix forms a typical lamellar arrangement in the skin. Lipids form structures with a long periodicity phase - LPP (d ~ 13 nm), with a short periodicity phase - SPP (d ~ 6 nm) and a separated Chol phase (d ~ 3,4 nm). The molecules are organized with each other in a lateral arrangement that can be orthorhombic, hexagonal, or liquid disordered.

Cer belong to the group of sphingolipids. This is a very heterogenous group of lipids. By this time, 15 subclasses of Cer had been discovered. They are divided according to whether they contain sphingosine (S), dihydrosphingosine (dS), which are typical for eukaryotic cells, phytosphingosine (P), or 6-dihydrosphingosine (H) specific to the epidermis.

The aim of this work was to prepare simple model membranes containing a mixture of Cer (NS, NdS or NP-type), FFA and Chol and to find out whether Cer structure has an effect on the properties of the deposited thin films. The effect of annealing (heating the samples over the melting temperature and subsequent cooling down) and the presence of water during annealing were also studied.

Periodical structure of samples, the conformational order, and the molecular arrangement of the lipids in the samples were investigated using X-ray diffractometry (XRD), Raman microspectrometry and Fourier transformed infrared spectroscopy (FTIR).

During the experiment, it was found that lipids form regular structures even before annealing. The formation of these structures and their periodicity was influenced by the structure of the Cer present in the model. Annealing in the presence of water effected these structures, usually prolonging their periodicity. The orthorhombic arrangement of chains was detected in the lipid mixtures. The significant effect of annealing and the presence of water on the lateral arrangement was not observed. Temperature was found to affect the interactions of the chains predominate in the molecular ordering before heating. The intermolecular interactions between the polar heads of Cer (hydrogen bonds) seem to be more involved in the lipid ordering after annealing.