Eco-design of sunscreens through the minimization of risks associated with nanomaterials

J. LABILLE[1], D. SLOMBERG[1], V. BARTHOLOMEI[3], R. CATALANO[1], J.-C. HUBAUD[2], V. VIDAL[1], J. ROSE[1], C. DE GARIDEL-THORON[1], D. BOUTRY[3]

[1] Labex Serenade, CEREGE, Aix-Marseille Université, BP80, 13545 Aix en Provence cedex 4, France
[2] Helioscience, Cité de la Cosmétique, 2 rue Odette Jasse, 13015 Marseille, France
[3] LITEN / DTNM / SEN / LR2N, CEA Grenoble, 17 rue des Martyrs, 38054 Grenoble Cedex 9, France

Among cosmetics and personal care products, sunscreen products are of emerging concern regarding both human and environmental health. The fate and impact of mineral nanoparticulate UV-blockers, such as TiO_2 nanomaterials, is under consideration from a regulatory perspective due to their potential impact.

The Eco-SUN research program is aimed at developing the eco-design of sunscreens through the minimization of risks associated with nanomaterials incorporated into the formulation. Reducing the potential release and / or toxicity of the nanomaterial from the cream is a decisive criterion for its eco-design. Different stages of the cream lifecycle are considered from its manufacture to its end of life, through its use by the consumer and its impact on the exposed environments. Here we present how the sunscreen design impacts the environmental risk. A particular focus is made on the role of the nanomaterial functionalisation leading to a hydrophobobic or hydrophilic character, and mainly driving the environmental fate and impact.

Different relevant TiO_2 UV-blockers have been selected to integrate a typical w/o formulation as case studies. The resulting sunscreens were characterised in terms of nanomaterial localisation, sun protection factor and photo-passivation. The risk for the aquatic environment directly exposed through bathing activity was assessed both in terms of exposure and hazard. The release of nanomaterials from the sunscreen upon normal usage was studied in the laboratory through a simulated aging procedure. Two biological models, sea urchin and coral colonies, were selected as relevant endpoints to assess the marine ecotoxicity of the by-products formed.

This work is a contribution to the Labex Serenade (no ANR-11-LABX-0064) funded by the “Investissements d'Avenir” French Government program of the French National Research Agency (ANR) through the A*MIDEX project (no ANR-11-IDEX-0001-02)