Transport And Survival Of Escherichia Coli Within Soil Aggregates

Alexandra N. Kravchenko

Michigan State University

Grant Number: 2008-35102-04567

Justification:
Presently, the fate of *Escherichia coli* in soils in rural agricultural settings is still not completely understood. It is clear that filtration, adsorption and die-off are the processes which impact the transport of these bacteria, however, differential survival, desorbtion and regrowth are occurring as well and likely are dependent on the micro environment within soil aggregates. Without improved assessment of the mechanisms associated with *E. coli* transport and survival in the soil, the ability to develop best management practices for manure application to minimize *E. coli* transport to surface and ground waters will be limited. Understanding the influence of the within aggregate micro environments on *E. coli* transport and survival can now be greatly facilitated by recent advances in X-ray computer tomography allowing obtaining high resolution images of interiors structure of undisturbed soil aggregates.

Objectives:
The main objective of the proposed project is to relate *E. coli* transport and survival in soil aggregates to the aggregate's pore networks and structures as delineated through X-ray computer topography. Three-dimensional pore structures of soil aggregates representing soils under widely used in Midwest agricultural practices and native forests obtained with 3-15 micron resolution will be related to *E. coli* adsorption and desorbtion, transport and survival within aggregate interiors.

Progress to date:
The soil samples have been collected. First session of soil aggregate X-ray scanning has been accomplished at Argonne National Laboratory and aggregate images have been processed. The next X-ray scanning session is scheduled for March 1.Preliminary *E. coli* assessments have been conducted on the whole soil aggregates. The main current focus of the project is selection of the segmentation procedure for classifying the images into pores/solids (the manuscript is in preparation) and peeling the aggregates into exterior/interior layers with determination of the physical and chemical characteristics of the layer materials along with assessments of their microbial populations (the manuscript is in preparation).

Impacts:
By looking with computer microtomography tools at a soil aggregate as a key building block of soil matrix, we can answer a number of questions clarifying fate and transport of pathogens in soil. For example, how does the soil pore structure affect the ability of *E. coli* to enter soil aggregates? Once within, which parts of the aggregate the *E. coli* can reach in the aggregates with different pore structures, and what are the environmental conditions within the aggregate for it survival and regrowth? Later, when the aggregate is subjected to saturated water flow during rainfall and runoff events, what are the *E. coli* numbers from within the aggregate that can leave the aggregate and become a potential surface water and groundwater contaminant? How are these numbers related to the aggregate's pore structure?