

Methylene blue removal from aqueous solutions by sulfonated polymeric porous sorbents

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ABSTRACT

In the present study, we tested the removal of methylene blue (MB) dye from aqueous solutions using sulfonated polyphenylsulfone (SPPS) and sulfonated polysulfone (SPS) porous sorbents. SPPS and SPS sulfonation were performed using trimethylsilyl chlorosulfonate (TMSCIS) as a sulfonating agent, and the ionic polymer films were subsequently prepared by the phase inversion method. The results revealed that direct sulfonation with TMSCIS gives sulfonation degrees (SDs) between 21% and 33% for SPPS membranes, while the SDs for SPS were between 13% and 33%. Considering both polymer films, the porosity and average pore size were from 46% to 71% and 1.0 to 4.5 μm , respectively. The incorporation of sulfonic groups on the polymeric matrix was confirmed by Fourier transform infrared spectroscopy. Thermogravimetric analysis showed a very high thermal resistance with onset of decomposition temperature at 450°C and 510°C for SPS and SPPS. In addition, the morphology (surface and cross section) was analyzed by scanning electron microscopy. Concerning MB dye uptake, the results showed a higher sorption capacity for membranes with higher SDs, reaching removal values from 57% to 72%. The kinetic study shows that the maximum retention values were reached after 24 h. Using optimized conditions (SD, time and pH adjustment), the removal of MB increased to maximum values for SPPS-33 at pH 6.0 and for SPS-33 between pH 2.0 and 8.0. The removal capacity of MB was maintained at higher levels for both membranes after three consecutive removal experiments.

Keywords: Methylene blue; Polysulfone; Sulfonation; Removal capacity; Water treatment

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