



INTRODUCTION

- A nitrogen rich Covalent triazine frameworks (CTF) was synthesized by molten salt templating ionothermal method and incorporated into commercial TiO₂ (Degussa P25) to yield a binary covalent triazine framework-Titanium dioxide (CTF-TiO₂).
- Reduced graphene oxide (rGO) with its large specific surface area and high conductivity has been used efficiently as an adsorbent and catalyst support in water remediation [1]. Hence, rGO was incorporated into CTF-TiO₂ by a simple ultrasonication and wet impregnation technique to yield porous ternary composites (CTF-TiO₂/rGO).
- Synergistic effect of adsorption and photodegradation remediation technique has proven to be efficient in removing pharmaceuticals that are present in aqueous solution at trace concentration [2].
- The prepared porous ternary composites are envisaged to be effective in the removal of pharmaceuticals such as ciprofloxacin (CIP) from aqueous solution.

AIM/OBJECTIVES

The aim of this work is to prepare a porous ternary nanocomposites CTF-TiO₂/rGO for the removal of ciprofloxacin (CIP) from water using adsorption and photodegradation remediation techniques.

- Synthesis of ternary nanocomposites CTF-TiO₂/rGO by ultrasonication and wet impregnation technique.
- To Characterise the prepared ternary nanocomposite using Fourier Transform Infrared Spectroscopy (FTIR), Powder X-ray diffraction (PXRD), and UV-Vis diffuse reflectance spectroscopy.
- To evaluate the sorption and photocatalytic activities of the prepared nanocomposite using CIP as a model pollutant.

