Recycled polystyrene used as a support for iron oxide nanoparticles by green synthesis and its application in wastewater

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The expanded polystyrene waste (EPSW) has alternative uses in the production of highly useful composite materials, whose economic and environmental importance lies in the reintroduction of waste in new production cycles. Some investigations have been proposed covering mechanical, thermal and chemical recycling methods as well as on their reuse, for example as a concrete aggregate [1,2]. Sulphonation process is an chemical recycling option [3]. In this chapter conventional treatments for waste polystyrene as well as different applications are described. Moreover, alternative methods for the chemical modification of expanded polystyrene are described. Such polystyrene are used as a support for iron nanoparticles and for removal of contaminants in water. The expanded polystyrene of waste (EPSW) is chemically modified through to attach sulfonic group to polymer chain; such modifications are evaluated by FT-IR technique and the degree of sulfonation (DS) determined using titration method. In situ a green synthesis of iron oxide nanoparticles (Gt-FeNPs) is made using green tea (Camellia sinensis) polyphenols and supported on the expanded polystyrene sulphonated. The composite is characterized using X-ray diffraction (XRD), scanning electron microscopy (SEM), energy dispersive spectrometer (EDS), thermogravimetric analysis (TGA), and transmission electron microscopy (TEM). Tests were carried out using the composite as an auxiliary agent in the coagulation-flocculation process for the removal of indigo carmine dye, aluminum chlorohydroxide (PAC) was used as a coagulating agent. EPSWand EPSWS-Gt-FeNPs without and with PAC are shown in Fig. 1. The concentration of indigo carmine dye in aqueous solution were monitored using UV–vis spectroscopy. Removal up to 98% of carmine dye was obtained using coagulant dose of 20 mg/L and 2 g/L of EPSWS-Gt-FeNPs.

Keywords: expanded polystyrene waste, sulphonation, green synthesis, iron oxide nanoparticles.

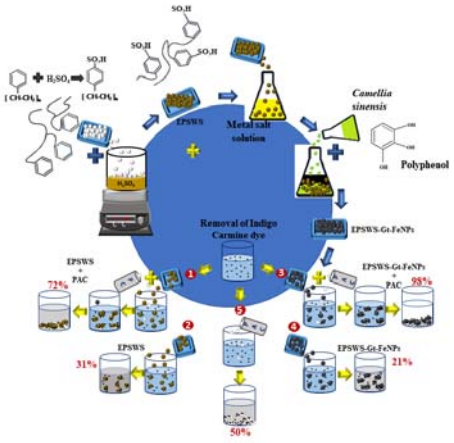

Fig. 1. Scheme for obtaining EPSW, EPSWS-Gt-FeNPs and application.

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