

Process evaluation study on the removal of Ni(II) and Cu(II) ions from an industrial paint effluent using kola nut pod as an adsorbent

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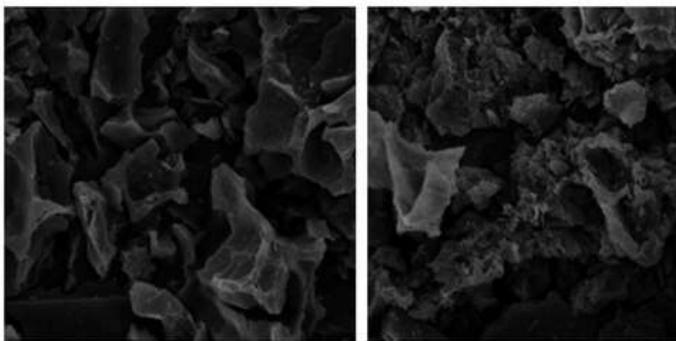
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Abstract

This study established the efficiency of a fixed bed column in the removal of Ni (II) and Cu (II) ions from an industrial paint effluent. The kola nut pod was characterized to identify functional groups, morphology, and porosity nature of the adsorbent. The appearance and shifts of some peaks in the Fourier transform infrared (FTIR) spectra revealed amide, carboxyl, and hydroxyl groups. The scanning electron microscopy (SEM) analysis revealed a non-cellulosic morphology with clear pore structure; the BET analysis gave a surface area and pore volume values of 225.0 m²/g and 0.03949 cm³/g, respectively. Surface area and pore volume of the loaded adsorbent decreased by 37.87 and 98.66%, respectively. Deposition and coverage of adsorptive sites were observed on the loaded adsorbent from the SEM results. Raw effluent from paint production industry was analyzed using the atomic absorption spectrophotometer (AAS). Results obtained indicated the presence of Ni(II) and Cu(II) at concentrations of

5.3747 mg/L and 35.6636 mg/L, respectively, among other heavy metals. Optimum values for an efficient column parametric study were obtained at a bed height of 10.0 cm, flow rate of 5.0 mL/min and at their respective initial concentrations. The percentage removal for Ni(II) and Cu(II) ions were 29.35 and 93.9%, respectively, with corresponding adsorption capacity of 12.841 and 6.100 mg/g. The range of values of the error functions obtained from the analysis on Thomas model for adsorption of both copper and nickel ions are SSE values range 0.0053–0.0928 and 0.0044–0.7491, HYBRID values of 0.0143–1.0999 and 0.0057–9.7006, MPSD values of 0.5193–5.4680 and 0.2260–30.0215 and R^2 values of 0.2720–0.8027 and 0.0008–0.5866, respectively. The kinetic isotherms revealed that the Thomas gave the lowest error between calculated and experimental values, coefficient of determination and thus can be used in describing the behavior of the adsorption process.



Q Keywords: [Kola nut pod](#) [paint effluent](#) [fixed bed](#) [nickel](#) [copper](#)