

# Supplementary information

## Spinel $\text{CoFe}_2\text{O}_4$ nanoflakes: A path to enhance energy generation and environmental remediation potential of waste-derived rGO

R. Tamilselvi<sup>1</sup>, G. S. Lekshmi<sup>1</sup>, V. Selvaraj<sup>2</sup>, O. Bazaka<sup>3</sup>, I. Levchenko<sup>4</sup>, K. Bazaka<sup>5</sup>, M. Mandhakini<sup>1,\*</sup>

<sup>1</sup>Center for Nanoscience and Technology, Anna University, Chennai- 600 025, India

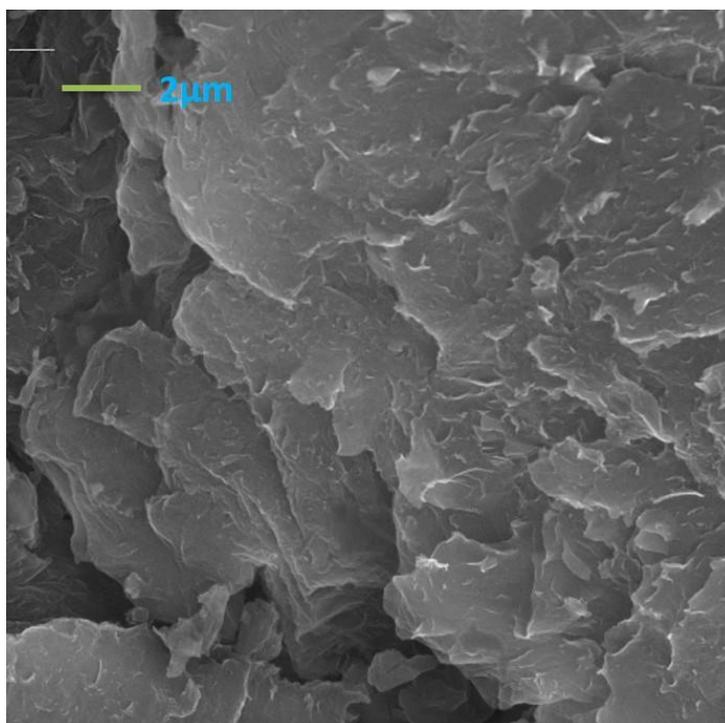
<sup>2</sup>Nanotech Research Lab, Department of Chemistry, University College of Engineering Villupuram (A Constituent College of Anna University, Chennai-25), Villupuram-605 103, Tamil Nadu, India

<sup>3</sup>School of Science, College of Science, Engineering and Health, RMIT University, Melbourne, VIC 3000, Australia

