Impacts of nanosilver on microbial activity in wetlands and streams

BENJAMIN P. COLMAN[1]*, MELANIE AUFFAN[2], CURTIS J. RICHARDSON[3] AND EMILY E. BERNHARDT[1], MARK. WIESNER

[1]Biology, Duke University, Durham, North Carolina, 27708, USA (*correspondence: bpc8@duke.edu)
[2]Dept. of Civil and Environmental Engineering, Duke University, Durham, North Carolina, 27708, USA
[3]Nicholas School of the Environment and Earth Sciences, Duke University, Durham, North Carolina 27708, USA

Due to its antimicrobial properties, nanosilver is becoming increasingly common in consumer goods ranging from clothing and children's toys to supplements and cosmetics. Through the use and cleaning of these products, nanosilver enters the wast stream, and may ultimately end up being discharged as treated wastewater into aquatic ecosystems, or applied as biosolids from wastewater treatment plants to terrestrial ecosystems. In both types of ecosystems, microorganisms are essential to decomposition and nutrient turnover. Given the importance of microbes and the antimicrobial properties of nanosilver, we pose the question: what are the effects of nanosilver on microbes in natural ecosystems? To answer this question, we have added different preparations of nanosilver to streamwater, sediments, and soils and examined several indexes of microbial activity including microbial respiration, microbial biomass, and enzyme activities.

Our results suggest that the impact of nanosilver depends on the form in which it is added and the environment to which it is added. While Choi *et al*. (2008) [1] found that 1mg/L nanosilver reduced E. Coli respiration by 86%, our work in wetland soils showed 250 mg/L of nanosilver did not cause decreases in biomass or respiration. However, nanosilver did cause an increase in phosphatase enzyme activity, and an increase in phosphorous concentrations rose from 0.12 µg/L to 0.27 µg/L in proportion to the concentration of nanosilver added. Our work shows that the form in which nanosilver is added, the complexity of the physicochemical environment to which it is added, and the nature of the microbial community drive the response of environmental microbes to nanosilver.

[1] Choi *et al.* (2008) *Water Research* **42**, 3006-4074.

Is it possible to access to the dissolution rate constant of soft minerals?

J. COLOMBANI

Laboratoire de Physique de la Matière Condensée et Nanostructures, Université de Lyon, Université Claude Bernard Lyon 1 and CNRS, 69622 Villerbanne, France (Jean.Colombani@univ-lyon1.fr)

In standard dissolution experiments of soft minerals (rotating disk, batch, AFM, ...), the studied mineral is dissolving in flowing water. Therefore, convection is present in addition to dissolution and diffusion and the dissolution kinetics is hindered by the diffusion and convection kinetics, all three being of the same order of magnitude. As a proof, we have exhaustively collected the dissolution rates of gypsum in water, measured by various techniques, reported in the literature. These results show absolutely no consistency. By analysing the hydrodynamical details of each setup, we explain quantitatively the origin of this inconsistency and deduce from all these measurements the real pure dissolution rate constant of gypsum in water, which is much smaller than expected. This value compares within experimental error with the value measured unambiguously by holographic interferometry, a technique enabling to work with a non-flowing liquid (cf. Fig. 1)

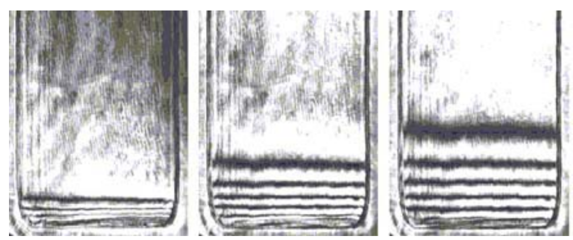

Figure 1: Evolution with time of the holointerferograms of the dissolution of a gypsum sample in still water.

[1] Colombani & Bert (2007) *Geochim. Cosmochim. Acta* **71**, 1913–1920. [2] Colombani (2008) *Geochim. Cosmochim. Acta* **72**, 5634–5640.