METHODOLOGY

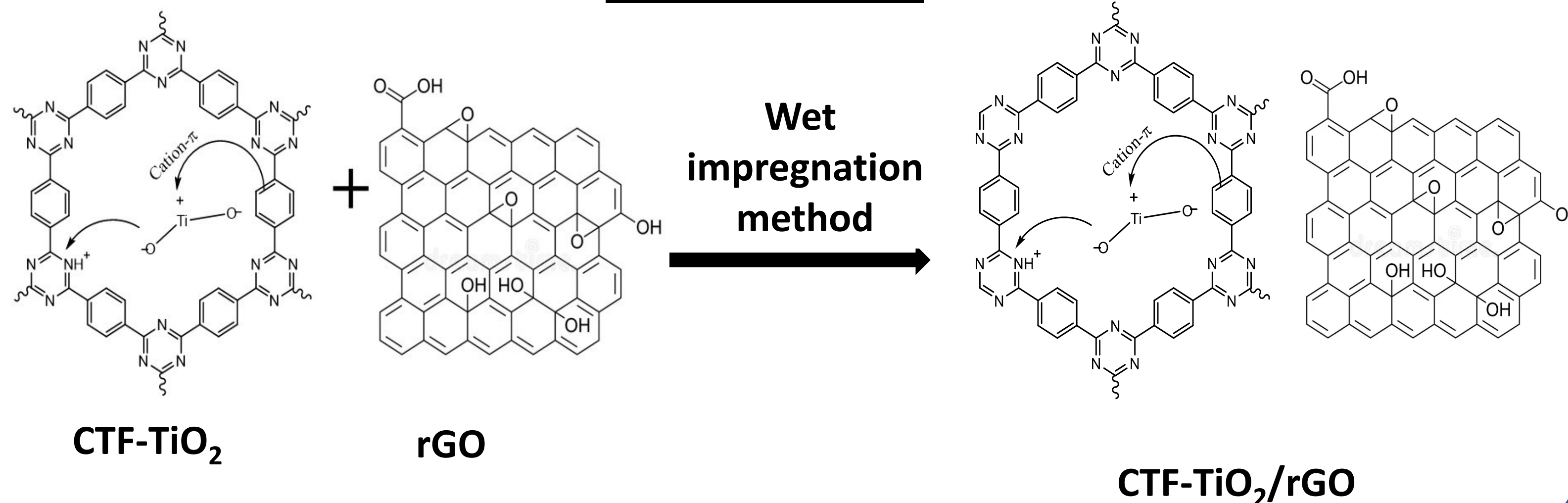


Fig. 1: Preparation of CTF-TiO₂/rGO by wet impregnation technique

CHARACTERISATION

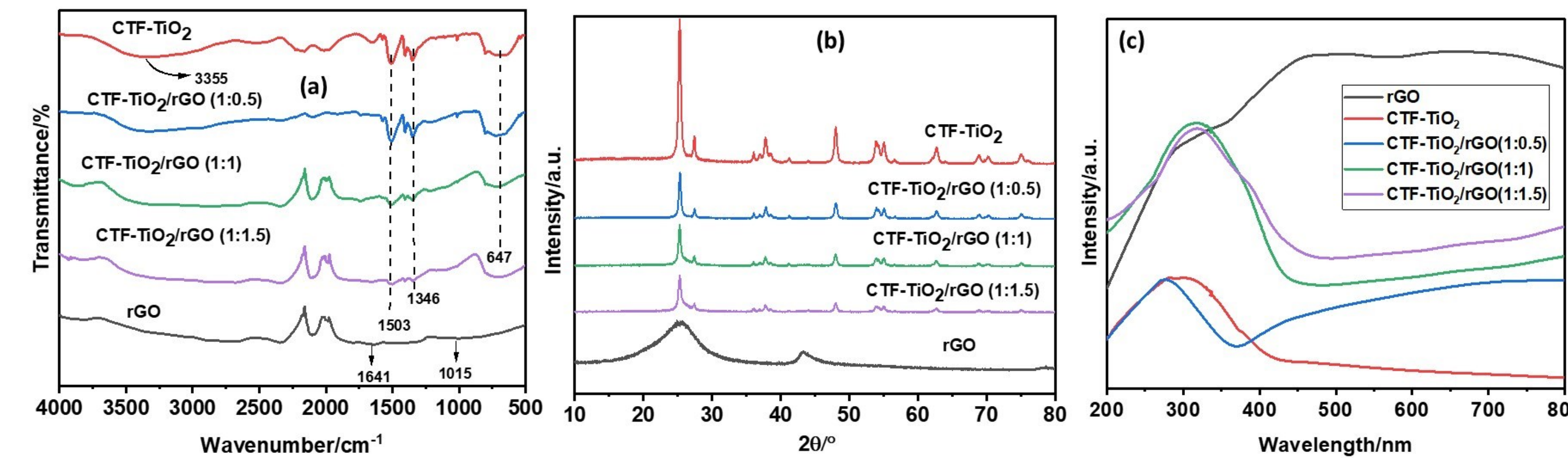


Fig. 2: (a) FTIR spectra, (b) PXRD diffractogram and (c) UV-Vis DRS of prepared materials