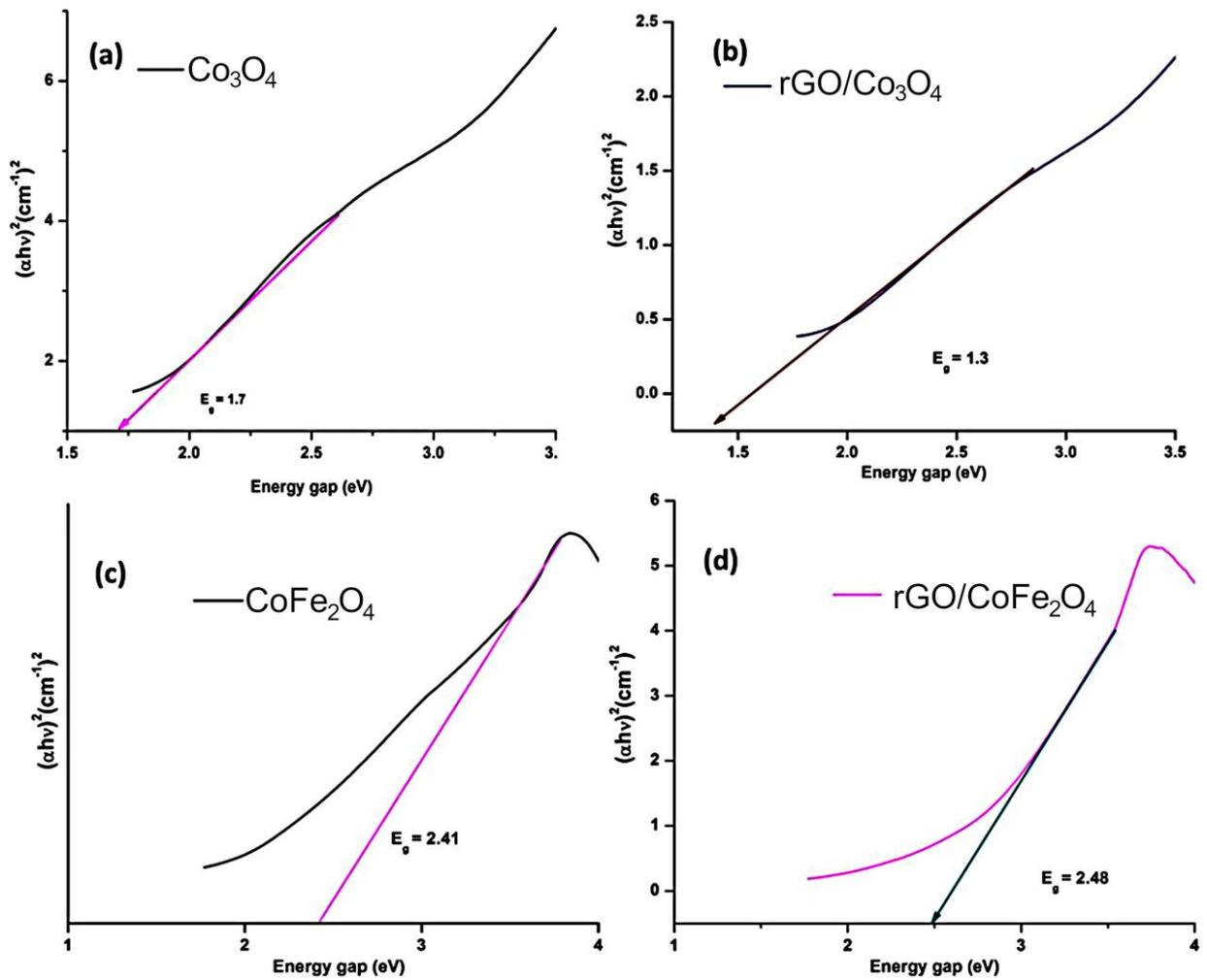
<sup>4</sup>Plasma Sources and Application Center, NIE, Nanyang Technological University, Singapore

<sup>5</sup>School of Engineering, Australian National University, Canberra ACT 2600

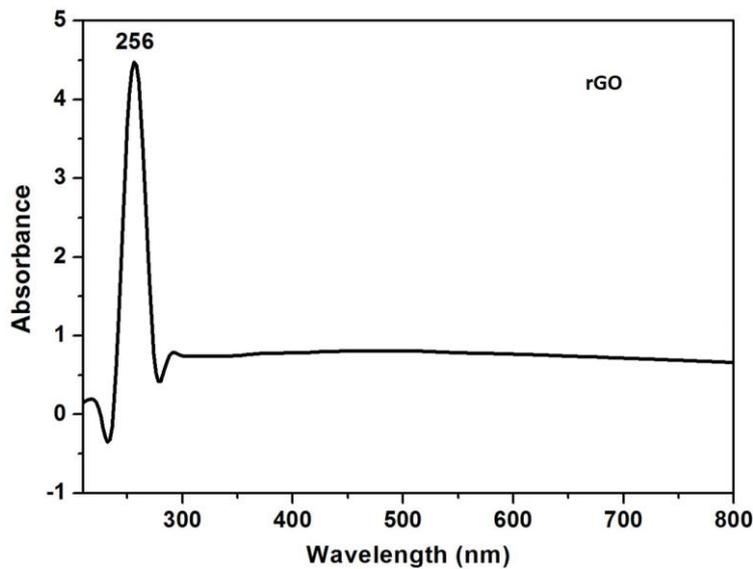
\*Corresponding author ([mandhakini7@gmail.com](mailto:mandhakini7@gmail.com))



