Electronic Supplementary Information

A Simple *'in situ'* Co-precipitation Method for Preparation of Multifunctional $CoFe_2O_4$-Reduced Graphene Oxide Nanocomposites: Excellent Microwave Absorber and Highly Efficient Magnetically Separable Recyclable Photocatalyst for Dye Degradation.

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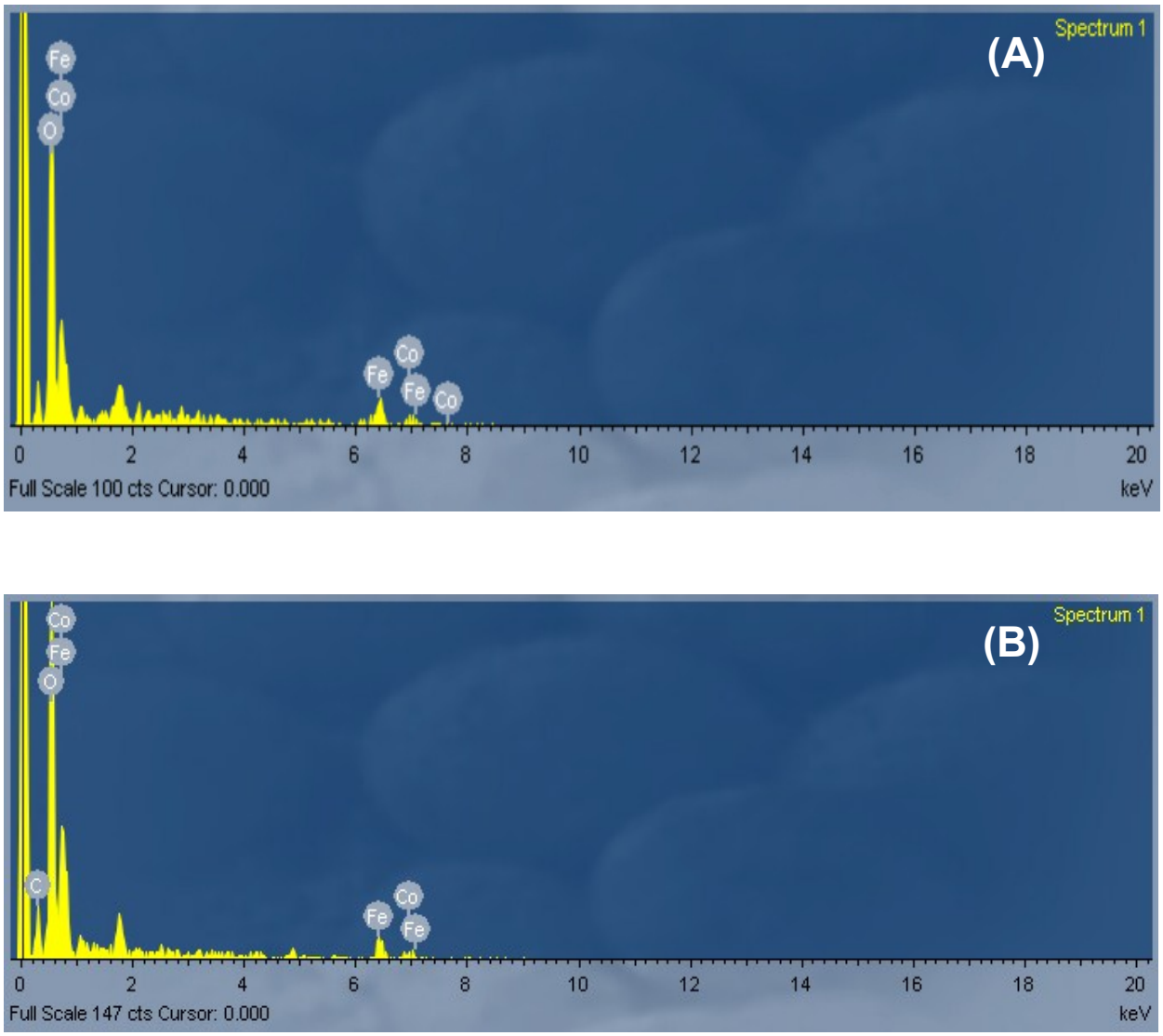

Fig S1. EDAX spectra of (A) synthesized $CoFe_2O_4$ nanoparticle and (B) $CoFe_2O_4$-RGO nanocomposite.

