Supplementary file

Ultrafast and simultaneous removal of four tetracyclines from aqueous solutions using waste material derived graphene oxide-supported cobalt-iron magnetic nanocomposites

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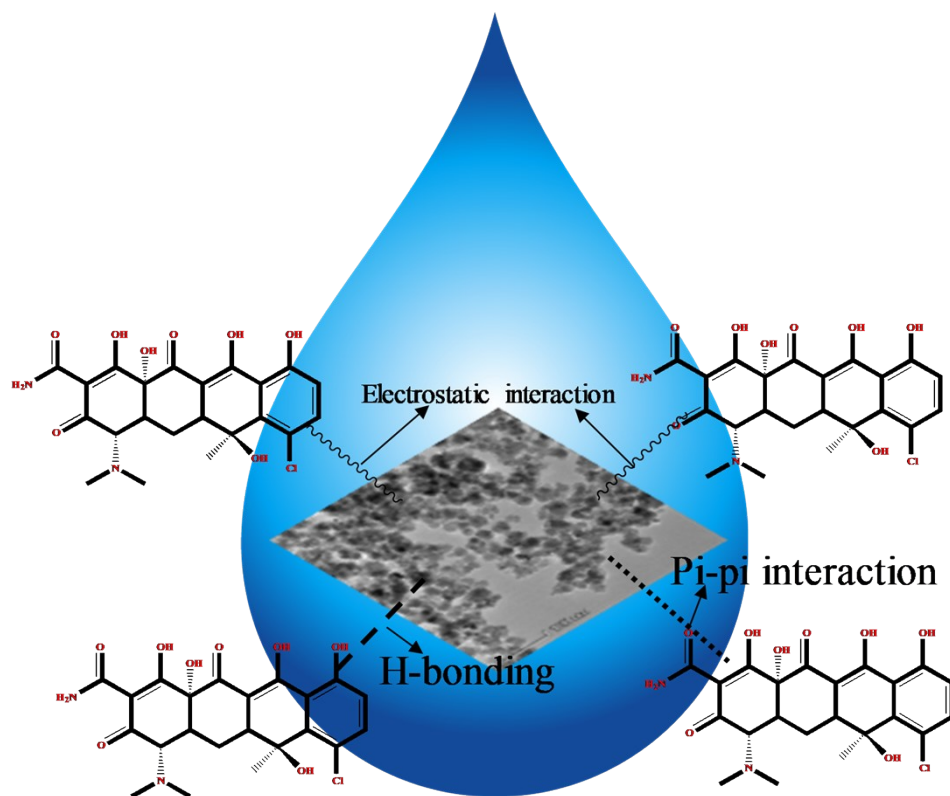*Corresponding author e-mail: (Md Aftab Ali Shaikh) aftabshaikh@du.ac.bd

Fig. S1: Mechanism of adsorption of TCs on GO/Co-Fe composite

Adsorption mechanism:

Fig. 10 shows the adsorption mechanism of TCs onto the surface of the GO/Co-Fe composite. The numerous -COOH and -OH groups on the composite's surface create a favourable environment for effective adsorption. The interaction between amino groups (-NH$_2$) of TCs and oxygenated functional groups of the GO/Co-Fe composite is facilitated by hydrogen bonding [1]. Moreover, the presence of Fe^{3+} and Co^{2+} in the GO/Co-Fe composite, which was verified by XPS, enhances adsorption through electrostatic interaction[2]. Additionally, the benzene rings and C=C double bonds of TCs interact with graphene-conjugated basal planes through the π-π interactions and finally increase the adsorption capability[1] [2].

Table 1: Table with all treatments (combinations of levels of the factors)

Experiment		Factor Level				Temperature (°C)	Optimum
		Dose (mg)	Time (min)	pH	Concentration (ppm)		
Adsorption Study	Effect of Dose	0.5-12	30	7	0.2	25	**3 mg**
	Effect of Time	3	0.5-20	7	0.2	25	**0.5 min**
	Effect of pH	3	0.5	2-12	0.2	25	**pH 7**
	Effect of Conc.	3	0.5	7	0.2	25	**0.2 ppm**
Kinetic study		3	0.5-90	7	0.2	25	Fitted with pseudo second order
Isotherm study		3	0.5	7	0.2-10	30, 40 and 50	Fitted with Langmuir Isotherm

References:

1 B. P. Upoma, S. Yasmin, Md. A. Ali Shaikh, T. Jahan, Md. A. Haque, M. Moniruzzaman and M. H. Kabir, *ACS Omega*, 2022, **7**, 29655–29665.

2 H. Zhu, T. Chen, J. Liu and D. Li, *RSC Adv.*, 2018, **8**, 2616–2621.