

Efficient removal of deltamethrin from polluted aquatic media by modified iron oxide magnetic nanoparticles

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ABSTRACT

In the present study, iron oxide magnetic nanoparticles were synthesized by co-precipitation method. Iron oxide magnetic nanoparticles were modified with 3-mercaptopropyltrimethoxysilane and grafted with 2-dimethylacrylamid, allylglycidylether and then coupled with 3-hydroxytyramine. The characterization of nanoparticles was confirmed by Fourier Transform Infrared spectroscopy, thermogravimetric analysis, elemental analysis, transmission electron microscopy, scanning electron microscope, and surface area determination. This was shortly followed by efficient removal of deltamethrin pesticide in environmental water as a real sample, using a modified nanoadsorbent. Optimum conditions for the removal of deltamethrin were obtained by examining important variables such as temperature, contact time, agitation speed and pH. The optimum condition for deltamethrin removal is obtained at 20°C with 200 rpm in pH 7 after 45 min. Different models of adsorption isotherms such as Langmuir, Freundlich and Temkin were studied, and relevant constants were determined and compared with previous studies. These studies showed that the Langmuir isotherm model adjusted well to the adsorption data. The optimum adsorption capacity of deltamethrin was 27.5 mg/g. The nanoadsorbent can be reused for 13 cycles of sorption-desorption with only maximum 17% changes in reducing sorption capacity. The practicality of the procedure is its usefulness in the removal of deltamethrin pesticide in agricultural wastewater with reasonable efficiency.

Keywords: Iron oxide magnetic nanoparticles; Deltamethrin; Agricultural wastewater; Adsorption isotherms; 3-hydroxytyramine

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