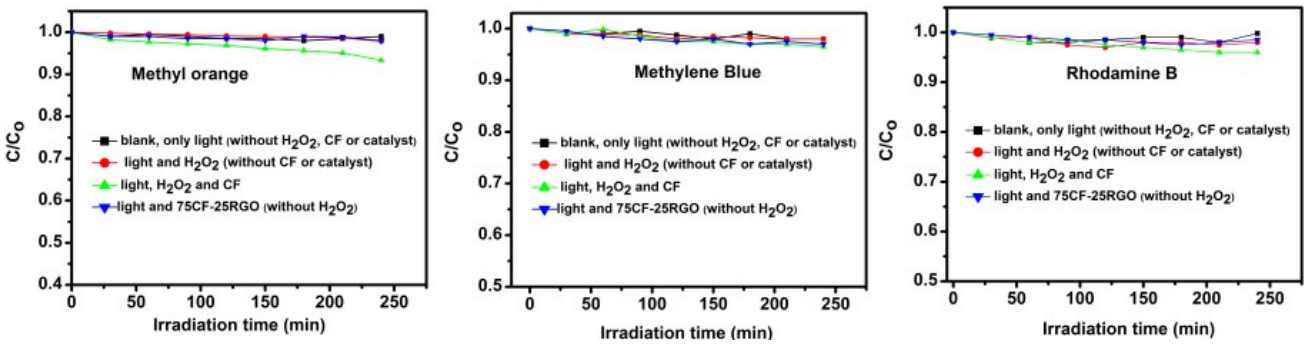

Fig S2: These C/C_0 vs. Irradiation time plots show that photocatalysis reactions of dyes do not occur in absence of CF-RGO and H_2O_2.

Table S1: Microwave absorption properties of various ferrites and ferrite based composites

Samples	Preparation Method	Minimum Reflection loss	Corresponding Frequency (GHz)	Absorber thickness	Effective band width (RL< -10dB)	Ref.
$NiFe_2O_4$	Hydrothermal at 180˚C for 6h	-24 dB	9.5 GHz	3.5 mm	8.5 to 13 GHz	[11]
60 wt % $ZnO/CoFe_2O_4$	Co-precipitation method 90˚C	-28.3 dB	8.6 GHz	-	4.1 to 13 GHz	[12]
$(Mn_{0.2}Ni_{0.4}Zn_{0.4}Fe_2O_4)_x$-$(BaFe_{12}O_{19})_{1-x}$	One pot precursor based method 800˚C for 4h	-25 dB	8.2 GHz	3.5 mm	-	[28]
$(NiFe_2O_4)_{0.85}$-$(SrFe12O19)_{0.15}$	One pot precursor based method 800˚C for 4h	−17 dB	8.2 GHz	3.2 mm	-	[29]
$Co_{0.6}Zn_{0.4}Fe_2O_4$ nanofiber.	Calcination at 700°C for 2h	-16 dB	10.6 GHz	2.9 mm	7.8 to 16.8 GHz	[30]
Hollow glass microsphere/ $CoFe_2O_4$	Co-precipitation method	-8.3 dB	18 GHz	1.5 mm	-	[31]
$SrFe_{12}O_{19}$/ $CoFe_2O_4$	Co-precipitation at 1200°C for 4h	-27.6 dB	10.8 GHz	-	8.2 to 9.6 GHz	[33]
N-RGO-Hematite wax composite	Refluxed in presence of PVP at 105°C for 24h	-78 dB	15.4 GHz	2 mm	11.3 to18 GHz	[36]
$ZnFe_2O_4$/RGO	Hydrothermal synthesis at 180˚C	-29.3 dB	16.7 GHz	1.6 mm	15.4 to 18 GHz	[47]
$CoFe_2O_4$ hollow / Graphene composites	Vapour diffusion followed by calcination at 550˚C	-18.5 dB	12.9 GHz	2 mm	11.3 to 15 GHz.	[48]
$NiFe_2O_4$ nanorod-graphene	Solvothermal 150°C for 15h.	-29.2 dB	16.1 GHz	2.0 mm	13.6 to18 GHz	[49]
$CoFe_2O_4$ nanorod /Graphene	Hydrothermal at 150˚C	-25.8 dB	16.1 GHz	2.0 mm	13.5 to 18 GHz.	[50]
(RGO)/$CoFe_2O_4$ composite	One-pot hydrothermal route at180˚C for 10h	-47.9dB	12.4 GHz	2.3mm	12.4 to 17.4 GHz	[51]

