Supporting information

Supporting Information Summary

The Supporting Information includes the FTIR, Raman, XPS, Zn-doped BiOBr of bandgap, EIS, MB degradation rate, RhB degradation rate, OFl degradation, six repeated cycles figures, and a comparative table of innovation with other articles.

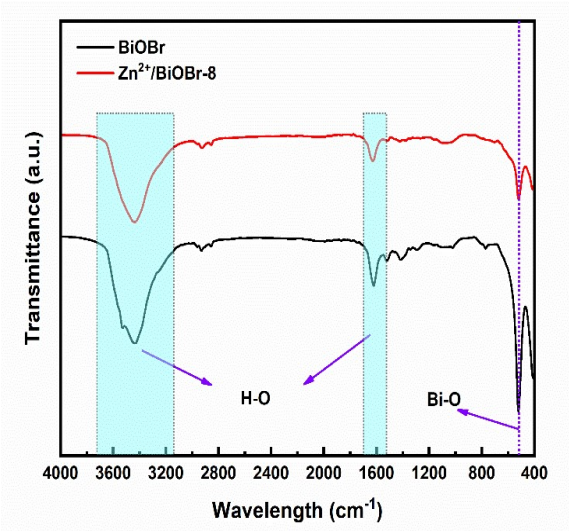

Figure S1 FTIR spectra of BiOBr and Zn^{2+}/ BiOBr-8.

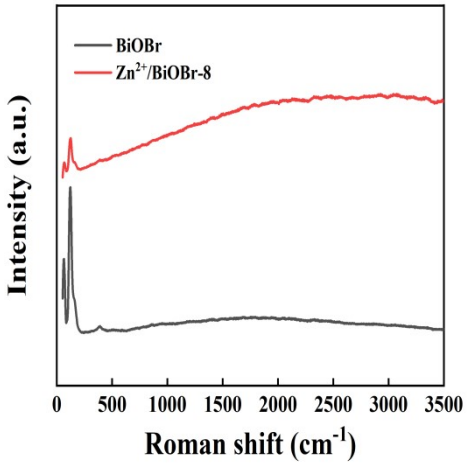

Figure S2 Raman spectra of BiOBr and Zn^{2+}/ BiOBr-8.

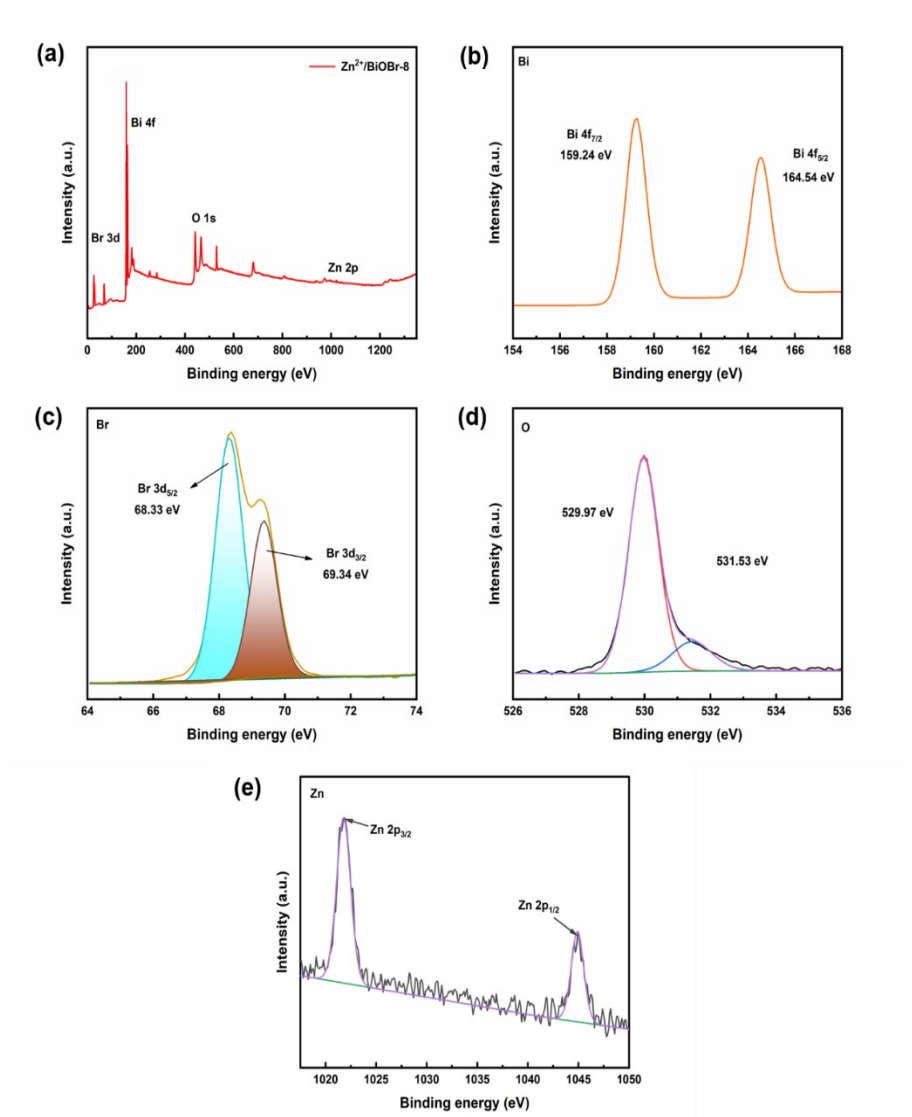

Figure S3 XPS spectra of the as-prepared Zn^{2+}/BiOBr-8 material:(a) Survey of the sample; (b) Bi 4f;(c) Br 3d;(d) O 1s;(e) Zn 2p.

