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An optimization study on adsorption of Reactive Blue 19 dye from aqueous solutions by extremely effective and reusable novel magnetic nanoadsorbent

Merve Pehlivan[a], Sinem Simsek[a], Sunullah Ozbek[b,*], Belma Ozbek[a,*]

[a]*Yildiz Technical University, Chemical Engineering Department, Davutpasa Campus, Esenler/Istanbul, 34220 Turkey, Tel. +90 212 383 4747; emails: bozbek@yildiz.edu.tr (B. Ozbek), mervep70@gmail.com (M. Pehlivan), sinemsimsekk@gmail.com (S. Simsek)*
[b]*Mechanical Engineering Department, Doğuş University, Acibadem Campus, Kadıköy/Istanbul, 34722, Turkey, Tel. +90 444 79 97 Ext. 1201; email: sunullah.ozbek@gmail.com (S. Ozbek)*

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ABSTRACT

In the present study, the potential usage of iron-based magnetic aluminium oxide nanocomposite (IMANC) as a novel magnetic nanoadsorbent, which was synthesized by solution combustion method using a stoichiometric amount of glycine (100%) as fuel type, was investigated for the Reactive Blue 19 (RB19) dye removal from aqueous solutions by adsorption process. The synthesized IMANC sample found to have small particle size and high surface area with the porous structure according to the results obtained from the characterization studies performed. The dye adsorption process onto IMANC sample was optimized by applying the response surface methodology. For optimization studies, the experimental set was planned using an experimental design programme, Design Expert 11.0 trial software. The effects of pH, temperature and nanoadsorbent amount were investigated for RB19 dye removal from aqueous solutions. A model equation was developed using the Box–Behnken methodology. Additionally, the adsorption isotherm and kinetic models were examined according to the data obtained from the adsorption experiments performed at optimum process conditions. Moreover, the removal efficiencies of the regenerated IMANC synthesized were determined for each adsorption–desorption cycle. Even after the tenth adsorption–desorption cycle, the removal efficiency of the regenerated IMANC was maintained at approximately 96% of the initial efficiency which shows that the nanoadsorbent is extremely effective and reusable. Therefore, it was concluded that IMANC synthesized has great application potential in dye removal from aqueous solutions due to its desirable features such as high adsorption capacity, easy regeneration and adequate repeated uses.

Keywords: Magnetic nanoadsorbent; RB19; Experimental design; Adsorption; Desorption

* Corresponding authors.