SUMMARY

The skin, as the outer covering of the body, is subjected to influence of the external environment. The appearance and condition of the skin is influenced by many internal factors (genetic predisposition, systemic diseases), exposure to UV radiation, medicines and cosmetics used. The dynamically developing cosmetics industry and increasing amount of cosmetic preparations available on the market shows the need to study the effects of ingredients of these preparations on the skin.

The skin transports ions that cause electric potential difference. The electrostatic field generated on the skin surface acts as a protective barrier against the penetration of external agents. Substances applied onto the skin surface can have an effect on ion transport causing changes in transepithelial electrical potential and electrical resistance. The skin is exposed to ultraviolet radiation, which has both positive and negative effects on it. In order to protect the skin against UV radiation, cosmetic preparations include antioxidants.

A direct premise to study the subject of this doctoral dissertation was to broaden the knowledge in the field of ion transport in rabbit and human skin under the influence of cosmetic ingredients and UV radiation. There are no publications available in the scientific literature concerning the effect of protective substances on the transport of sodium and chloride ions. There are only few publications explaining the ion transport mechanism in rabbit skin, while there are no reports on changes in electrophysiological parameters of the human skin measured using the Ussing chamber.

The doctoral dissertation includes a review of the literature starting from the human and rabbit skin structure and description of electrophysiological parameters. The transport of sodium, chloride, potassium and calcium ions and water in the skin was characterized. The effect of UV radiation on the skin surface and ion channels was presented and the relationship between UV radiation and the immune system was demonstrated. The consecutive paragraph specifies the influence of substances with antioxidant properties on the skin surface.

Cosmetic formulations of specific and desirable antioxidant effect spectrum were designed and obtained in the experimental part. Human and rabbit skin specimens (232 fragments of rabbit skin and 120 fragments of human skin) were used for the tests. The rabbit and human skin specimens were assigned to individual test groups. The skin fragments were incubated for 30 minutes in moisturizing ointment and in moisturizing ointment with the addition of antioxidant ingredients (vitamin A, C and E and coenzyme Q_{10}). After applying

antioxidant protection, the next group of skin after antioxidant protect was exposed to UVA and UVB radiation. The electrophysiological parameters of the rabbit and human skin specimens were measured by Ussing chamber.

The electrophysiological tests conducted explain a so far unknown mechanism of the effect of UVA and UVB radiation and the antioxidant components added to moisturizing creams used in the cosmetics industry on the transport of ions in rabbit and human skin. The differences in the effect of the analyzed compounds and UV radiation on the ion transport in rabbit and human skin were determined on the basis of the analysis of electrophysiological parameters. Human skin and rabbit skin do not show statistically significant differences as regards electrophysiological parameters after application of moisturizing ointment with vitamin A and E. The moisturizing ointment with vitamin C affects the transport of sodium ions in the human skin and chloride ions in the rabbit. The study did not prove the effect of other ions than sodium and chloride on the human skin electrical potential changes under the conditions of inhibited Na^+ and Cl^- ions transport, as opposed to rabbit skin (the effect of other ions is possible). Rabbit skin is more sensitive to ultraviolet radiation than human skin. A moisturizing ointment containing vitamin C, coenzyme Q_{10} and ultraviolet radiation reduce the electrical resistance of the rabbit skin.

The results of the study permit to conclude that rabbit skin should not be an equivalent model for tests on ion transport and electrophysiological parameters in relation to human skin due to different mechanisms of changes induced by the effect of various chemical substances. The results of the authors' own studies presented in the doctoral dissertation constitute a significant contribution to the state of knowledge on the effect of cosmetic ingredients on changes in ion transport and transepithelial electrical resistance of the skin. The results of experimental tests should help to explain the mechanism of transepidermal ion transport.

It is justified to conduct further research on the factors that can modulate transepidermal transport of xenobiotics into the body, without causing morphological damage to the epidermis. This knowledge can also be used to counteract the process of skin photoaging.

Paulina Smyk