Global Mercury Pollution and Seafood Safety

LAURIE H.M. CHAN

University of Ottawa, CAREG, Biology, Ottawa, Canada, laurie.chan@uottawa.ca

Mercury is a global pollutant and there is strong evidence that the emission will increase by 50% in 2050. The major source of mercury is from the emission of fuel fossil burning power plants. Mercury accumulates along the aquatic food chain and can reach high levels in fish and shellfish. Mercury is a known neurotoxicant that is particularly harmful to fetal brain development. However, fish and shellfish are widely available food that provides many nutrients, particularly the n-3 polyunsaturated fatty acids (n-3 PUFAs), to many populations globally and there are benefits linked to brain and visual system development in infants and reduced risk for certain forms of heart disease. In this talk, we will review the current state of knowledge including results of our ongoing research in this area. We will also discuss the national and international efforts on regulation policy and public health messages on benefits and risks associated with fish consumption (1).

[1] Mahaffey KR, Sunderland EM, Chan HM, et al. (2011). Balancing the benefits of n-3 polyunsaturated fatty acids and the risks of methylmercury exposure from fish consumption. Nutr Rev. **69(9):**493-508.

Fate, Transport, and Deposition of Gold Nanoparticles in Porous Media

MATTHEW Y. CHAN[1*], MATTHEW S. HULL[1], JASON C. JONES[2], AND PETER J. VIKESLAND[1]

[1]Department of Civil and Environmental Engineering, Virginia Tech, Blacksburg VA 24061, USA, mychan@vt.edu (* presenting author)

[2]Department of Materials Science and Engineering, Virginia Tech, Blacksburg VA 24061, USA

Over the past two decades, there has been a steady increase in the application of nanomaterials and nanotechnology.[1] Gold-nanoparticles (AuNP) show significant potential in cancer treatment, drug delivery, self-assembling constructs, chemical analytical techniques and many more.[2] As the utilization and manufacture of AuNP increase it is important to understand the fate of these materials once they are released to the environment. In this work, we sought to investigate the fate, transport and stability of AuNP discharged to groundwater environments.

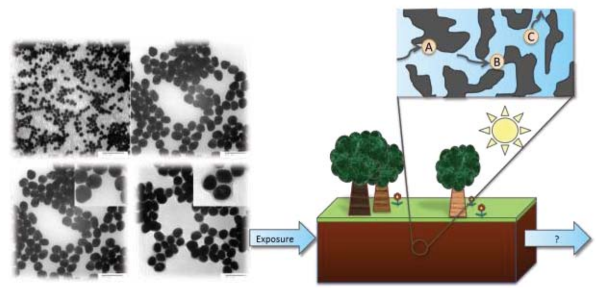

Figure 1: Exposure of AuNP to groundwater environment. There can be many possibilities for the fate of AuNP once released. For example: A) Adsorped by sediment; B) Fitrated and retained by pores; C) Unhindered transport.

AuNP transport in groundwater is heavily influenced by the intrinsic properties of the nanoparticles and the external parameters of the environment. Batch experimental data indicated that 15 nm AuNP coated by bovine serum albumin (BSA-AuNP) was more stable under high ionic strength conditions compared to citrate-coated AuNP (Cit-AuNP) of similar size. It was expected that the stability of these AuNP would be replicated in column studies. Column experiments with varying monovalent and divalent ion concentrations using both types of AuNP yielded breakthrough curves that both adhere and deviate from this hypothesis. BSA-AuNP was found to be more stable relative to Cit-AuNP during flow in the presence of increasing concentrations of $CaCl_2$, but the opposite occurred with an increase in NaCl concentration. Colloidal filtration theory (CFT) fails to predict and explain this discrepancy.

[1] Mueller, N. C.; Nowack, B. Environ. Sci. Techno. 2008, 42:4447-4453.
[2] Halvorson, R. A.; Vikesland, P. J. Environ. Sci. Techno. 2010, 44:7749-7755.