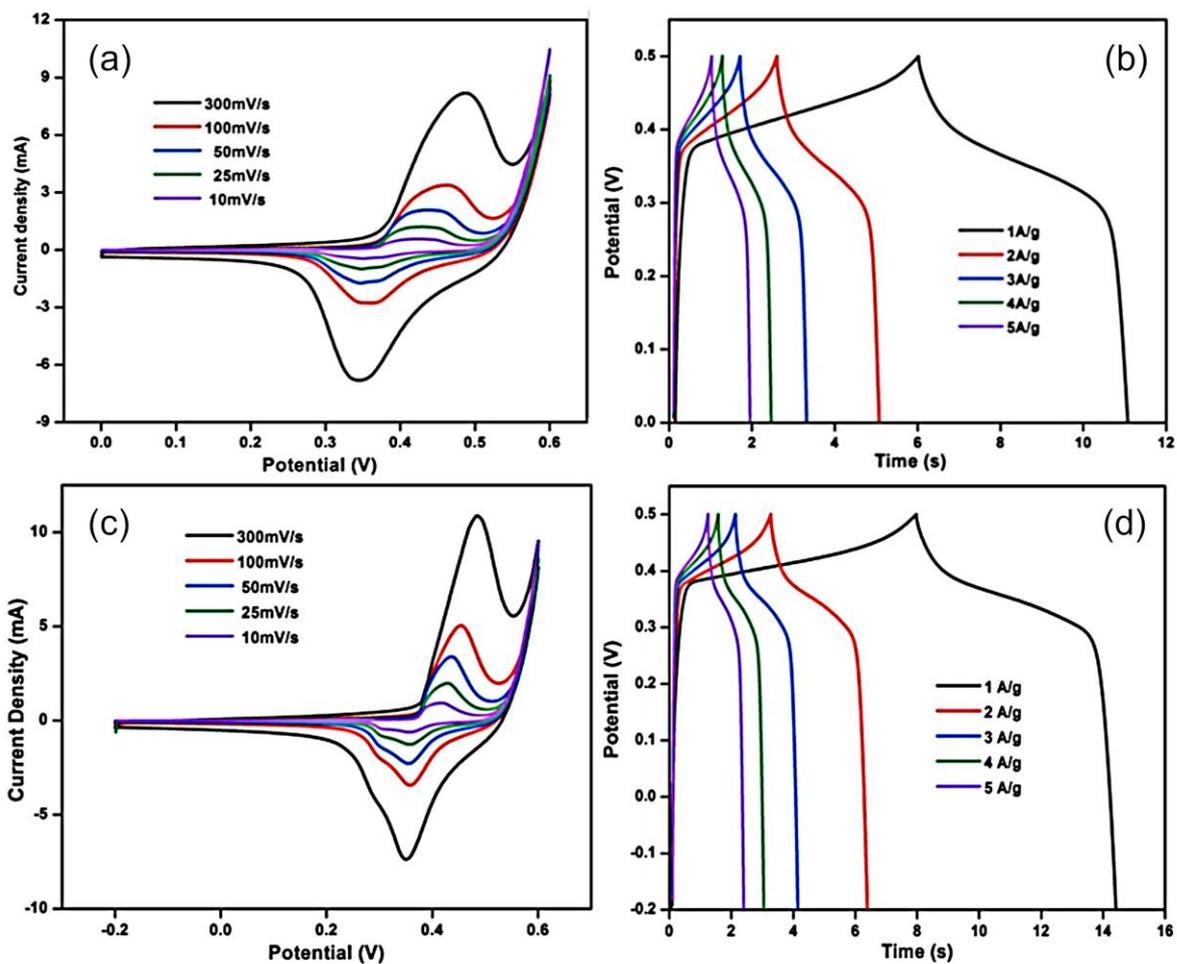
**Figure S1.** SEM image of pure rGO flakes.



