World Academy of Science, Engineering and Technology
International Journal of Materials and Textile Engineering
Vol:16, No:11, 2022

Selective Adsorption of Anionic Textile Dyes with Sustainable Composite Materials Based on Physically Activated Carbon and Basic Polyelectrolytes

Authors : Mari Carmen Reyes Angeles, Dalia Michel Reyes Villeda, Ana María Herrera González

Abstract : This work reports the design and synthesis of two composite materials based on physically activated carbon and basic polyelectrolytes useful in the adsorption of textile dyes present in aqueous solutions and wastewater. The synthesis of basic polyelectrolytes poly(2-vinylpyridine) (P2VP) and poly(4-vinylpyridine) (P4VP) was made by means of free radical polymerization. The carbon made from prickly pear peel (CarTunaF) was thermally activated in the presence of combustion gases. Composite materials CarTunaF2VP and CarTunaF4VP were obtained from CarTunaF and polybasic polyelectrolytes P2VP and P4VP with a ratio of 67:33 wt. The structure of each polyelectrolyte, P2VP, and P4VP, was elucidated by means of the FTIR and 1H NMR spectrophotometric techniques. Their thermal stability was evaluated using TGA. The characterization of CarTunaF and composite materials CarTunaF2VP and CarTunaF4VP was made by means of FTIR, TGA, SEM, and N2 adsorption. The adsorptive capacities of the polyelectrolytes and the composite materials were evaluated by adsorption of direct dyes present in aqueous solutions. The polyelectrolytes removed between 90 and 100% of the dyes, and the composite materials removed between 68 and 93% of the dyes. Using the four adsorbents P2VP, P4VP, CarTuna2VP, and CarTuna4VP, it was observed that the dyes studied, Direct Blue 80, Direct Turquoise 86, and Direct Orange 26, were adsorbed in the range between 46.1 and 188.7mg•g-1 by means of electrostatic interactions between the anionic groups in the dyes with the cationic groups in the adsorbents. By using adsorbent materials in the treatment of wastewater from the textile industry, an improvement in the quality of the water was observed by decreasing its pH, COD, conductivity, and color considerably

Keywords : adsorption, anionic dyes, composite, polyelectrolytes
Conference Title : ICPSMC 2022 : International Conference on Polymer Synthesis, Modification and Characterization
Conference Location : San Francisco, United States
Conference Dates : November 03-04, 2022