

## **The impact of coatings on the sulfidation and dissolution of silver nanoparticles**

MEHRNOOSH AZODI,<sup>1</sup> SUBHASIS GHOSHAL<sup>2</sup>

<sup>1</sup> Department of Civil Engineering, McGill University, Montreal, QC, Canada, mehmoosh.azodi@mail.mcgill.ca

<sup>2</sup> Department of Civil Engineering, McGill University, Montreal, QC, Canada, subhasis.ghoshal@mcgill.ca

Silver nanoparticles (nAg) are among the most commonly used nanoparticles in consumer products and thus their environmental fate needs to be characterized. Although, the dissolution of nAg generates toxic Ag ions, sulfidation of nAg severely reduces its dissolution. Sulfidation is a significant transformation process for nAg in wastewater and sediments. However, little is known about the impacts of surface coatings of nAg on its sulfidation and dissolution potential. In this study, sulfidation and dissolution of nAg coated with polyvinylpyrrolidone (PVP), alginate, proteins (cysteine/methionine), and humic acids were systematically assessed. These polymers and macromolecules represent nAg released from polymer composites or food and medical products, and natural organic matter (NOM) with which it will be associated upon release. Batch experiments were conducted where PVP-nAg (1 ppb, an environmentally relevant concentration) was contacted first with NOM and then with sulfides (S:Ag=0.4), or in the reverse sequence. Single particle inductively coupled plasma mass spectrometry (*spICPMS*) was used to measure dissolved Ag and nAg concentrations and sizes. The dissolved Ag was 54.6% of the total PVP-nAg (30 nm) mass added when pre-contacted with humic acids and then reacted with sulfides. Exposure to alginate and cysteine/methionine before sulfidation resulted in lower dissolution (23.2% and 2%, respectively). The sequence of sulfidation and exposure to NOM dramatically altered the extents of sulfidation and dissolution. The results suggest that the coatings associated with nAg will greatly influence its sulfidation extent and thus its dissolution in natural waters.