Phytoremediation potential of Iriyawetiya wetland at Kelaniya for heavy metal contaminated urban runoff

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Discharging wastewater, urban runoff and disposing dump waste in to natural wetlands is common practice in Sri Lanka. These effluents and urban runoff contain pollutants such as nutrients, toxic substances, oils and heavy metals. These pollutants in urban waste, when discharged in to the aquatic environment, accumulate primarily in water and sediment. Freshwater marshy wetlands are reported to possess the ability of reducing pollutants such as suspended matter, inorganic nutrients, heavy metals and pathogens in water.

Iriyawetiya wetland is a distant part of the Muthurajawela peat bog and situated close to the University of Kelaniya and in populous area (Kiribathgoda). This wetland provides an ideal site for the study on feasibility of using natural wet ecosystem in ecological engineering for wastewater treatment. Three replicates of water and sediment samples from ten sites including two main inlets, seven middle areas and one outlet area in the Iriyawetiya wetland with 1 m, 5 m and 10 m distance shoreline to middle were collected every two months. Except for Sn (2.83±0.02 – 37.51±2.91 mg/L), concentrations of heavy metals of Al (68.06.±0.03 – 4316.86±9.2 μg/L), Cd (37.00.±0.08 – 138.40±5.19 μg/L), Cr (709.10±0.02 – 3031.60±0.08 μg/L), Cu (66.0±0.01 - 1153.78 ±0.23 μg/L), Fe (8.59 ±1.78 - 75.16±0.90 mg/L), Mn (1.61±0.005 – 6.35±0.009 mg/L), Ni (123.00±0.03 - 805.17±0.032 μg/L), Pb (146.19±0.19 – 995.19±1.79 μg/L), Zn (8.25±0.02 – 352.00±1.18 μg/L) in water samples taken from inlet areas were higher than that of taken from outlet area of the wetland. Iron (8.59 ±1.78 - 75.16±0.90 mg/L) was found to be the highest in concentration amongst metals studied in water samples collected from the wetland. Sn (2.83±0.02 – 37.51±2.91 mg/L) was the next high occurring heavy metal in water.

Except for Sn (0.54±0.007- 1.326±0.30 mg/kg), concentrations of the other heavy metals Al (4.44±0.47 – 14.97±0.33 g/kg), Cd (0.67±0.15 – 3.05±0.18 μg/kg), Cr (70.49±0.07-108.55±0.01μg/kg), Cu (1.23±0.01- 4.34±0.004 mg/kg), Fe (4.03±0.24 – 47.453±1.21 mg/kg), Mn (11.06±0.00 – 508.45±0.02 μg/kg), Ni (1.75±0.31 – 34.93±0.34 μg/kg), Pb (4.76±0.001 – 75.27±0.002 μg/kg) and Zn (1.50±0.13 – 42.38±0.28 μg/kg) in sediment samples taken from the inlets areas were higher than those samples taken from outlet areas. Al (4.44±0.47 – 14.97±0.33 g/kg) was recorded at the highest level in sediments, while Fe (4.03±0.24 – 47.453±1.21 mg/kg), Cu (1.23±0.01- 4.34±0.004 mg/kg) and Sn (0.54±0.007- 1.326±0.30 mg/kg) were in fairly high amounts.

According to results obtained, the concentrations of metals in water (except Sn (2.83±0.02 – 37.51±2.91 mg/L)) gradually decreased when water moves through the wetland from inlet to outlet. But water samples in some sites taken from middle areas had moderate concentrations of metals. This could be due to the additions of house wastewater and dumping waste to the wetland. Results indicate the phytoremediaty potential of natural wetlands, could be used in ecological engineering for wastewater treatment.

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