ADSORPTION AND PHOTOCATALYTIC DEGRADATION RESULTS

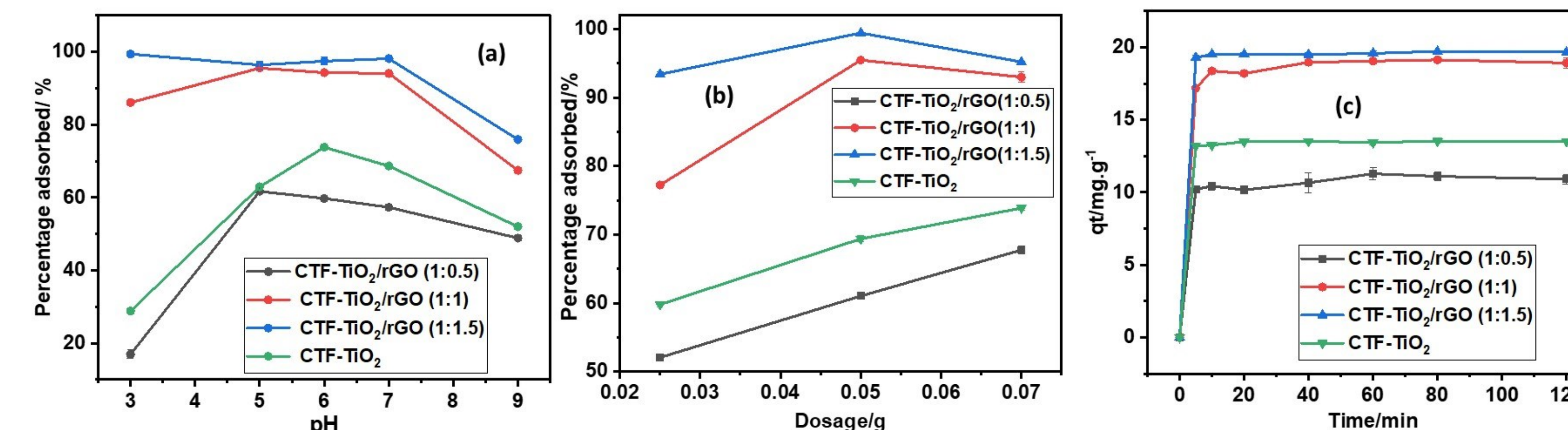


Fig. 3: Effect of (a) pH, (b) dose and (c) time (condition: 100 ml of 10 ppm ciprofloxacin) and prepared materials

