

Evaluation of the environmental exposure to nanoparticulate UV-filters used in sunscreens

J. LABILLE¹, D. SLOMBERG¹, R. CATALANO¹, S. ROBERT², J.-L. BOUDENNE³, M.-L. APERS-TREMELO², A. MASON¹, C. DE GARIDEL¹

¹Labex Serenade, CEREGE (UMR 7330) Aix-Marseille Université / CNRS, Aix en Provence, France

²ESPACE (UMR 7300) - CNRS / Aix-Marseille Université, Aix-en-Provence, France

³Laboratoire chimie de l'Environnement (UMR 7376) Aix-Marseille Université, Marseille, France

Sunscreens are of emerging concern regarding both human and environmental health. While TiO₂ nanoparticles used as UV-blockers may offer a safer alternative to organic filters, their fate and impact and resulting regulation are still under consideration, largely related to the potential risk of nanotechnology-based products.

After leaving the skin either through bathing or cleaning, the TiO₂ nanomaterials contained in the sunscreen can be released into rivers, lakes, sea shores, and/or sewage treatment plants. Their fate and impact in these different systems is largely determined by the surface properties, i.e. the coating type and lifetime. All stages of the cream life cycle must be considered in this light, from its manufacture to its end of life, through its use by the consumer and its impact on the exposed environment.

In this work we developed both lab and field studies to assess the environmental exposure to UV-filters used in sunscreen.

Our field campaign was realised on three French beaches during summer recreational activities. The quantities of sunscreen used on the beach was evaluated through population counting and social survey, while the actual concentrations of UV filters recovered in the bath water was analysed spatially in terms of both organic and mineral UV-filters. The effective release and exposure to UV filters in such littoral system could thus be evaluated.

In the lab approach, sunscreen fabrication, risk for the direct aquatic environment and risk related to the end of life of the product are as many key steps of the sunscreen lifecycle that were investigated. In the end, by considering each development stage of the sunscreen, from the choice of UV-blocker and its integration into a cosmetic formulation, to the knowledge of the risk involved in this choice all along the product lifecycle, an eco-design approach can be achieved and risk can be minimized.