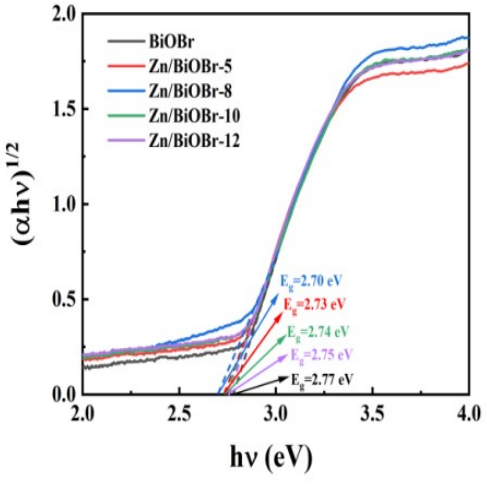

Figure S4 Plot of (αhν)1/2-hν of BiOBr and Zn^{2+}/BiOBr-x;

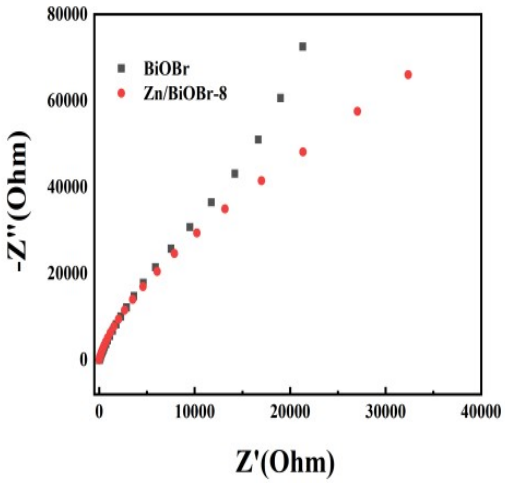

Figure S5 Electrochemical impedance (EIS) spectra of BiOBr and Zn/BiOBr-8.

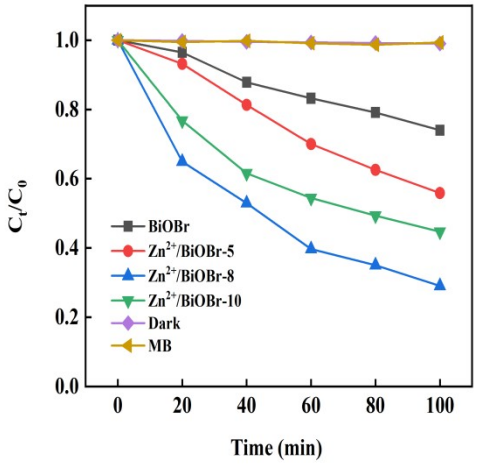

Figure S6 Degradation rates of MB (20mg/l) of the samples

The 20 mg catalyst was added to 40 ml RhB with a concentration of 20 mg/l and illuminated for 20 min. RhB degradation rates of 20 mg/l by pure BiOBr, Zn^{2+}/BiOB-5, Zn^{2+}/BiOB-8 and Zn^{2+}/BiOB-10 reached 44.1%, 69.82%, 90.96% and 64.53%, respectively.

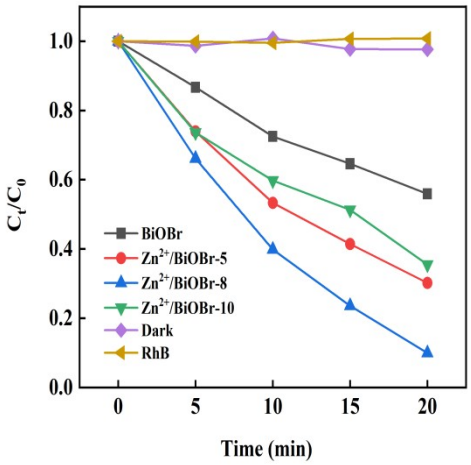

Figure S7 Degradation rates of RhB (10mg/l) of the samples

The 20 mg catalyst was added to 40 ml OFl with a concentration of 20 mg/l, illuminated for 100 min. The OFl degradation rates of pure BiOBr, Zn^{2+}/BiOB-5, Zn^{2+}/BiOB-8 and Zn^{2+}/BiOB-10 for 20 mg/l reached 58.19%, 66.59%, 75.4% and 64.89%, respectively.

