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Synthesis of Magnetic Plastic Waste-Reduced Graphene Oxide Composite and Its Application in Dye Adsorption from Aqueous Solution

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Abstract : The valorization of plastic wastes, as a mitigation strategy, is attracting the researchers' attention since these wastes have raised serious environmental concerns. Plastic wastes have been reported to adsorb the organic pollutants in the water environment and to be the main vector of those pollutants in the aquatic environment, especially dyes, as a serious water pollution concern. Recycling technologies of plastic wastes such as landfills, incineration, and energy recovery have been adopted to manage those wastes before getting exposed to the environment. However, they are far from being widely accepted due to their related environmental pollution, lack of space for the landfill as well as high cost. Therefore, modification is necessary for green plastic adsorbent in water applications. Current routes for plastic modification into adsorbents are based on the combustion method, but they have weaknesses of air pollution as well as high cost. Thus, the green strategy for plastic modification into adsorbents is highly required. Furthermore, recent researchers recommended that if plastic wastes are combined with other solid carbon materials, they could promote their application in water treatment. Herein, we present new insight into using plastic waste-based materials as future green adsorbents. Magnetic plastic-reduced graphene oxide (MPrGO) composite was synthesized by cross-linking method and applied in removing methylene blue (MB) from an aqueous solution. Furthermore, the following advantages have been achieved: (i) The density of plastic and reduced graphene oxide were enhanced, (ii) no second pollution of black color in solution, (iii) small amount of graphene oxide (1%) was linked on 10g of plastic waste, and the composite presented the high removal efficiency, (iv) easy recovery of adsorbent from water. The low concentration of MB (10-30mg/L) was all removed by 0.3g of MPrGO. Different characterization techniques such as XRD, SEM, FTIR, BET, XPS, and Raman spectroscopy were performed, and the results confirmed a conjugation between plastic waste and graphene oxide. This MPrGO composite presented a good prospect for the valorization of plastic waste, and it is a promising composite material in water treatment.

Keywords : plastic waste, graphene oxide, dye, adsorption
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