Surface Modification of Stratum Corneum for Drug Delivery and Skin Care by Microplasma Discharge Treatment

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Humanskin is the largest organ and also, the main barrier which prevents foreign substancesto enter the body. The surface properties of the skin are relevant for transdermaldrug delivery and cosmetics. Adsorption process is important for creams,detergents and other formulation applied on the skin surface. Adsorption ofdrugs or other substances can be measured directly by determining concentrationof molecules on surface or indirectly by measuring of water contact angle. Microplasmaelectrode is used for surface modification of the skin epidermal layer ofYucatan micropig. Microplasma is AC barrier discharge with thin dielectric as abarrier (~50 ?m) and frequency of 25 kHz. Surface properties of the epidermallayer were characterized by measurement of a contact angle of the water droplet.Effect of different gasses such as air, nitrogen, oxygen, helium or argon wascompared. Plasma was generated at low voltage around 800 V (0-Vpeak) in thecase of rare gases (argon and helium) and around 1.2 – 1.3 kV for the rest ofgases. Change of the contact angle is temporal and it is returned to initialstate after several hours. Among gasses used for plasma ignition, oxygen and argonwere the most effective in the skin treatment. However, high temperature ofelectrode during treatment, disqualify oxygen. Distance of the skin from the electrodeand treatment time played crucial role for increase of water contact angle. Changesof surface atomic concentration were determined by XPS (X-ray photoelectron spectroscopy).After microplasma treatment, oxygen concentration increased. These results demonstratethat microplasma discharge is powerful tool for surface modification of stratumcorneum. Adsorption of drugs and cosmetics on the skin can be increased which impactsthe effectivity of transdermal drug delivery and skin care.