Announcing the Final Examination of Rylee Hernandez for the degree of Master of Science

Time & Location: March 23, 2012 at 8:30 AM in ENGR2 211
Title: Turbidity Removal Efficiency and Toxicity Issues Associated with the chitosan-based Dual Bio-Polymer Systems

Stormwater runoff picks up and transports pollutants and sediments to surface water bodies, which results in both physical and biological changes in aquatic ecosystems. Polymers have been shown to be an effective technique to remove suspended sediment from stormwater runoff, ensuring the protection of the state's water bodies. This work examines the use of a chitosan based dual polymer system to remove suspended particles from stormwater runoff and the associated risk of toxic effects downstream. Three soils common in the state are examined: sandy soil, silty-sandy soil (AASHTO soil classifications A-3 and A-2-4 respectively), and a soil with a fine-grained limestone component. An optimum dose of the chitosan-based dual polymer system is first determined using jar testing. The optimum dose is defined as the dose that reduces the final turbidity to the state mandated 29 NTU or below and creates distinct, significant flocs. The under and over dosages are calculated based on the optimum dose and are intended to represent misuse in the field. Using these dosages, field scale tests are conducted using two different treatment methods: a semi-passive treatment method that utilizes a pipe manifold and dewatering bag and a passive treatment method that utilizes a treatment channel.

Whole effluent toxicity and residual chitosan tests are conducted on the effluent from the field scale treatment methods. The passive treatment method had the highest turbidity removal for the silty-sandy soil and the soil with a fine-grained limestone component. The semi-passive treatment method had the highest turbidity removal for the A-3 soil. The passive treatment method achieves a final turbidity of 123.9 NTU (88.45% removal) for the silty-sandy soil and achieves a final turbidity of 132 NTU (83.86% removal) for the soil with a fine-grained limestone component. The semi-passive treatment method achieves a final turbidity of 31.43 NTU (82.04% removal) for the sandy soil. Ultimately, this treatment method must be used as a part of an overall treatment train.

Significant toxicity was observed for the passive treatment method tests using the soil with a fine-grained limestone component. Toxicity tests using the effluent from the optimum dose have a survival NOEC of 0% effluent and a growth NOEC of 12.5% effluent. The LC50 for the survival is 9.57% effluent and the IC25 for growth is 13.52% effluent. Toxicity tests using the effluent from the over dose have a survival NOEC of 25% effluent and an LC50 of 41.02% effluent. Toxicity tests are designed to determine only if there is a toxic effect and not identify the causes. It is unclear whether the soil or polymer was responsible for this effect in the present case. The effluent from the soil with a fine-grained limestone component was found to be significantly more turbid than the effluent with any other soil.

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Approved for distribution by Dr. Manoj Chopra, Committee Chair, on March 2, 2012.

The public is welcome to attend.