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EFFECTIVENESS OF COMBINED TREATMENT OF ADSORPTION AND PHYTOREMEDIATION OF A TEXTILE DYE

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The textile sector is one of the major driving forces of the Sri Lankan economy. However, the generation of heavy loads of textile dyes containing wastewater leads to various detrimental effects on the ecosystem. Therefore, the present study aimed to evaluate the effectiveness of the combined physical adsorption and phytoremediation to remove an anionic textile azo dye: CI Direct Blue 201 (DB 201). Based on the preliminary studies, a laterite soil collected from the Western Province of Sri Lanka was selected as the filter material for the physical treatment unit (2 kg of soil filled in an acrylic column with 0.0015 m^3 of total volume) and water hyacinth (*Eichhornia crassipes*) for the phytoremediation unit (four plants in 2 l tank). Three separate feeding sessions (0.25 l of 50 mg l^{-1} DB 201 textile dye with 25 ml min^{-1} flow rate) were maintained with 2 h of facilitating trickling time. After each three feeding sessions, one day gap was maintained and continued for 119 days. The effluent colour, pH, electric conductivity, and oxidation-reduction potential were measured using standard meters. The changes in dye structure and soil filter material were analyzed using Fourier-Transform Infrared Spectroscopy (FTIR) and Powder X-ray Diffractometer (PXRD), respectively. During the study period, laterite soil removed 90-80% of colour without leaching of major heavy metals present in the original soil (Zn^{2+}, Cu^{2+}, Ni^{2+}, Pb^{2+}), and complete removal of colour (100%) was achieved after the treatment by phytoremediation unit. Low concentrations of Ca^{2+} (< 643.5 mg ml^{-1}) and Mg^{2+} (<1027 mg ml^{-1}) were detected in the effluent after the physical treatment unit and reduced below the detectable level after passing through the phytoremediation treatment unit. PXRD indicated the presence of goethite, gibbsite and hematite as the major components in the laterite soil. Results suggest the potential applicability of laterite soil and water hyacinth as a combined treatment method to treat textile dyes in an environmentally-friendly approach.

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