Sand Cap Stabilization, Sediment Resuspension Mitigation and GAC/PAC Amendment Transport Optimization Using Innovative Protein Polysaccharide Biopolymers (PPBs)

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Background/Objectives. There are increasing concerns regarding the potential environmental impact of dredging PAH-, PCBs- or metals-contaminated sediments and the resulting resuspended sediments. The concern with dredging resuspension is not just the increase of suspended solids in the water column but also the release of contaminants from pore water and desorption of the contaminants from the resuspended sediment particles into the water. An in situ technology that uses PPB amendments has been developed by Dr. Dahmani and SESI to minimize dredging-related resuspended sediment. The amendments can also be used to render sand-based isolation capping of sediment more stable, and to efficiently transport granulated activated carbon/powdered activated carbon (GAC/PAC) amendments through the water column for in situ placement with a sand matrix.

Approach/Activities. Testing was conducted at the University of Connecticut (UCONN) to assess the cohesion-enhancing properties of PPB amendments by measuring direct shear strength (ASTM D3080) of treated sand. Testing was also conducted on sediment from a tidally influenced shallow creek system in southern New Jersey to assess PPB treatment effectiveness in reducing the turbidity and total suspended solids (TSS) of sediment/water mixtures. In addition, a visual evaluation of transport through the water column of PPB-treated GAC/PAC/sand mixtures was conducted to assess whether the PPB treatment could minimize GAC/PAC dispersion in the water column. Finally, aquatic toxicity testing was conducted to assess toxicity of the PPB amendments. The tests (EPA-821-R-02-012) were performed using Ceriodaphnia dubia and Pimephales promelas as freshwater species, and Mysidopsis bahia and Menidia beryllina as saltwater species.

Results/Lessons Learned. The results of the sand cap treatment demonstrated an increase in shear strength (ASTM D3080) and cohesion of sand treated with PPBs when compared to untreated sand. This indicates that the treatment could enhance erosion resistance of sand caps. The experiments conducted with the sediment from a tidally influenced shallow creek system showed that reductions of 76% in turbidity and 87% in TSS were achieved for the PPB-treated sand as compared to the control tests. This indicates that PPB treatment could be used to stabilize sediment in situ or minimize sediment resuspension during dredging operations. The GAC/PAC tests showed that the PPB treatment of sand amended with GAC/PAC resulted in the complete reduction of suspended GAC/PAC and fine sand particles in the water column as compared to untreated GAC/PAC/sand mixtures. This indicates that PPB treatment could enhance the in situ placement of GAC/PAC. Finally, the aquatic toxicity results indicate that the PPB treatment passed the acute toxicity tests (> 90% survival).