Graphene-Fe_3O_4	Hydrothermal at 200˚C for 24h	-20 dB	16 GHz	5 mm	-	[52]
30 wt.% hollow Fe_3O_4/RGO	Solvothermal method. 200˚C for 12h.	-24 dB	12.9 GHz	2.0 mm	10.8 to 15.7 GHz	[53]
RGO/$CoFe_2O_4$	Hydrothermal at 180˚C for 10h.	-47.9 dB	2.4 GHz	2.3 mm	12.4 to 17.4 GHz	[54]
5 wt. % filler RGO/$MnFe_2O_4$/PVDF	Hydrothermal at 140°C for 12h	-29 dB	9.2 GHz	3 mm	8 to 12.88 GHz	[55]
10 wt. % filler RGO/Co_3O_4/Poly(vinylidene fluoride)	Hydrothermal at 140°C for 12h.	-25 dB	11.6 GHz	4 mm	7.5 to 12 GHz	[56]
RGO/ Fe_3O_4	One pot Co-precipitation at 80˚C for 2h	-44.6 dB	6.6 GHz	3.9 mm	12.2 to 16.5 GHz	[61]
$CoFe_2O_4$	Co-precipitation method 120°C for 12h	-55dB	9.25 GHz	2 mm	8.2 to 10.8 GHzGHz	[63]
50NZF-50RGO nanocomposite	In situ Co-precipitation method at 120°C for 12h	-19.99dB	11.58 GHz	1.8 mm	10.22 to 12.4 GHz	[68]
$ZnFe_2O_4$/ppy	Polymerization under 80°C for 8 h	-28.9 dB	10.8 GHz	2.7 mm	-	[70]
a) EG/PANI/ $CoFe_2O_4$ with m_{CF}/ m_{EG}/ m_{PANi} of 0.8 b) $CoFe_2O_4$	Co-precipitation method sintered at 300˚C	a) -19.13 dB b)-13.58 dB	a)13.28 GHz b) 14.83 GHz	a) 0.5 mm b) 1 mm	a) 5.94GHz b)3.6 GHz.	[71]
CNT/ $CoFe_2O_4$	Chemical Vapor Deposition	-18 dB	9 GHz	-	6.5 to 13.5 GHz	[72]
Rugby Shaped $CoFe_2O_4$	Vapour diffusion followed by calcination at 550˚C	-34.1 dB	13.4 GHz	2.5 mm	12.3 to 14.9 GHz.	[73]
$CoFe_2O_4$/ SBA-15	Double solvent technique and incipient impregnation method	-18 dB	16 GHz	2 mm	13.5 to 18 GHz.	[74]

Polyaniline-$CoFe_2O_4$	Citrate precursor based method at 1000˚C	-21.5 dB	-	-	-	[75]
$Ni_{0.5}Co_{0.5}Fe_2O_4$	Co-precipitation at 85°C	-18 dB	2.47 GHz	1.5 mm	-	[76]
Graphene@Fe_3O_4@SiO_2 @NiO	Sol-Gel process with hydrothermal reaction followed by calcination at 400°C for 2h	-51.5 dB	14.6 GHz	1.8 mm	12.4-17.5 GHz	[77]
$(Ni_{0.65}Zn_{0.35}Fe_2O_4)_{0.85}$–$(BaFe_{12}O_{19})_{0.15}$	One pot precursor based method 800˚C for 4h	−21 dB	9.86 GHz	3.05 mm	-	[78]
Flaky graphite/cobalt zinc ferrite	Calcined at 700˚C for 2h	-33.85 dB	11.7 GHz	2.5 mm.	10.3 to 13.5 GHz	[79]
$BaFe_{12}O_{19}$@RGO	Calcination at 900°C for 2h	-32 dB	-	3 mm.	-	[80]
$BaFe_{11.92}(LaNd)_{0.04}O_{19}$-$TiO_2$ /MCNTs/wax composite	Sintering at 1200°C for 3h	−21.56 dB	11.04 G Hz	2 mm	9.50 to 12.75 GHz	[81]
Fe_3O_4/C composite	Calcination at 600°C	−46 dB	12.8 GHz	2.9 mm	10.3 to 17.1GHz.	[82]
Fe_3O_4−Fe/G composite	Calcination at 420°C for 3h	−30 dB	4.72 GHz	2.0 mm	6.2 GHz	[83]
Graphene/Fe_3O_4 incorporated polyaniline	Refluxing at 80°C for 5h	-26 dB	15 GHz	-	-	[84]
graphene/$BaFe_{12}O_{19}$	Calcination at 1100°C for 1h	−58 dB	11.42 GHz.	-	-	[85]
85CF-15RGO	Co-precipitation reduction at 160°C at 16h	-31.13 dB	9.05 GHz	2.15 mm	8.2 to 10.92 GHz	This work

