Phytoremediation of Stormwater by Aquatic Macrophytes[1]

Michael Nattrass and Brian Baldwin[2]

Abstract: Stormwater runoff from applied coal fly ash raises concern over potential downstream impacts of selenium (Se) on aquatic ecosystems. Constructed wetland phytoremediation is a sustainable, inexpensive, eco-friendly technology with potential to remove Se from stormwater. The objectives of this study were to: 1.) Evaluate the bioavailability of Se chemical form and concentration on plant uptake and 2.) Determine the potential of aquatic macrophytes to improve water quality in a constructed wetland. The experiment was arranged as a 2 X 2 factorial nested within a split-split plot design replicated three times. Cattail (CT; *Typha angustifolia* L.), duckweed (DWD; *Lemna minor* L.), fanwort (CAB; *Cabomba caroliniana* A. Gray), soft rush (SR; *Juncus effuses* L.), muskgrass (MG; *Chara* spp.) and unplanted controls (UNP) were acclimatized 14 d in 115-L microcosms containing 0.034 m^3 of a Catalpa silty clay loam with 26 L of water supplemented with 0.1% Hoagland's solution. Selenium treatments were applied as a 4-L solution of either sodium selenite (SeO_3^{2-}) or selenate (SeO_4^{2-}) at 0, 0.5, and 1 mg Se L^{-1}. Soil and plant samples were collected at 0, 3, and 6-d post Se application. Water samples were collected daily for six days. Soil, plant, and water samples were analyzed for total [Se] by inductively coupled plasma-mass spectrometry. Data were analyzed using repeated measures with PROC GLM α=0.05. After six days, CT and MG-planted microcosms significantly reduced aqueous [Se] by 76 and 71%, respectively, compared to 60% for UNP. Microcosms planted to CAB, DWD, and SR were similar to UNP controls. Plant tissue Se content in CT was significantly less than CAB, DWD, or MG, suggesting CT has the potential to volatilize Se. Given its abundance and efficacy, cattail is likely a suitable species for Se removal in constructed wetlands supplied with either selenite or selenate contaminated stormwater[3].

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2. Michael Nattrass, Student, Ph.D., Plant and Soil Sciences, Mississippi State University, Mississippi State, MS; Brian S. Baldwin, Professor, Plant and Soil Sciences, Mississippi State University, Mississippi State, MS.

3. Work reported here was conducted 33° 28' 9" N; 88° 47' W.