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Photocatalytic removal of methylene blue using titania- and silicacoated magnetic nanoparticles

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Abstract: The scope of this investigation is the photocatalytic degradation performance of newly synthesized nanoparticles(NPs); namely; Fe3O4; Fe3O4@TiO2 and Fe3O4@SiO2. Non-thermal synthesis methods are used to synthesize the NPs and to explore the ferromagnetic properties of the photocatalysts. The synthesized NPs are characterized using TEM, XRD, FTIR, TGA, VSM, and surface area analysis techniques. The photocatalytic activities of Fe3O4 and Fe3O4@SiO2 NPs, put under solar irradiation, and Fe3O4@TiO2 NPs, put under UV irradiation, are examined. The efficiency in degradation of Methylene Blue (MB) pollutant is shown to be the best for Fe3O4@SiO2 NPs, then in Fe3O4 NPs, and lastly in Fe3O4@TiO2 NPs. The silica (SiO2) coating on Fe3O4 NPs significantly enhances the light absorption and is found to improve the MB degradation rate and the photoinduced charge generation and separation (i.e. it enhances the exciton lifetime). That makes the Fe3O4@SiO2 NPs promising candidates for organic pollutants removal in various environment-related applications.