

### **Description for the general public**

The skin is the biggest human organ. It covers the entire body and also acts extremely important function - separates the body from the surrounding environment. Barrier formed by epidermis effectively protects the further layers of skin, cardiovascular system and other organs from harmful environmental factors, including chemical agents. However, this mechanism not always operates effectively. Different substances are able to penetrate the skin barrier or other chemical can help in their migration. The example compounds with this property are surfactants. This function is used in application of drugs in *transdermal therapeutic systems* (TTS), which are glued on the skin as a patch (e.g. contraceptives drugs, painkillers, for the treatment of nicotine addiction). TTS uses effect of the transport of active compounds in the coexisting of other substances. Among other things, as materials used to support transport can be added surfactants that are not indifferent to the human health and they can cause side effects. Surfactants due to their specific structure and properties, they are widely used in cosmetics, detergents, pesticides, production of textiles and electronics, extraction of raw materials. The concentration of surfactants in the environment is dramatically increasing and it is connected with increasing human exposure. In addition to the environmental exposure of consumers every day are applying directly to their skin as different types of cosmetics and detergents often in irrational quantities. Under these conditions, the skin loses its barrier properties and open access to the interior of the body substance. In 2014, Chinese scientists published first results, which confirmed an increased ability to penetrate through the skin of di-2-ethylhexyl phthalate (DEHP) in the presence of a non-ionic surfactant. Phthalic acid esters (phthalates) are used in the production of plastic packaging, decorative materials, toys, cosmetics, detergents, adhesives, dyes, medicines, sanitary materials, sometimes consist 30-40% of their weight. They are used as flexibility agents in TTS. Phthalates are among the compounds that interfere with the functions of the human hormonal system even at low concentrations. The studies, conducted between 80-90, indicate that phthalates have little ability to migrate through the skin of animals. However, in these studies, researchers did not taken into account the participation of the factors supporting their transport. Presently, knowledge about barrier of human skin when the various components co-existence (e.g. in particular of phthalate-surfactant mixtures) is very limited. This aspect is very important in assessment of exposure in real conditions, which is particularly important in the context of human health, especially children and adolescents.

The main objective of the project is to examine the possibility of migration of selected phthalates through the human skin in the presence of surfactants and their penetration into the bloodstream. The research will include determining the endocrine activity of compounds penetrate the human skin, and animal/*in vitro*/synthetic skin models used to study the absorption of compounds (porcine skin, *EpiDerm*, *Strat-M<sup>®</sup> membrane*). The legitimacy of the proposed project can be supported due to the dramatic increase in diseases and disorders associated with the presence of endocrine disrupting chemicals (EDCs). Endocrinologists inform about the alarming increase in the incidence of adverse biological effects indicating exposure to the EDCs, like fertility disorder, cryptorchidism, precocious puberty girls and boys, hormone-dependent tumors (endometrial cancer breast, prostate, ovarian and testicular).

World and Polish Endocrinology Societies (Endocrine Society, Pediatric Endocrine Society, European Society of Pediatric Endocrinology, Polish Society of Endocrinology), in publications from 2009 and 2015, have expressed their official position on the need for research on determining the relationship between exposure to EDCs and incidence of mentioned diseases. Particularly worrying is the phenomenon is observed, named as "*transgenerational epigenetic effects of EDCs*", which assumes the existence of biological effects following exposure of pregnant mothers in subsequent generations.

The planned study is a scientific novelty and fit in with trends in the marketing of safer cosmetic products and detergents. At the same time the results of research will allow for the verification data used in assessing the hazard to humans of various types of cosmetics and detergents and their admission to trading. Examination of human skin barrier relative to the phthalate-surfactant mixture will put attention and raise public awareness in the area of increased exposure to EDCs after the application of cosmetics and detergents. Availability of research on the negative action of phthalate-surfactant mixture on human health can translate into more aware of their use and the use of appropriate personal protective equipment, what can improve the health and quality of life consumers.