

Nanocrystalline structured ethylene glycol doped maghemite for persistent pollutants removal

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Electronic supplementary information

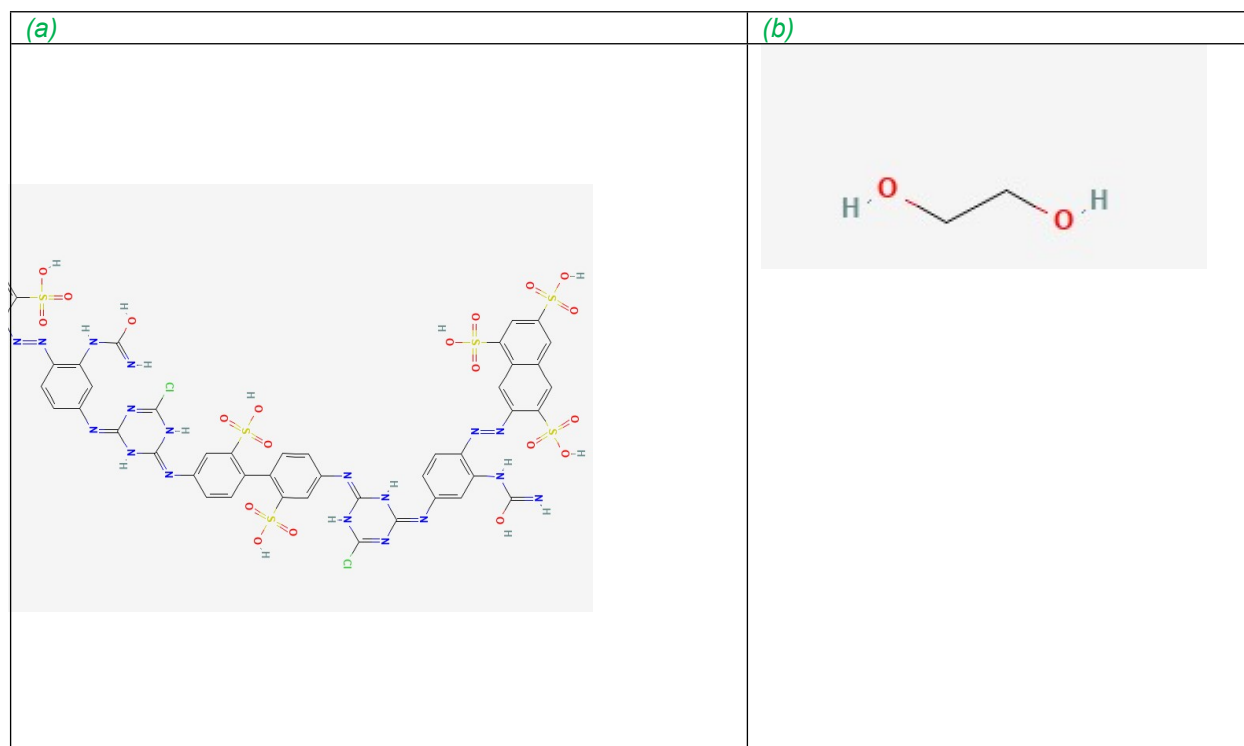
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Materials and Methods

Chemical structure of RY84 and EG

The chemical structure of RY84 and EG used for graphical representation of containing functional groups were downloaded from an international NIH.GOV database available at:

[C.I.Reactive Yellow 84 | C52H38Cl2N18O26S8 - PubChem \(nih.gov\)](https://pubchem.ncbi.nlm.nih.gov/compound/Reactive-Yellow-84)



[Ethylene Glycol | CH₂OHCH₂OH - PubChem \(nih.gov\)](https://pubchem.ncbi.nlm.nih.gov/compound/Ethylene-glycol)

Fig. S1. Chemicals structures of (a) Reactive Yellow 84 and (b) Ethylene glycol.

Flame atomic adsorbtion spectrophotometri (FAAS)

An Analytic Jena, FAAS CONTRAA 300 series was used for measuring Fe concentration in adsorbtion supernatant after adsorbtion in order to check the stability of the nanoparticle during the adsorbtion.

FAAS setting used for Fe determination were: flame type: Air/Acetylene, Flare flow: 60 L/h, Burner height: 5-8mm. Calibration curve was set at 0-1mg/L interval. The sensitivity of FAAS for Fe was 0.07 mg/L.

