Electronic Supplementary Material (ESI) for New Journal of Chemistry. This journal is © The Royal Society of Chemistry and the Centre National de la Recherche Scientifique 2021

# Simple fabrication and unprecedented visible light response of NiNb<sub>2</sub>O<sub>6</sub>/RGO heterojunctions for the degradation of emerging pollutants in water

Benjamin Moses Filip Jones<sup>a</sup>, G. Mamba<sup>b</sup>, S.A. Ansari<sup>c</sup>, D. Maruthamani<sup>d</sup>, V. Muthuraj<sup>a\*</sup> T.T.I. Nkambule<sup>b</sup>

<sup>a</sup> Department of Chemistry, V.H. N. Senthikumara Nadar College (Autonomous),

Virudhunagar-626 001, Tamil Nadu, India.

<sup>b</sup> Institute for Nanotechnology and Water Sustainability, College of Science, Engineering and Technology, University of South Africa, Florida, 1709, Johannesburg, South Africa.

<sup>c</sup> Department of Physics, College of Science, King Faisal University, P.O. Box 400, Hofuf, Al-Ahsa 31982, Saudi Arabia.

<sup>d</sup> Department of Chemistry, PSG College of Technology, Coimbatore - 641 004, India.

#### List of Figures and Tables.

Figure S1. EDX spectrum of NiNb<sub>2</sub>O<sub>6</sub>/10wt%RGO.

Figure S2. EDX element mapping of the composite NiNb<sub>2</sub>O<sub>6</sub>/10wt%RGO.

Figure S3: Survey spectrum of NiNb<sub>2</sub>O<sub>6</sub>/10wt%RGO and NiNb<sub>2</sub>O<sub>6</sub>.

Figure S4. DOX and TC removal in the dark using NiNb2O6/10wt%RGO

**Figure S5.** Kinetic graph for degradation of (a) DOX and (b) TC under simulated light using the prepared catalysts

**Figure S6.** Kinetics for effect of NiNb<sub>2</sub>O<sub>6</sub>/10wt%RGO dosage on the degradation of (a) DOX and (b) TC.

**Figure S7.** Kinetics for the effect of initial concentration on the degradation of (a) DOX and (b) TC.

Figure S8. Kinetics for the degradation of (a) DOX and (b) TC at different solution pH

Figure S9. Scavenging experiments during the degradation of (a) DOX and (b) TC.

Figure S10. (a) Evaluation of the reusability of  $NiNb_2O_6/10wt\%RGO$  for degradation of DOX

and TC, and (b) XRD patterns of NiNb<sub>2</sub>O<sub>6</sub>/10wt%RGO before and after DOX degradation

Figure S11. Mass spectra of DOX and possible intermediates

Table S1: Comparative studies of photocatalytic degradation of DOX and TC.



## Figure S1.



Figure S2







Figure S5



Figure S6.



Figure S7.



Figure S8.







Figure S10.



gure S11.

### Table S1.

Photocatalyst	Light Source	Pollutant	Dosage	Time (min)	Percentage of degradation	Ref
TCPP/Bi <sub>2</sub> MoO <sub>6</sub>	300W-Xe lamp > 420 nm	TC (20 mg/L)	10 mg	60	85.7%	1
Bi <sub>2</sub> Sn <sub>2</sub> O <sub>7</sub> / Bi <sub>2</sub> MoO <sub>6</sub>	300W-Xe lamp > 400 nm	TC (20 mg/L)	35 mg	100	98.7%	2
Ag/Ag <sub>2</sub> S/ Bi <sub>2</sub> MoO <sub>6</sub>	300W-Xe lamp > 400 nm	TC (20mg/L)	30 mg	100	92.8%	3
C-doped Bi <sub>2</sub> MoO <sub>6</sub> /In <sub>2</sub> O <sub>3</sub> - ZnO	500W-Xe lamp	DOX (20mg/L)	50 mg	40	99.7%	4
BiOBr/FeWO <sub>4</sub>	300W-Xe lamp> 400 nm	DOX (10mg/L)	100 mg	60	90.4%	5
$\alpha$ -Bi <sub>2</sub> O <sub>3</sub> /g-C <sub>3</sub> N <sub>4</sub>	150W-Xe lamp > 420 nm	DOX (10mg/L)	25 mg	120	80.5%	6
NiNb <sub>2</sub> O <sub>6</sub> /RGO	300W- tungsten lamp> 420 nm	TC (10mg/L)	50 mg	80	94.1 %	This work
NiNb <sub>2</sub> O <sub>6</sub> /RGO	300W- tungsten lamp> 420 nm	DOX (10 mg/L)	50 mg	80	89.2 %	This work

#### References

- C. Wang, M. Cai, Y. Liu, F. Yang, H. Zhang, J. Liu, S. Li, J. Colloid Interface Sci., 2022, 605, () 727–740.
- S. Li, C. Wang, Y. Liu, M. Cai, Y. Wang, H. Zhang, Y. Guo, W. Zhao, Z. Wang, X. Chen, Chem. Eng. Sci., 2022, 429, () 132519.
- S. Li, C. Wang, Y. Liu, B. Xue, W. Jiang, Y. Liu, L. Mo, X. Chen, Chem. Eng. Sci., 2021, 415, 128991.
- 4. H. Li, J. Li, P. Yang, D. H.L. Ng, X. Cui, F. Ji, J. Environ. Sci., 2019, 79, 54-66.
- J. Gao, Y. Gao, Z. Sui, Z. Dong, S. Wang, D. Zou, J. Alloys Compd., 2018, 732, 43-51.
- 6. W. Liu, Z. Li, Q. Kang, L. Wen, Environ. Res., 2021,197, 110925.