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Comparative evaluation of pollutant removal efficiency of selective aquatic plants in recycling sewage effluent by constructed wetland technology

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Introduction: Wastewater generated from domestic and industrial sectors in developed countries remains 70% treated whereas it gets declined to the tune of 38 percent and 28 percent in middle-income and lower middle-income countries, respectively. Enormous funds are needed to spend for maintenance and operation cost of the available conventional treatment techniques. Hence, utilization of an ecofriendly low-cost technology for treating the wastewater is need of the hour. Constructed wetlands are the artificial wetland system designed with wetland soils, vegetation and their associated microbes undergoing the physical, chemical, and biological processes for treating wastewaters (1). With this view, an attempt has been made to comparatively evaluate the selected aquatic plants for its pollutant removal efficiency in treating the sewage effluent using constructed wetland technology.

Methods: Three efficient aquatic plants *Canna indica*, *Xanthosoma sagittifolium* and *Typha angustifolia* was selected for the experiment. A lab scale model constructed wetland was designed with horizontal flow system with 45×21.5×30 cm (L×B×H). Inlet and outlet were arranged to optimize the average flow rate and collection of treated effluent. Sewage effluent was collected from Tamil Nadu Agricultural University (TNAU), Coimbatore - Sewage Treatment Plant (STP). Seven different retention time of 7 days (1st, 2nd, 3rd, 4th, 5th, 6th and 7th day) after beginning of the experiment with two average flows of 5 ml/min and 10 ml/min was maintained throughout the experiment period. Collected treated sewage effluent samples were subjected to analysis following the standard analytical techniques.

Results & Discussions: The heavy metals lead and nickel were significantly reduced with increasing retention time at 7th day to 66.3 % and 61.7% respectively at 5 ml/min flow rate and 58.9 % and 53.5 % respectively at 10 ml/min flow rate. Similar results reported by (2) stated that *Canna indica* grown in metal contaminated soil effectively translocated from the soil to root system but not translocated from stem to leaves. The performance of *Canna indica* and *Xanthosoma sagittifolium* found to be superior to *Typha angustifolia* in reducing the pollutants.

Conclusions: The present investigation concludes that the pollutants like heavy metals and nutrients were significantly reduced by using aquatic plants and at increasing retention time under constructed wetland technology. The pollutant load was highly reduced at the retention time of 7th day with flow rate @ 5 ml/min. Hence, *Canna indica*, *Xanthosoma sagittifolium* and *Typha angustifolia* is highly recommended for wastewater treatment using constructed wetlands with high retention time and lower HLR.

Keywords: Sewage effluent, Recycling, Aquatic plants, Retention time

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