SURVIVAL AND BEHAVIOR OF PATHOGENIC BACTERIA WITHIN SEDIMENT PONDS

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Abstract
In recent years, the use of sediment basins on construction sites have been questioned as research has revealed that sediment in these ponds may be a reservoir and even a source for pathogenic bacteria (Zhang et al., 2006). Therefore, the goal of this project is to better understand the existence, persistence, transport, and fate of Escherichia coli within sediment basins. The objectives of this study are to analyze the presence of indicator bacteria, E. coli with respect to particle size in sediment ponds, analyze the E. coli concentration with respect to sediment depth, and evaluate the E. coli concentration at the inlet and outlet of these ponds during rain events. Preliminary results show that the first inch (2.54 cm) of sediment contains highest levels of E. coli, and that E. coli prefer particle sizes 0.05mm to 0.002 mm. This study will allow more informed decisions to be made about sediment pond design and management.

Materials and Methods
E. coli concentration with respect to particle size will be evaluated aseptically by taking sediment samples from representative basin transects and performing sieve analysis and pipette analysis on the samples, using water from the site. Once particles are separated by size, they will be shaken for 1 minute to achieve E. coli separation from soil particles, and 10 mL of the subsample will be transferred from the container to the Colilert System for E. coli enumeration. The remaining particles will be transferred to the drying oven for further analysis and construction of a particle size distribution.

Preliminary Observations
The results shown below (on left) reveal that hand shaking samples is most likely to be more effective than centrifuge. However, a more consistent mechanical shaking method is currently being tested to replace hand shaking. Additionally, results have shown so far that E. coli is most prevalent at the surface of the sediment layer (on right); yet, they can live up to 9 inches (23 cm) below the surface. Lastly, the largest E. coli counts have been observed in sediment containing predominately silt (0.05 mm to 0.002 mm).

Introduction
Sediment ponds are designed to allow sediment from stormwater on construction sites to settle out of the water column before the water is discharged downstream. As sediment is resuspended from rain events, it introduces high levels of pathogenic bacteria into the water column, as E. coli levels are often 10 to 10,000 times greater in the sediment layer than the water column above. Additionally, E. coli has been found to adhere to fine particles in the top sediment layer that are readily resuspended (Craig et al., 2002). To decrease pathogenic bacteria release from sediment ponds, new pond design techniques and management practices must be considered.

Site Description
All sediment basin sites are located in Anderson, SC. Five properly constructed, representative basins have been obtained for evaluation. These ponds are located in urban watersheds, but traces of wildlife are present at these sites. These basin ages range from less than one year to over three years. Additionally, all soils are of the Cecil series, and the average rainfall of the region is 124 cm per year. The average yearly temperature is 16 degrees C.

Figures 1, 2. Two of the selected sediment basins. Figure 2. Left to right: QuantiTray/2000 after E. coli incubation, Pipette apparatus, and fabricated sediment corer with check valve.

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References