Sorption of nickel ions from aqueous solutions using activated carbon derived from walnut shell waste

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ABSTRACT

Studies on a batch sorption process using activated carbon derived from walnut shell were investigated to remove Ni(II) ions from aqueous solutions. The influence of operational conditions such as contact time (0–150 min), solution initial pH (2–8), Ni(II) initial concentration (10–80 mg/L), sorbent mass (0.05–1.0 g/100 mL) and temperature (293–313 K) on the sorption was studied. Sorption data of Ni(II) ions onto walnut shell carbon (WSC) obeys the Langmuir isotherm model. Maximum sorption capacity of sorbent was 15.34 mg/g at 303 K. The kinetic data was fitted to pseudo-first-order model and pseudo-second-order model for different initial concentration to evaluate the model parameters. Pseudo-second-order model is better to represent the sorption process. Values of $\Delta G^\circ$ ranging from −1.58 to −3.47 kJ/mol suggest that the sorption process is spontaneous and mainly governed by specific surface interaction mechanism. The values of $\Delta H^\circ$ and $\Delta S^\circ$ were 26.35 kJ/mol and 0.095 kJ/mol K, respectively. Results of this study will be useful for future scale up for using this waste material as a low-cost sorbent for the removal of Ni(II) ions from wastewater.

Keywords: Sorption; Nickel; Activated carbon; Kinetic model; Langmuir isotherm

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