Nuclear microprobe study of TiO_2-penetration in the epidermis of human skin xenografts

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Titanium-dioxide is a widely used physical photoprotective agent as a component of various cosmetic products. However very few experiments were carried out on its penetration through the human epidermal barrier and its possible biological effects *in vivo* and *in vitro*.

In the frame of the NANODERM EU5 project, the penetration of TiO_2 nanoparticles through the epidermis of human forhead skin grafts transplanted into SCID mice was investigated in the Debrecen and Bordeaux nuclear microprobe laboratories using combined IBA techniques. Transmission electron microscope studies of the same samples were also carried out in the DMPFCS laboratory.

The skin grafts were treated with a hydrophobic emulsion containing micronised TiO_2-nanoparticles in occlusion, for different time periods. Quantitative elemental concentrations and distributions have been determined in 14-16 μm thick sections obtained from quick frozen punch biopsies using STIM, PIXE and RBS analytical methods.

Using both microscopic methods, we have observed nanoparticles having penetrated into the corneocyte layers of stratum corneum by direct visualisation in TEM and via their chemical fingerprint in PIXE. Experiments are still going on to evaluate to which extent.

The human skin xenograft has proved to be a model particularly well adapted to such penetration studies. The epidermis structure with a large and homogeneous stratum corneum provides an excellent topography to track the micronised titanium-dioxide particles and to evaluate their penetration depth. From a methodological point of view, the model offers the advantage of allowing long application times to simulate chronic exposure in the frame of penetration studies.