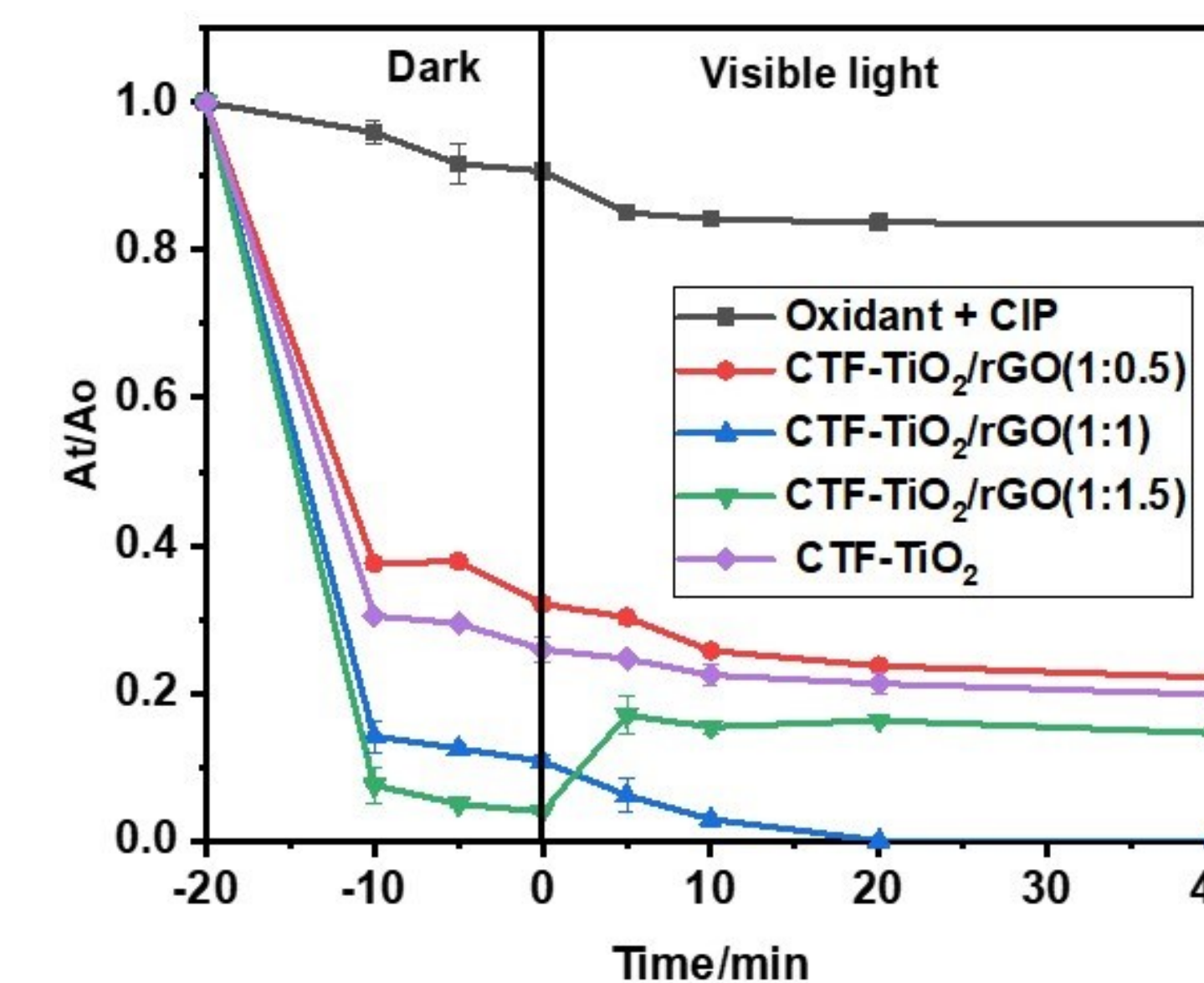


Fig. 4 a: Photocatalytic degradation of ciprofloxacin (condition: 100 ml of 10 ppm ciprofloxacin, by 0.05 g of photocatalyst, 5mM H₂O₂ at optimum pH)

DISCUSSION/CONCLUSION

- FTIR spectra of the ternary composites (Fig 2 a), displayed new absorption band at 1503 and 1346 cm⁻¹ corresponding to CN heterocycles of the triazine ring, while peak at 647 cm⁻¹ corresponds to characteristic peak of TiO₂. Peak at 3355 cm⁻¹ suggest -OH stretch, while at 1641 cm⁻¹ is attributed to -C=C- group.
- PXRD diffractograms of the CTF-TiO₂ and CTF-TiO₂/rGO composite reveals crystalline structure of TiO₂, XRD patterns belonging to CTF and rGO were not observed in the result.
- According to Fig 2 a, all prepared materials displayed absorption edge in the visible region except for rGO.
- Characterisation results reveals that materials were successfully prepared.
- Incorporating rGO into CTF-TiO₂ enhanced its adsorption and photocatalytic degradation of ciprofloxacin from aqueous solution.
- The optimum condition for adsorption was pH 3 for CTF-TiO₂/rGO(1:1.5), 5 for CTF-TiO₂/rGO(1:0.5) and CTF-TiO₂/rGO(1:1), and pH 6 for CTF-TiO₂; dose of 0.05 g for ternary composites and 0.07 g for CTF-TiO₂; and sorption equilibrium time of ~ 20 min.
- About ~ 100 % of CIP was eliminated from aqueous solution through combined adsorption-and photodegradation technique

REFERENCES

- [1] Maharsi, R., Arif, A. F., Ogi, T., Widiyandari, H., & Iskandar, F. (2019). Electrochemical properties of TiO_x/rGO composite as an electrode for supercapacitors. *RSC advances*, 9(48), 27896–27903. <https://doi.org/10.1039/c9ra04346b>
- [2] Feng, J. ., Wang, L., Ran, X., Xiao, B., Lei, L., Zhu, J., Li, R., Xi, X., & Feng, G. (2022). Adsorption and photocatalytic synergistic removal of ciprofloxacin on mesoporous ErFeO₃/g-C₃N₄ heterojunction. *Environmental Technology & Innovation*, Volume 28, 102785, ISSN 2352-1864. <https://doi.org/10.1016/j.eti.2022.102785>.

ACKNOWLEDGEMENTS

- College of Agriculture, Engineering and Sciences, University of KwaZulu-Natal for financial support.
- University of KwaZulu-Natal for facilities