Inter-calibration of nuclear microprobe setups

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Six microprobe groups are involved in NANODERM, a European consortium formed in the frame of "Quality of Life", a part of the 5th European programme. Micronised TiO_2 nanoparticles are widely employed nowadays as physical photoprotective agent in sunscreen formulations. The aim of the project was to evaluate a possible penetration of such particles through the skin barrier and its eventual consequences on public health.

Nuclear microscopy techniques were chosen for their capability to provide quantitative results on a microscopic scale in the outermost epidermis layers. The aim of the present work was to conduct an inter-calibration procedure in order to make consistent the data provided by the different groups. For this purpose, dedicated reference samples were prepared by sectioning cryofixed gelatine gels uniformly loaded with Ti at different concentrations. Thin freeze-dried sections were then analysed using the six different setups. PIXE was carried out to measure the Ti level whereas RBS and STIM allowed the normalisation of results in terms of concentrations. After the analysis of 26 sections with a mean Ti concentration of 81 μg/g dry weight, we observed a standard deviation of less than 16,4 %. The Standard deviation increased up to 20 % for a mean Ti concentration of 600 μg/g (25 sections analysed).

This procedure, was a pre-requisite before to launch studies on animal and human skin samples previously exposed to TiO_2 nanoparticles. By this way, we proved the reliability and reproducibility of quantitative procedures usually employed in our community to derive absolute concentrations from nuclear microscopy. It constitutes a first in the frame of such a large collaboration.