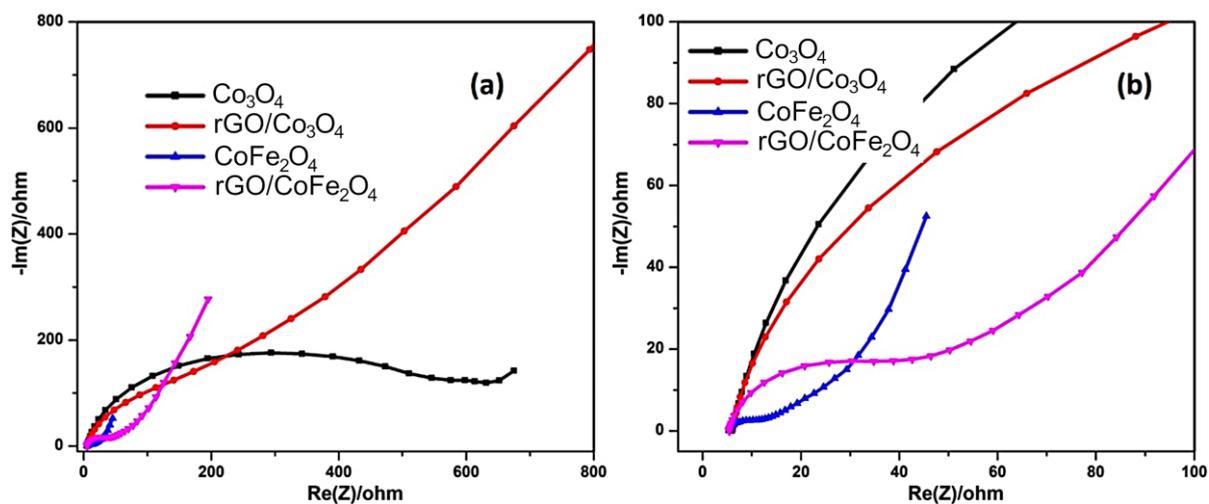
**Figure S2.** Tauc plots for (a)  $\text{Co}_2\text{O}_3$  and  $\text{rGO}/\text{Co}_2\text{O}_3$ , and (b)  $\text{CoFe}_2\text{O}_4$  and  $\text{rGO}/\text{CoFe}_2\text{O}_4$ . Absorption data obtained using UV-Vis spectroscopy.  $E_g$  estimated as the intercept ( $y=0$ ) between the linear fit to plot generated using the Tauc equation  $\alpha h\nu = B (h\nu - E_g)^n$ , where  $\alpha$  is the optical absorbance,  $\nu$  is the frequency of light, and  $n$  and  $B$  correspond to the type of transition and the length of localized state tails respectively.



