Efficient adsorption of copper ion from aqueous solution by amino-functioned porous eggshell membrane

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ABSTRACT

A novel porous membrane adsorbent was prepared by grafting of amino groups onto surface of eggshell membrane (Amino-ESM). Adsorption property of the Amino-ESM was investigated by removing Cu(II) ions from aqueous solution. Physicochemical properties of the pristine and the Cu(II)-loaded Amino-ESM were characterized by the FT-IR, SEM-energy dispersive X-ray, and contact angle goniometer methods. Meanwhile, effects of several important parameters, such as the amount of ammonia using for grafting, solution pH, temperature, contact time, and ionic strength, on adsorption behavior were studied by batch experiments. Adsorption capacity of the as-prepared Amino-ESM was about 2.5 times higher than that of the pristine ESM. The adsorption rate was rapid, and the equilibrium adsorption could be achieved within 60 min. Effect of ionic strength on the Amino-ESM adsorption was slight. Adsorption behavior was favorable and endothermic. Moreover, kinetics experiments indicated that the pseudo-first-order model displayed the best correlation with adsorption kinetics data. Besides, the intraparticle diffusion model and Crank model showed that the intraparticle solute diffusion is the rate-controlling step. Finally, adsorption experimental data could be better described by the Freundlich isotherm model. These results suggested that the prepared Amino-ESM could be an efficient adsorbent for removing Cu(II) ions from aqueous solution.

Keywords: Amino-functioned; Eggshell membrane; Cu(II); Adsorption

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