

## Removal of Heavy Metals from Sewage Sludge by Floating Macrophytes; *Eichhornia crassipes* (Mart.) Solms., *Pistia stratiotes* L. and *Salvinia molesta* Mitch

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The land disposal of sewage sludge generated from industrial waste water treatment plants is a major environmental concern as the sludge has been contaminated with heavy metals. Hence, immobilization of such metals prior to land disposal reduces the burden of posing environmental risks. The present study was therefore planned to assess the efficacy of *Eichhornia crassipes*, *Salvinia molesta* and *Pistia stratiotes* to control heavy metals in diluted sludge (1:5) from the Common Waste Water Treatment Plant (CWWTP) in Biyagama Export Processing Zone, Biyagama, Sri Lanka. Equal weights of the second generation of above three plant species were introduced to batch type constructed wetlands of 63 L capacity. The experimental set-up was kept for 28 days. The weekly harvested plant and sludge samples were pre-treated and digested using Mars 6 Microwave digester. The heavy metals Zn, Pb, Ni, Cd and Fe analyzed using Atomic Absorption Spectrophotometer (Analytikjena NOVA 400P). The methods used for sample preparation, digestion and quantificational analysis were established generating satisfactory analytical precision. Statistical analysis was performed using Minitab 14 software. The results revealed that root accumulated much higher concentrations (more than 50.0%) of Fe, Zn, Pb, Ni and Cd than shoots. The plant uptake of Fe, Zn, Pb, Ni and Cd increased with increased exposure time. Nevertheless, the removal capability of metals by these plants differed from each other. *S. molesta* showed significantly higher Zn (36.0% in Cycle-1 and 40.0% in Cycle-2), Fe (26.6% in Cycle-1 and 25.6% in Cycle-2) and Ni (26.9% in Cycle-1 and 33.7% in Cycle-2) removals from sludge than *E. crassipes* and *P. stratiotes* by 28 days exposure period for both cycles ( $p < 0.05$ ; ANOVA after arc-sign transformation of data). In addition, *E. crassipes* showed significantly higher Pb (41.2% in Cycle-1 and 46.4% in Cycle-2) removal than *P. stratiotes* and *S. molesta*. Moreover, *P. stratiotes* showed significantly higher Cd (27.1% in Cycle-1 and 29.3% in Cycle-2) removal than other two species ( $p < 0.05$ ; ANOVA after arc-sign transformation of data). The present study concludes that floating macrophytes *E. crassipes*, *S. molesta* and *P. stratiotes* significantly reduce the heavy metals Zn, Pb, Ni, Cd and Fe from sewage sludge.

**Keywords:** Floating Macrophytes, Heavy Metals, Phytoremediation, Sewage Sludge

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