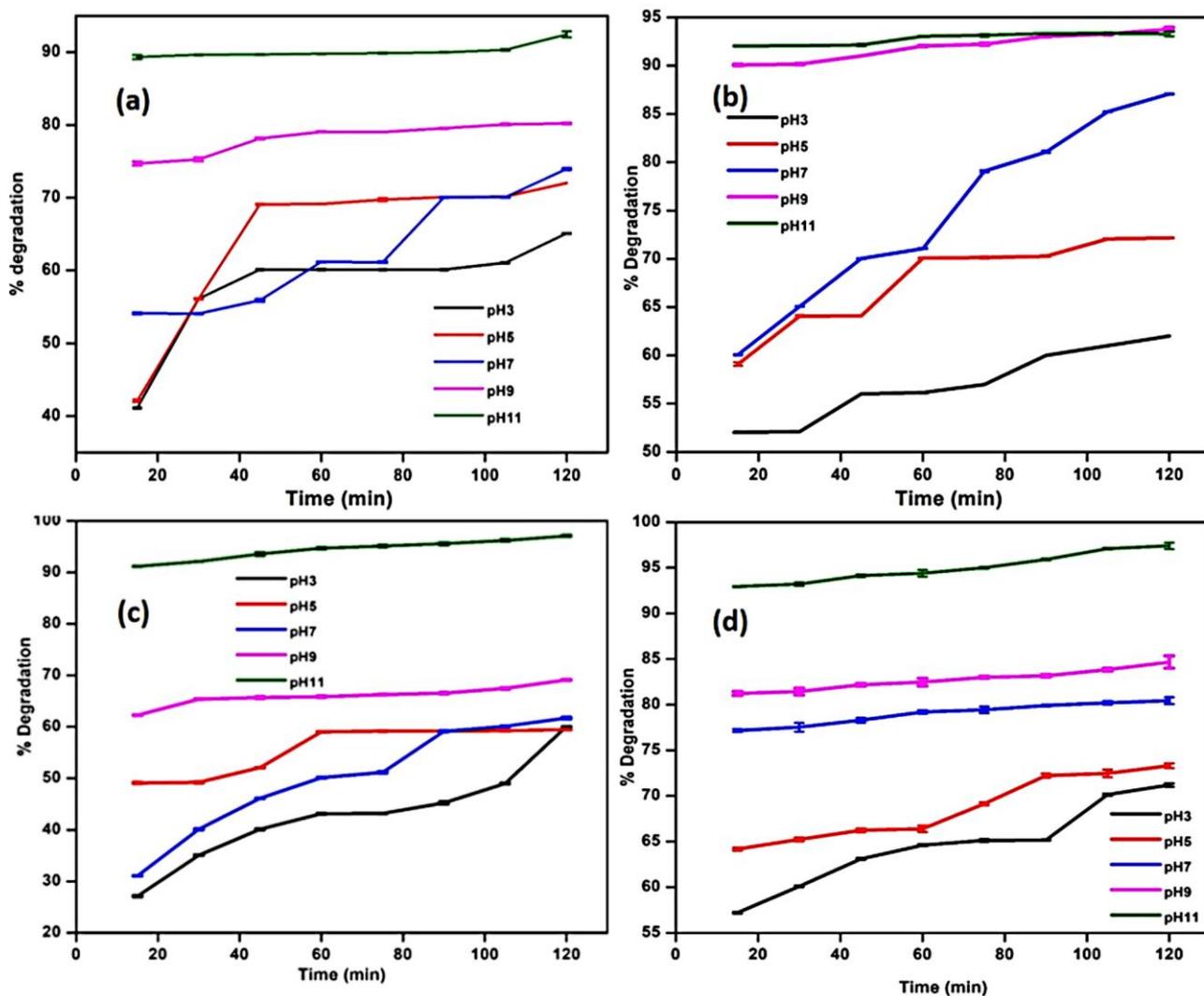
**Figure S3.** Spectrum for rGO flakes



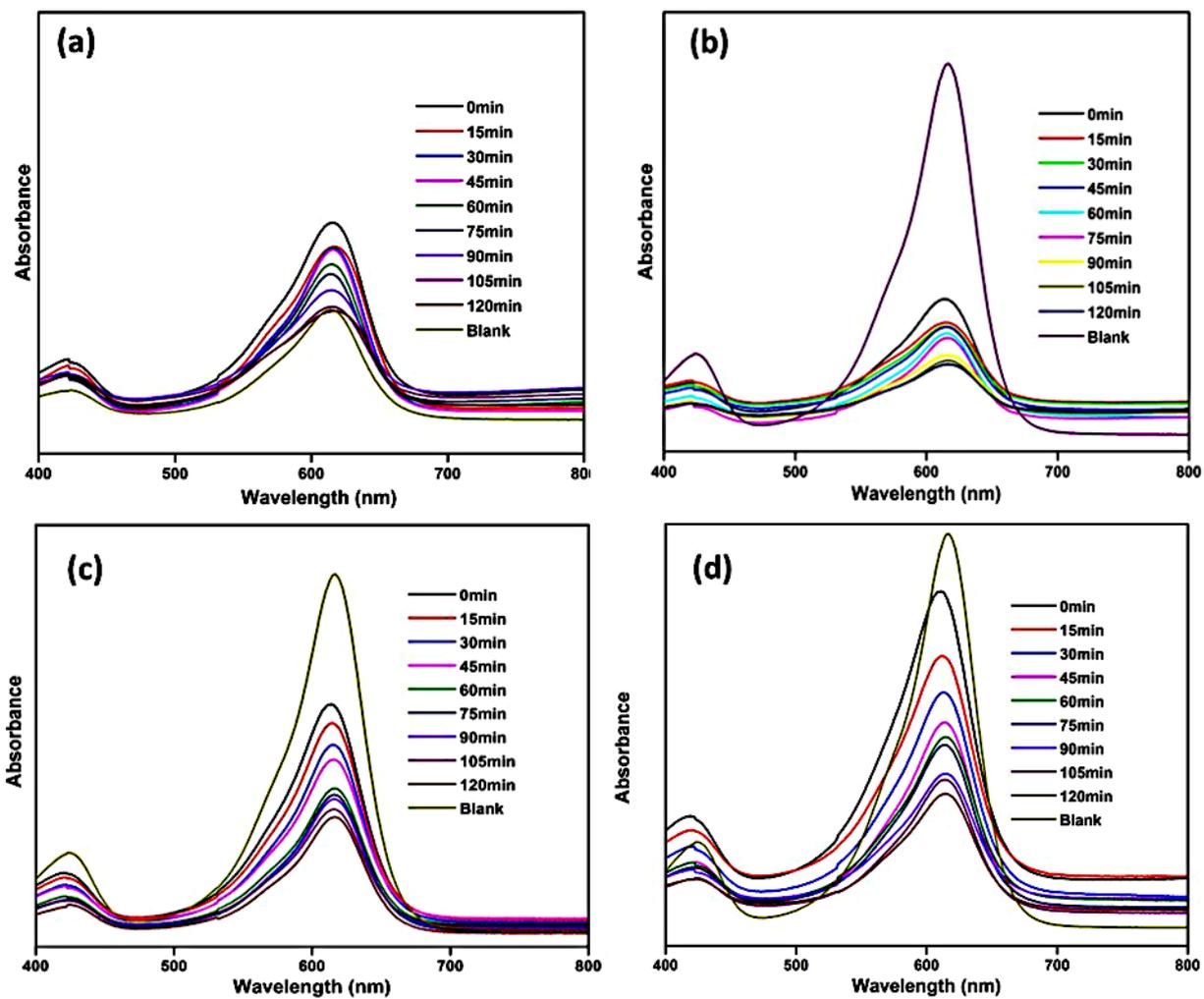
**Figure S4.** (a, c) Representative CV curves for  $\text{Co}_3\text{O}_4$  and  $\text{rGO}/\text{Co}_3\text{O}_4$  samples at different scan rates. (b, d) Representative CP curves for  $\text{Co}_3\text{O}_4$  and  $\text{rGO}/\text{Co}_3\text{O}_4$  samples at different current density.



