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Ultrasound wave assisted adsorption of Congo Red using gold-magnetic nanocomposite loaded on activated carbon: optimization of process parameters

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Abstract

In this study, gold-magnetic nanocomposite in the presence of ultrasound wave assisted was synthesized and loaded on activated carbon (Au-Fe_3O_4-NCs-AC) by simple, fast and low-cost process. This novel material was applied for ultrasound assisted adsorption of congo red (CR) as model of toxic and even carcinogenic substance from aqueous solution. The detail of morphology and identity of Au-Fe_3O_4-AC was characterized by SEM and TEM techniques and correlation among response to variables such as pH (2-10), adsorbent mass (0.005-0.025 g), initial CR concentration (10-30 mg L^{-1}) and ultrasound time (2-6 min) was investigated by response surface methodology (RSM) under central composite design (CCD). Analysis of variance (ANOVA) exhibit a high R^2 value of 0.999 and confirm suitability of constructed second-order regression model for excellent evaluation and prediction of the experimental data. The interaction and main factor and optimum conditions of the under study process were determined from response surface plots based on desirability function. The maximum CR adsorption were achieved at pH of 4, 15 mg L^{-1} of CR, 0.017 g of Au-Fe_3O_4-AC and 5 min sonication which owing to 99.49 % removal efficiency is highly recommended for future CR

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