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Removal of Nickel Ions from Industrial Effluents by Batch and Column Experiments: A Comparison of Activated Carbon with Pinus Roxburgii Saw Dust

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Abstract : Rapid industrial development and urbanization contribute a lot to wastewater discharge. The wastewater enters into natural aquatic ecosystems from industrial activities and considers as one of the main sources of water pollution. Discharge of effluents loaded with heavy metals into the surrounding environment has become a key issue regarding human health risk, environment, and food chain contamination. Nickel causes fatigue, cancer, headache, heart problems, skin diseases (Nickel Itch), and respiratory disorders. Nickel compounds such as Nickel Sulfide and Nickel oxides in industrial environment, if inhaled, have an association with an increased risk of lung cancer. Therefore the removal of Nickel from effluents before discharge is necessary. Removal of Nickel by low-cost biosorbents is an efficient method. This study was aimed to investigate the efficiency of activated carbon and Pinusroxburgiisaw dust for the removal of Nickel from industrial effluents using commercial Activated Carbon, and raw P.roxburgii saw dust. Batch and column adsorption experiments were conducted for the removal of Nickel. The study conducted indicates that removal of Nickel greatly dependent on pH, contact time, Nickel concentration, and adsorbent dose. Maximum removal occurred at pH 9, contact time of 600 min, and adsorbent dose of 1 g/100 mL. The highest removal was 99.62% and 92.39% (pH based), 99.76% and 99.9% (dose based), 99.80% and 100% (agitation time), 92% and 72.40% (Ni Conc. based) for P.roxburgii saw dust and activated Carbon, respectively. Similarly, the Ni removal in column adsorption was 99.77% and 99.99% (bed height based), 99.80% and 99.99% (Concentration based), 99.98%, and 99.81% (flow rate based) during column studies for Nickel using P.Roxburgiisaw dust and activated carbon, respectively. Results were compared with Freundlich isotherm model, which showed “r2” values of 0.9424 (Activated carbon) and 0.979 (P.RoxburgiiSaw Dust). While Langmuir isotherm model values were 0.9285 (Activated carbon) and 0.9999 (P.RoxburgiiSaw Dust), the experimental results were fitted to both the models. But the results were in close agreement with Langmuir isotherm model.

Keywords : nickel removal, batch, and column, activated carbon, saw dust, plant uptake
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