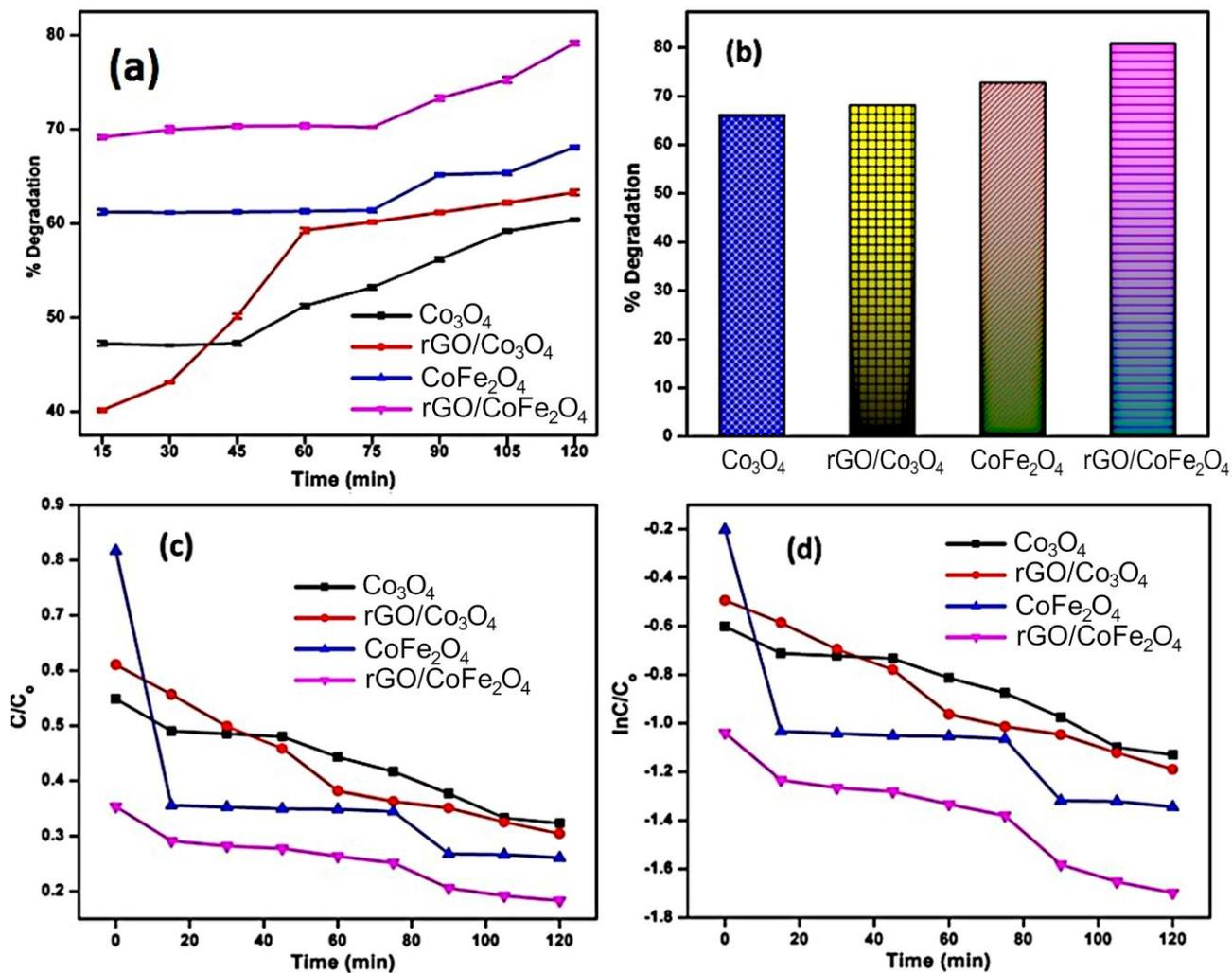
**Figure S5.** Nyquist plots for  $\text{rGO}/\text{CoFe}_2\text{O}_4$ ,  $\text{CoFe}_2\text{O}_4$ ,  $\text{rGO}/\text{Co}_3\text{O}_4$ , and  $\text{Co}_3\text{O}_4$ , (d) Expanded view.



**Figure S6.** Degradation of MG dye solution by Co<sub>3</sub>O<sub>4</sub>, rGO/Co<sub>3</sub>O<sub>4</sub>, CoFe<sub>2</sub>O<sub>4</sub>, and rGO/CoFe<sub>2</sub>O<sub>4</sub> catalysts under visible light irradiation as a function of solution pH.



**Figure S7.** (a-d) Changes in the visible spectra of MG at different irradiation time in the presence of  $\text{Co}_3\text{O}_4$ ,  $\text{rGO}/\text{Co}_3\text{O}_4$ ,  $\text{CoFe}_2\text{O}_4$ , and  $\text{rGO}/\text{CoFe}_2\text{O}_4$ .



**Figure S8.** Photocatalytic activity of  $\text{Co}_3\text{O}_4$ ,  $\text{rGO}/\text{Co}_3\text{O}_4$ ,  $\text{CoFe}_2\text{O}_4$ , and  $\text{rGO}/\text{CoFe}_2\text{O}_4$  catalysts as a function of degradation time.