Table S2: Comparison of photocatalytic activity of 75CF-25RGO nanocomposite with those of the other reported RGO-Ferrite and RGO based nanocomposites.

Composite	Preparation method	Amount of catalyst	Dye concentration	Source	Time	Dye	Reference
TiO_2-Fe_3O_4-RGO composite	Hydrothermal at 105°C for 24h	0.01g in 40 ml	0.0535 mmol/L	Visible Light Xe lamp 500W	120 min	MB	[24]
Fe_3O_4-RGO -TiO_2 composite	Hydrothermal at 200°C for 10h	1.5 g/L	10 mg/L	Visible light 300W UV-Vis Xenon Lamp>400nm	120 min	MB	[25]
$CoFe_2O_4$-TiO_2	Hydrothermal at 150°C for 24h	20 mg in 5 ml	5 ppm aqueous solution (initial concentration)	UV light irradiation 8W UV –Hg lamp 5 sets	6 h	MB	[26]
$CoFe_2O_4$-RGO (10wt. %)	Hydrothermal at 180°C for 12h	20 mg in 200 ml	10 mg/L	Tungsten halogen lamp 500 W	180 min	MB	[38]
$CoFe_2O_4$-RGO (45 wt. %)	Ball milling for 6h at 25 sec^{-1}	0.01g /40mL	20mg/L	Visible light Xe lamp 800W cutoff λ >420nm	180 min	MB, RhB, and MO	[39]
(3%)P25/ $CoFe_2O_4$/RGO	Hydrothermal at 180°C for 20h	10 mg in 30 ml	40 mg/L	Visible light Xe lamp 500W cutoff λ >420nm	240 min	MB	[40]
$CoFe_2O_4$-RGO (40 wt. %)	Hydrothermal at 180°C for 20h	25 mg in 100 ml	20mg/L	Visible light Xe lamp 500W cutoff λ >420nm	240 min	MB (100%) MO (94%) RhB (71%)	[41]

Composite	Preparation method	Amount of catalyst	Dye concentration	Source	Time	Dye	Reference
$ZnFe_2O_4$-RGO (20 wt. %)	Hydrothermal at 180°C for 12h	0.05g in 100 ml	20 mg/L	Visible light Xe lamp 500W cutoff λ >420nm	90 min	MB	[42]
$MnFe_2O_4$-graphene (30 wt. %)	Hydrothermal at 180°C for 20h	0.025 g in 100 mL	20 mg/L	500 W mercury and xenon lamp cutoff λ >420nm Visible light	360 min	MB	[43]
RGO-MFe_2O_4 (M=Zn, Co and Ni)	Hydrothermal at 200°C for 10h	20 mg in 150 ml	10 mg/L	Tungsten lamp 500 W	180 min	RhB and MB	[44]
$CdFe_2O_4$/Graphene	Hydrothermal at 180°C for 12h	100 mg in 100 ml	10 mg/L	Xe lamp 500W cutoff λ >420nm Visible light	240 min	MB	[45]
$Bi_2Fe_2O_9$/RGO (4.5 wt. %)	Hydrothermal at 95°C 36h	0.5mg/L	10mg/L	150W Xenon arc Lamp Visible light	3h	Bisphenol-A	[46]
Graphene-SnO_2 aerosol nanocomposite	Hydrothermal at 180°C for 12h	100 mg in 200 ml	4.79×10^{-5} g/L	300W Xenon Lamp cutoff λ >400nm Visible light	40 min	RhB	[88]
75CF-25RGO	Co-precipitation followed by reflux at 160°C for 16h	500 mg/L	20 mg/L	100 W Reading lamp Visible light	i) 60 min ii) 75 min iii) 45 min iv) 120 min	i) MO ii) MB iii) RhB iv) Dye mixture	This work

MB= Methylene Blue, MO= Methyl Orange and RhB= Rhodamine B