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NATIONAL RISK MANAGEMENT RESEARCH LABORATORY
GROUND WATER AND ECOSYSTEMS RESTORATION RESEARCH

Sorption of *Cryptosporidium parvum* oocysts (*C. parvum*) From Water by Nanoparticles

Background

Cryptosporidium parvum (*C. parvum*) is an obligate enteric protozoan parasite released into the environment by feces of infected human and animals. The environmental resistant form of *Cryptosporidium parvum* parasites is the oocyst. These organisms pose threats to human health and ecological systems. Among the water microbial contaminants commonly found in nature, *C. parvum* oocysts are of significant concern in United States and elsewhere. Transmissive oocysts are difficult to treat and highly resistant to low levels of conventional disinfection chemicals and inactivation methods compared to most microorganisms. Concern about *C. parvum* oocysts transport in surface water has prompted a need for water quality criteria to protect animals and humans from adverse effects of *C. parvum* oocysts contamination.

Objectives

- Using batch equilibration methods, study sorption of *Cryptosporidium parvum* oocysts to nanoparticles from water to better understand the sorption mechanisms responsible for fate and transport in soils
- Using equilibrated batch methods, evaluate the effect pH and ionic strength of solution on the sorption of oocysts to nanoparticles and desorption/release of oocyst from nanoparticles in water
- Using a zeta potential meter, study the effect of pH and ionic composition of solution on both *C. parvum* oocyst and nanoparticles zeta potential (surface charges)

Approach

Researchers use a wide array of state-of-the-science instruments and test innovative techniques specific to collected nanoparticles and microbial interaction data in order to support EPA's mission. This research project focuses on the use of various types of manufacture-engineered nanomaterials to remediate water pathogens (*Cryptosporidium parvum* oocysts) from suspension. A central goal of this project involves the evaluation of the effects of pH and different ionic strengths of aqueous solution on the stability of *C. parvum* oocysts and nanoparticles in water.

For bench-top studies, scientists conducted sorption batch equilibrated experiments with *C. parvum* oocysts and positive-charged nanoparticles in water for the purpose of understanding their fate and transport in natural soil and water ecosystems. To leverage technical expertise, this project is being coordinated with in-house research scientists, with a proposed collaborative scientist in EPA's National Risk Management Research Laboratory, and with researchers from Michigan State University.

Accomplishments

All experimental results of this project will be available in technical reports, posters, or oral presentations. Journal articles are under preparation.

Selected Publications

Roberts, M.G., J. Griffitts, B. Faulkner, C. Su, M. Ware, J. Groves, and J. Ferguson. (Under preparation). "The Effects of Geochemical Processes on the Stability of Suspended *Cryptosporidium parvum* Oocysts and Copper (II) Oxide Nanoparticles in Water."

Non-Refereed Publications/Presentations

Ferguson, J. and M.G. Roberts. (2009). "The Effects of pH on the Stability of *Cryptosporidium parvum* Oocysts and Copper (II) Oxide Nanoparticles in Water." Presentation, 2009 Annual Meeting of The McNair Internship Program, East Central University, Ada, Oklahoma, April 29.

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