



Congo red adsorption on shell powder and chitosan-coated shell powder biosorbents: experiments and theoretical calculation

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ABSTRACT

Shell powder (SP) with chitosan (CS) immobilized was applied as a composite biosorbent (CS-SP) for adsorptive removal of Congo red from aqueous solution. The materials were characterized using Fourier transform infrared spectroscopy, X-ray diffraction, and scanning electron microscopy. Dye adsorption onto SP and CS-SP was investigated under varied conditions such as chitosan content, initial dye concentration, pH, salt concentration, and temperature. The optimum CS content was determined as 15 wt%, under which CS-SP displayed a fine coating structure and a greater adsorption capacity of 258.53 mg/g compared with 36.50 mg/g for SP at 30°C. The composite adsorbent maintained its performance in high-salinity, acidic or alkaline environment, and exhibited excellent reusability throughout five-recycle regeneration. The dynamic data conformed to pseudo-second-order and Elovich models while the equilibrium isotherms followed Langmuir and Temkin models, which revealed that chemisorption was involved in the adsorption mechanism. Besides, the maximum monolayer adsorption capacity for CS-SP reached 263.85, 283.29, 322.58 mg/g at 30°C, 40°C, and 50°C, respectively, and adsorption on CS-SP was verified to be endothermic and spontaneous from thermodynamic study. The results indicated that the prepared CS-SP biosorbent is quite promising for dye wastewater treatment.

Keywords: Shellfish shell; Chitosan; Biosorbent; Congo red; Adsorption

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