Textile industrial effluent dye removal using green synthesized iron oxide nanorods

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Abstract: Water is a precious resource for living organisms on earth. Nowadays, it is largely contaminated by a range of pollutants which make it unfit for human consumption and other purposes. Dyes are one among such pollutants. Textile industry consumes most of the freshwater[1]and also discharges significant quantities of organic dyestuff and colors to the effluent generated back. Some of the dyes are extremely toxic, carcinogenic and mutagenic[2], and also they decrease the photosynthetic activity of aquatic plants[3], hence, it is essential to remove these dyes from wastewaters.

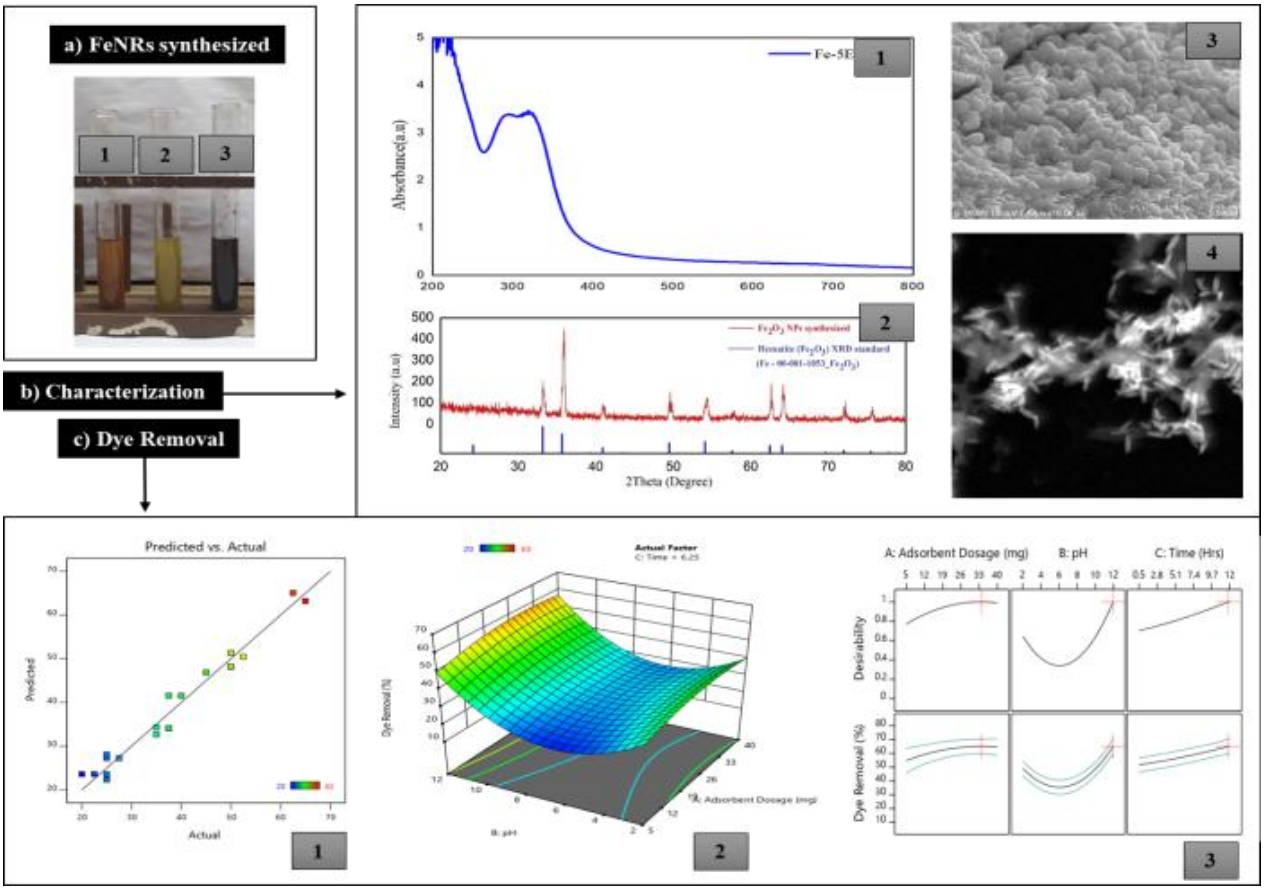

Figure (a): Synthesis of FeNRs (1) ferric chloride metal salt solution (2) *Wedelia urticifolia* leaf extract and (3) FeNRs colloid. Figure (b): characterization techniques used (1) UV-Vis spectroscopy (2) XRD pattern of synthesized FeNRs (3) SEM image of the nanopowder obtained (4) Scan TEM image of synthesized FeNRs. Figure (c): Dye removal application of FeNRs from textile industrial effluent (1) Fig:

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predicted vs actual percentage dye removal (2) Response surfaces for percentage dye removal (3) Optimized values for maximum dye removal percentage using FeNRs.

In the present work, green synthesized iron oxide nanorods (FeNRs) were used for removal of the dye from textile industrial effluent. FeNRs were synthesized by an eco-friendly, easy and single step process using leaf extract of *Wedelia urticifolia* (Blume) DC. The plant extract was added to anhydrous ferric chloride solution and its color changed to black[4] which confirmed the nanorod synthesis. The characterization techniques used were UV-Visible spectroscopy, X-Ray diffraction spectroscopy (XRD), fourier transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), transmission electron microscopy (TEM) and energy dispersive spectroscopy (EDAX). From the results, it was revealed that the synthesized iron oxide nanostructures were rod-shaped, with a length range of 40-70 nm and a width range of 15-20 nm, and they depicted two UV-Vis peaks at 290 and 320 nm. Response surface methodology was used for optimization of process parameters for dye removal from textile industrial effluent. Maximum dye removal percentage of 65 in the study was achieved at pH 2 and pH 12 and was found to be dependent on adsorbent dosage and contact time. The optimized parameters for maximum dye removal were the adsorbent dosage of 33.8mg/10 ml of colored effluent, pH 12 and time of 12 hours. It can be concluded from the present work that, *Wedelia urticifolia* leaf extract is the potential candidate for synthesizing iron oxide nanorod. The as-synthesized nanorods possess the property of dye removal and hence can be used for textile industrial effluent treatment.

References:

1. Emami, F., Tehrani-Bagha, A. R., Gharanjig, K., Menger, F.M.; Desalination. 257(2010), 124-128.
2. Ghaedi, M., Ansari, A., Habibi, M. H., Asghari, A. R.; J. of Ind. Eng.Chem. 20 (2014), 17–28.
3. Nassar, N.N., Ringsred, A.; Environ. Eng. Sci. 29 (2012), 790-797.
4. Groiss, S., Selvaraj, R., Varadavenkatesan, T., Vinayagam, R.; J. Mol. Struct. 1128 (2017), 572-578.

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