X-ray diffraction (XRD)

The XRD analysed used for mineralogical characterization of the nanoparticles after adsorption was a Shimadzu X-ray diffractometer using Cu-K α radiation ($\lambda=1.5418\text{\AA}$) at 40 kV and 30 mA. The diffraction pattern in the 20–80° 2 θ range was collected at a scanning angle step of 0.02° and 2°/min⁻¹ scan speed.

Results

Adsorption studies: kinetic and isotherm modeling

Table S1 Langmuir's separation factor

Co, mg/L	K _L	R _L
10	0.089	0.529
20		0.359
30		0.272
40		0.219
60		0.158
100		0.086

Table S2 Summary of fitting parameters from adsorption isotherms modelling with the Langmuir and Freundlich models

	Langmuir isotherm	Freundlich isotherm
Parameters	q _{max} = 37.73±9.69 mg/g K _L = 0.089±0.07 R _L =0.0856±0.529	K _F = 9.267±2.09 mg/g 1/n = 0.306±0.06
Statistics	Adj. R ² = 0.643 R ² = 0.634	Adj. R ² = 0.867 R ² = 0.867
Experimental conditions: C _{RY84} = 10 to 100 mg/L, batch adsorption at pH 4, T=RT, C _{ads} = 1g/L		

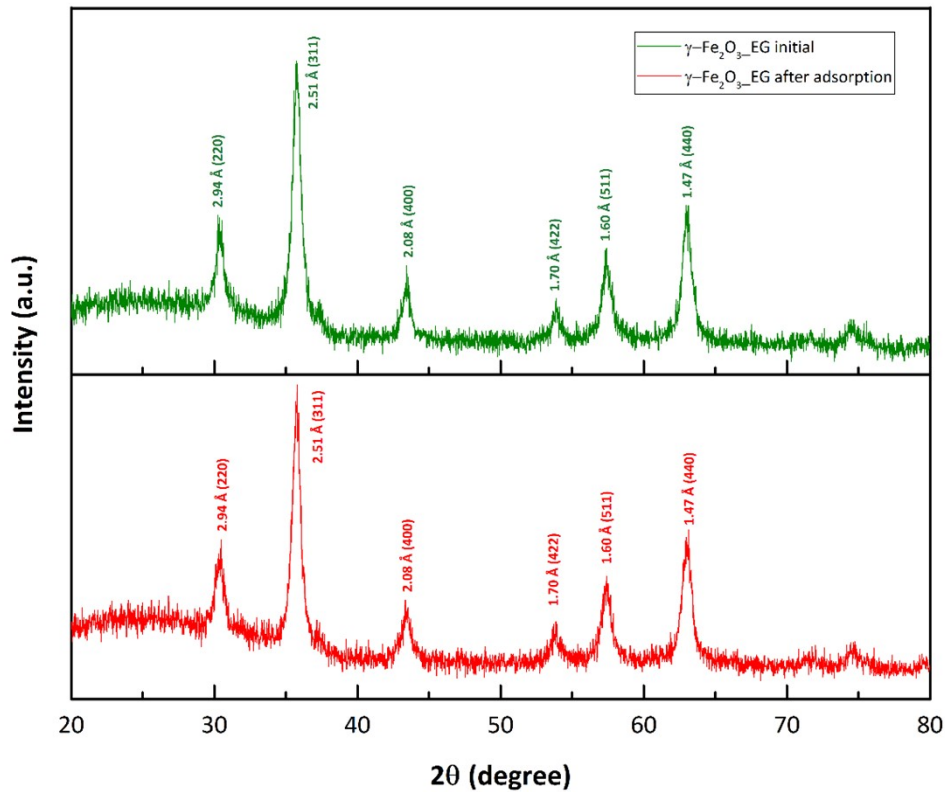


Fig. S2 XRD results for the maghemite doped with Ethylene Glycol after adsorption experiments, showing identical patterns as before adsorption, indicating that nanoparticles remained stable during the adsorption and did not transformed in other iron oxides.

Dye adsorption from wastewater

Table S3 Chemical and physical parameters of non-diluted wastewater effluent from the WWTP

Parameter	Unit	Value	Parameter	Unit	Value
pH	unit. pH	7.40	Sulphides	mg/L	0.05
BOD5	mgO ₂ /L	9.00	TSP	mg/L	12.00
COD	mgO ₂ /L	<30.00	Fixed residue	mg/L	480
NH ₄ ⁺	mg/L	0.069	Total N	mg/L	7.40
NO ₂	mg/L	<0.040	Total P	mg/L	0.67
NO ₃	mg/L	29.97	Conductivity	μS/cm	750