Environmental Engineering and Management Journal

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CHROMIUM (VI) ION DESORPTION AND REGENERATIVE CHARACTERISTICS OF SPENT MACADAMIA NUTSHELL

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Abstract

Desorption characteristics of previously adsorbed hexavalent chromium (Cr^{6+}) ions by carbonized macadamia nutshell (CMN) and raw macadamia nutshell (RMN) were tested by three desorption agents; sodium hydroxide (NaOH), hydrochloric acid (HCl) and nitric acid (HNO_3). Spent CMN adsorbent had the highest desorption rate at 98.8%, 91.3% and 87.7% as compared to spent RMN at 83.3%, 70.1% and 53.3% in the 1st, 2nd and 3rd cycles respectively. Optimum desorption occurred at 0.1M HCl, pH 4, contact time 2hrs, adsorbent mass 0.2 g/100ml and 30°C. The desorption study revealed that 0.1M HCl and HNO_3 were the best desorbing eluants/agents for Cr^{6+} ions due to high desorption efficiency at 98.8% and 78.01% respectively as compared to 0.1M NaOH at 64.6% in the first cycle. After the third cycle, the desorption efficiency declined by 11%, 18% and 26% for 0.1M HCl, HNO_3 and NaOH desorbing agents respectively. The equilibrium data was best described by both Langmuir and Freundlich isotherm. Experimental data were well fitted with Pseudo-second order kinetics. The study concludes that 0.1M HCl desorbing agent achieved the highest desorption efficiency rate in all the four cycles compared to 0.1M HNO_3 and NaOH desorbing agents. As a result, this makes the process more ecofriendly, thus increasing the spent adsorbent regenerative viability and potential application in the steel industry wastewater treatment.

Key words: Cr (VI), desorption, regenerative, desorbing agent, spent macadamia nutshell

Received: June, 2023; Revised final: April, 2025; Accepted: April, 2025

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