

Polyethyleneimine modified spent coffee grounds as a novel bio-adsorbent for selective adsorption of anionic Congo red and cationic Methylene blue

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ABSTRACT

Here, a new renewable bio-adsorbent (SCG-PEI) was prepared by grafting polyethyleneimine (PEI) onto spent coffee grounds (SCG) surface. Effects of molecular weight and dosage of PEI, initial dye concentration, contact time, temperature and pH on the adsorption properties of SCG-PEI adsorbent for Congo red (CR) were comprehensively researched. The SCG-PEI adsorbent possesses higher adsorption capacity towards CR when using PEI with higher molecular weight. Adsorption capacity of SCG-PEI to CR (1,313 mg/g) is better than Methylene blue (MB, 814 mg/g) owing to the high content of amino groups in SCG-PEI adsorbent that has a selective adsorption to CR. The specific surface area of SCG-PEI sample is 18.336 m²/g, and the pore volume is 0.0169 cm³/g. Kinetic and isothermal analysis explored that the adsorption behavior of CR dye complies with Elovich kinetic model and Freundlich adsorption isotherm model. The adsorption mechanism further reveals that electrostatic force and pore filling are prominent effects for the higher adsorption of CR. The study provides an approach for preparing environmentally friendly and efficient adsorbents.

Keywords: Adsorption; Congo red; Methylene blue; Polyethyleneimine; Spent coffee grounds

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