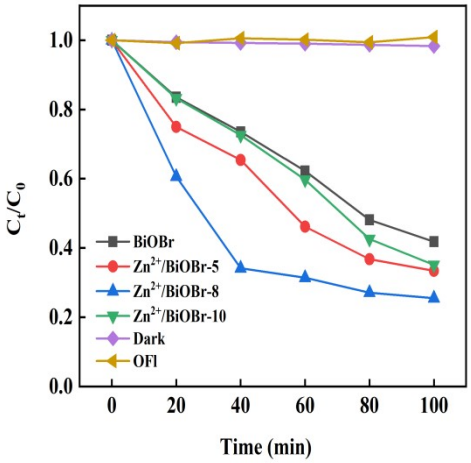

Figure S8 Degradation rates of OFl (20mg/l) of the samples

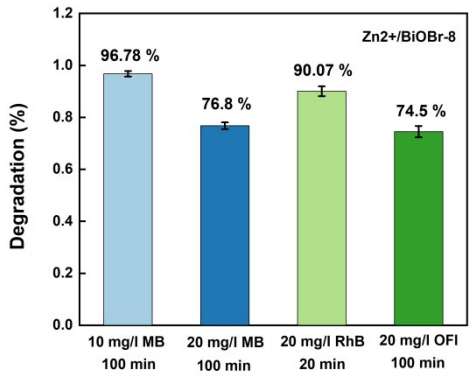

Figure S9 Degradation rate of RhB, MB, and OFl by Zn^{2+}/BiOBr-8

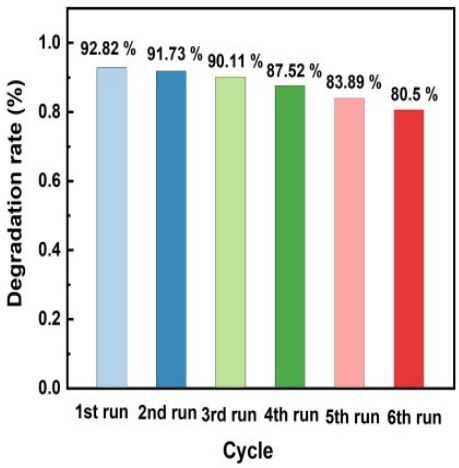

Figure S10 The degradation rate of Zn^{2+}/BiOBr-8+H_2O_2 in six cycles

Table 1 Comparison of photocatalytic activity of composite BiOBr based photocatalyst

Catalysts	Removal efficiency (%)	Removal time (min)	Dye type	Dye concentration (mg/L)	Light source	Reaction volume (ml)	Catalyst usage (mg)	Refs*
Bi2MoO6/ BiOBr	90	40	MB	20	50W LED λ>410nm	30	30	i
Bi/BiOBr/ AgBr	95.6	90	RhB	10	10W LED 400nm<λ	100	50	ii
BiOCl/ BiOBr	93	360	MB	10	LED λ>410nm	30	30	iii
Co^{2+}/ BiOBr	98.9	150	MB	10	500W Xe λ>400nm	60	60	iv
Ln^{3+}/ BiOBr/rGO	70	65	RhB	10	300W Xe λ>420nm	100	50	v
Yb^{3+}, Er^{3+}/ BiOBr	56	80	RhB	10	1000W halogen	100	100	vi
BiOBr	40.52	100	MB	10	300 W Xe λ>400nm	40	20	this study
Zn^{2+}/BiOBr	96.78	100	MB	10	300 W Xe λ>400nm	40	20	this study

* References:

[i] Hu, T., Yang, Y., Dai, K., Zhang, J., & Liang, C. (2018). A novel Z-scheme Bi_2MoO6/BiOBr photocatalyst for enhanced photocatalytic activity under visible light irradiation. *Applied Surface Science, 456*, 473-481.

[ii] Lyu, J., Li, Z., & Ge, M. (2018). Novel Bi/BiOBr/AgBr composite microspheres: Ion exchange synthesis and photocatalytic performance. *Solid State Sciences, 80*, 101-109.

[iii] Zhang, J., Lv, J., Dai, K., Liang, C., & Liu, Q. (2018). One-step growth of nanosheet-assembled BiOCl/BiOBr microspheres for highly efficient visible photocatalytic performance. *Applied Surface Science, 430*, 639-646.

[iv] Huang, W., Hua, X., Zhao, Y., Li, K., Tang, L., Zhou, M., & Cai, Z. (2019). Enhancement of visible-light-driven photocatalytic performance of BiOBr nanosheets by Co^{2+} doping. *Journal of Materials Science: Materials in Electronics, 30*, 14967-14976.

[v] Ren, X., Sun, Y., Xing, H., Wu, K., Wang, W., Yin, J., ... & Yang, H. (2019). 3D/2D Ln^{3+} -doped BiOBr/rGO heterostructure with enhanced photocatalytic performance. *Journal of Nanoparticle Research, 21*, 1-14.

[vi] Liang, S., He, M., Guo, J., Yue, J., Pu, X., Ge, B., & Li, W. (2018). Fabrication and characterization of BiOBr: Yb^{3+}, Er^{3+}/g-C_3N_4 pn junction photocatalysts with enhanced visible-NIR-light-driven photoactivities. *Separation and Purification Technology, 206*, 69-79.