REMOVAL OF CADMIUM (II) FROM ACID MINE DRAINAGE USING BIODEGRADABLE ADSORBENT USING RESPONSE SURFACE METHODOLOGY

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ABSTRACT

To eliminate Cd^{2+}, an adsorbent derived from cellulose nanocrystals (CNCs) was effectively produced. The FTIR, SEM, TGA and BET specific surface area were used to ascertain the properties of CNCs. In addition to how well they predicted reaction (adsorption capacity), the response Surface Methodology modeling was used. The process was further understood by applying the kinetic models and the adsorption isotherm. The response surface model method performs well, according to statistical data. After 240 minutes of contact, a beginning concentration of 300 mg/L, an adsorbent dosage of 12 mg, and a pH of 6 initially, the adsorption capacity was 400.01 mg/g. The FTIR examination revealed that the functional groups of the nanocomposites were equivalent to those of CNCs and chitosan; however, the nanocomposites were more thermally stable than CNCs and chitosan. The SEM images of the nanocomposites showed a needle-like form, thin particle size, and porous structure. The adsorption process is spontaneous, explained by the Langmuir model; chemisorption was the main controlling factor. The Dubinin-Radushkevich Model indicates that chemisorption was likely involved since it takes more energy than 8 kJ mol-1 to adsorb Cd^{2+}. With the use of the pseudo-second-order rate model, the adsorption kinetics were determined. H_{OMO}–L_{UMO} energy binding differences were used to find the best locations for adsorption.

Keywords: Cellulose nanocrystals, Central composite design, Response surface method, Cadmium (II), Adsorption.