Methyl Orange adsorption by reuse of a waste adsorbent poly(AAc/AM/SH)-MB superabsorbent hydrogel: matrix effects, adsorption thermodynamic and kinetics studies

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ABSTRACT

The traditional method for the treatment of used adsorbents is usually recovery for recycling or direct discarding them. In the present study, a more potential and economical method is described to reutilize a waste adsorbent. Poly(AAc/AM/SH) SAHs have proved to be a good adsorbent for cationic MB dye, and after adsorption, the SAHs were recovered for recycling. In this work, the waste MB dye loaded poly(AAc/AM/SH) SAHs were not recovered but directly applied to adsorb an anionic MO dye from another waste solution. The poly(AAc/AM/SH) SAHs after the MB dye adsorption were stable and suitable for MO dye adsorption for altered surface structures within a wide pH range. The various factors affecting the MO dye adsorption, including pH, contact time, ionic strength, initial concentration of the MO dye, and temperature, were systematically investigated. The equilibrium adsorption data fitted very well to the Langmuir adsorption isotherm and the maximum MO dye adsorption capacity reached to a high of 134 mg/g at 30˚C. The thermodynamic parameters such as $\Delta H^0$, $\Delta G^0$, and $\Delta S^0$ for the MO dye adsorption processes onto the SAHs were also evaluated, and the obtained negative $\Delta G^0$ and $\Delta H^0$ values confirmed that the MO adsorption process was spontaneous as well as exothermic. The kinetic studies indicate that the MO dye adsorption process was well consistent with the pseudo-second-order kinetic model. The desorption studies showed that the regeneration of the poly(AAc/AM/SH)-MB SAHs adsorbent can be easily achieved.

Keywords: Hydrogels; Sodium humate; Adsorption kinetics; Methyl Orange adsorption; Thermodynamic parameter