Integrated Wastewater Treatment Using Water Hyacinth *(Eichhornia crassipes)* and Blue Swimming Crab *(Portunus pelagicus)* Shell Waste

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Natural compounds and biotic structures are used as low cost, eco-friendly methods to treat industrial wastewater by phytoremediation and adsorption/biosorption. Objective of this study was to assess applicability of readily available blue swimming crab *(P. pelagicus)* shell waste and water hyacinth *(E. crassipes)* for removing of heavy metals, organic and inorganic pollutants from wastewater. Integrated waste water systems (IWWS) with 10 different treatments of crab shell powder + water hyacinth (Shell powder as dry weight + water hyacinth as wet weight basis: 2 g & 100 g/ 2 g & 200 g/4 g & 100 g/4 g & 200 g/6 g & 100 g/6 g & 200 g/8 g & 100 g/8 g & 200 g/10 g & 100 g/10 g & 200 g) were subjected to analyse efficiency of each treatment. Efficacy of improved rate of Dissolved oxygen, removal capacity of COD, pH, TS, TDS and $P0^{3-}_4$ was tested in each treatment for 6-day retention period. Removal capacity of Cr, Cd and Cu levels was assessed in each treatment for 4-day contact period. According to results, both blue swimming crab shell powder levels and water hyacinth weight significantly affect on water quality improvement ($p < 0.05$). pH in all treated systems improved at 7.0, indicating optimum levels. The 4 g of crab shell powder with 200 g of water hyacinth recorded highest DO (4.1 ± 0.16), while removal rate of COD (95%), TS (72%), TDS (61%) and PO^{3-}_4 (65 - 55% for 1 - 3ppm of $PO^{3-}4$ levels) were most effective at same treatment. Integrated system with 4 g crab shell +200 g water hyacinth had 92 - 78%, 86 - 77% and 96 - 86% of maximum removal efficiency for Cr, Cu and Cd respectively indicating suitability of crab shell and water hyacinth for IWWS. Metal adsorption capacity depends on adsorbent dosage, pH level, metal ion charge, initial heavy metal concentration, and ionic radius of metal. This study implies novel approach in wastewater treatment as a cost effective, environmentally acceptable method, while controlling freshwater invasive alien species load and value addition to crab shell residues.

Keywords: Phytoremediation, Biosorption, Adsorption rate, Heavy metals, Eco-friendly Wastewater Treatment Systems