Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.20011

The shape of nanomaterials drives their impacts on freshwater ecosystems: a safer-by-design perspective

MÉLANIE AUFFAN[1], CATHERINE SANTAELLA[2], LENKA BROUSSET[3], JEROME ROSE[4] AND ALAIN THIÉRY[3]

[1]CEREGE
[2]CNRS
[3]CNRS, Aix-Marseille Université, CNRS, IMBE, UMR 7263, Marseille
[4]Aix Marseille Univ, CNRS, IRD, INRAE, Coll France, CEREGE UMR 7330

Presenting Author: auffan@cerege.fr

Controlling the size, shape, and structure of metal-based nanomaterials (NMs) is technologically important due to the strong correlation between the intrinsic properties of NMs and their applications. For instance, silver nanomaterials (nanospheres, nanoplates, nanowires, nanorods, nanocubes) are valued by industries and scientists for their size- and shape-dependent properties which make them useful for diverse applications as optics, catalysts, sensors, antimicrobial agents... Silver nanospheres are commonly used in antibacterial and antifungal applications, silver nanoplates in analytical chemistry as optical sensors, and silver nanowires as promising conductive films for flexible touch screens. One reason for the particularities of these applications stems from the relationship between nanoparticle shapes and the associated crystallographic faces exhibited that may allow for the tuning of surface reactivity and bulk properties. Despite the challenge of controlling the shape of NMs during synthesis, several questions have been raised regarding the potential shape dependence of hazard and exposure posed by NMs.

From a safer-by-design perspective, the risk related to NMs for both humans and the environment may be mitigated by lowering either the hazard or the exposure potential. Controlling the shape of Ag NMs could be an option to fine-tune their efficacy in specific applications while reducing their potential harmful effects once released in the environment. We designed indoor aquatic mesocosm experiments to compare the environmental behavior, fate, and impact of Ag NMs with different shapes (plate and sphere) and consequently contrasting surface reactivities [1]. Mesocosm experiments allow answering two research questions. First, are the shape-dependent biological effects of Ag NMs previously observed *in vivo* also observed in freshwater ecosystems under a realistic exposure scenario (chronic low-level additions of Ag, mid-term exposure)? Second, how do the impacts on benthic and planktonic ecological niches of a lotic ecosystem differ following exposure to these Ag NMs and their degradation by-products?

References:

[1] Auffan et al. *ESnano* **2020** 7, 3167-3177