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## COMPARATIVE INVESTIGATION OF $Fe_3O_4$ , $Fe_3O_4@HA$ AND $Fe_3O_4@AC$ NANOPARTICLES ON DYES ADSORPTION

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### Abstract

In this study, the removal of Methylene Blue (MB) and Methyl Orange (MO) dyestuffs from aqueous solutions via adsorption by using magnetic nanoparticles of  $Fe_3O_4$ ,  $Fe_3O_4@HA$  and  $Fe_3O_4@AC$  synthesized under laboratory conditions was investigated. The synthesized magnetic nanoparticles were characterized by SEM, EDX, XRD, BET surface area, FTIR, average pore diameter and particle size distribution analysis. When  $Fe_3O_4$ ,  $Fe_3O_4@HA$  and  $Fe_3O_4@AC$  were used as adsorbents, the optimum pH values for MB were determined as pH 11, pH 9 and pH 7, respectively, and pH 6, pH 4 and pH 4 for MO, respectively. At the determined optimum pH values,  $Fe_3O_4$ ,  $Fe_3O_4@HA$  and  $Fe_3O_4@AC$  were determined to be 4.2 mg/g, 4.8 mg/g and 8 mg/g for MB at an initial dye concentration of 10 mg/L, while  $Fe_3O_4$ ,  $Fe_3O_4@HA$  and  $Fe_3O_4@AC$  were determined to be 3 mg/g, 1.6 mg/g and 4.5 mg/g for MO, respectively. It was found to be compatible with the Freundlich isotherm and pseudo second-order model of all adsorption experiments. This study showed that  $Fe_3O_4@HA$ , synthesized by binding HA to  $Fe_3O_4$ , and  $Fe_3O_4@AC$ , synthesized, and carbonized by pyrolysis, magnetic nanoparticles can be used as a good alternative adsorbent for removing hazardous dyes from wastewater due to their good cleaning efficiency as well as easy synthesis and regeneration.

**Key words:** adsorption, color removal, desorption, magnetic nanoparticle

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