Supporting Information

Degradation of tetracycline hydrochloride by near-infrared light-responsive 0D/3D GdF_3: Yb^{3+}, Er^{3+}/$MgIn_2S_4$ upconversion photocatalysts

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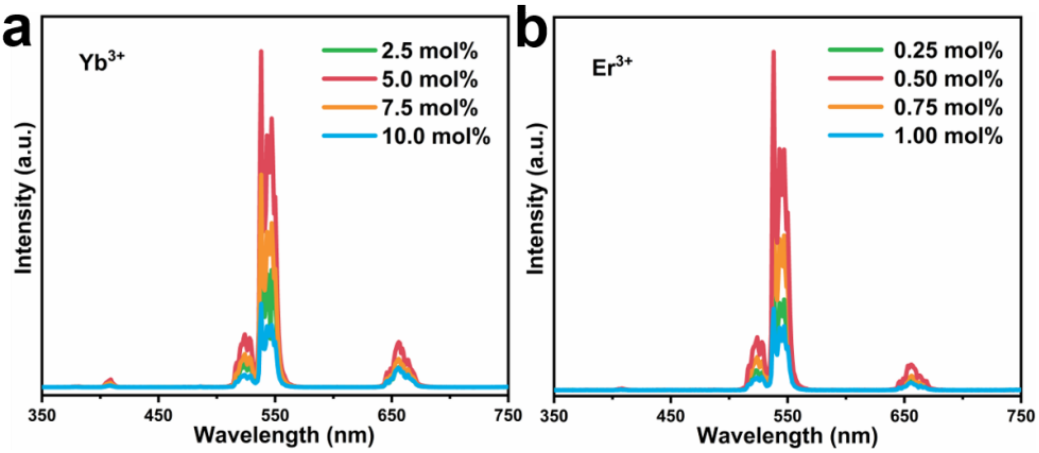

Fig. S1. Upconversion emission spectra of GFYEwith different Yb^{3+} contents(a) and Er^{3+} contents(b).

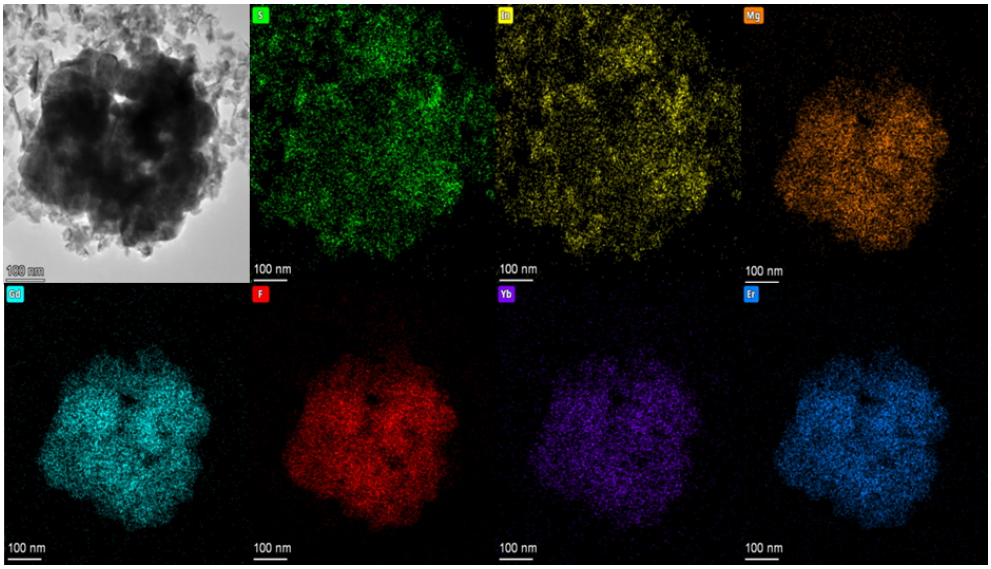

Fig. S2. EDS elemental mappings of GFYE(30)/MIS

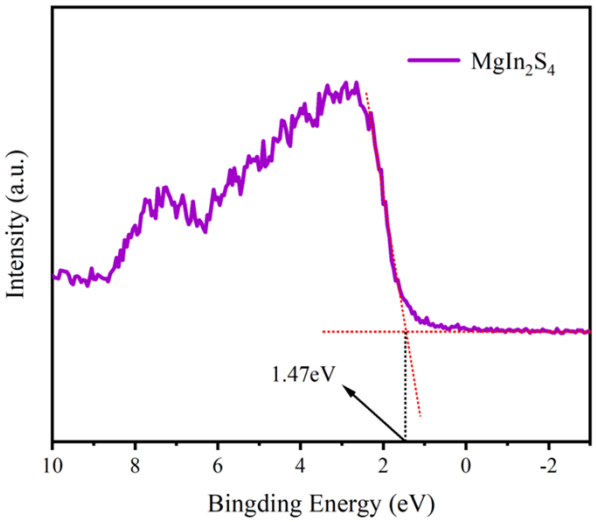

Fig. S3. XPS valence band spectrum of $MgIn_2S_4$

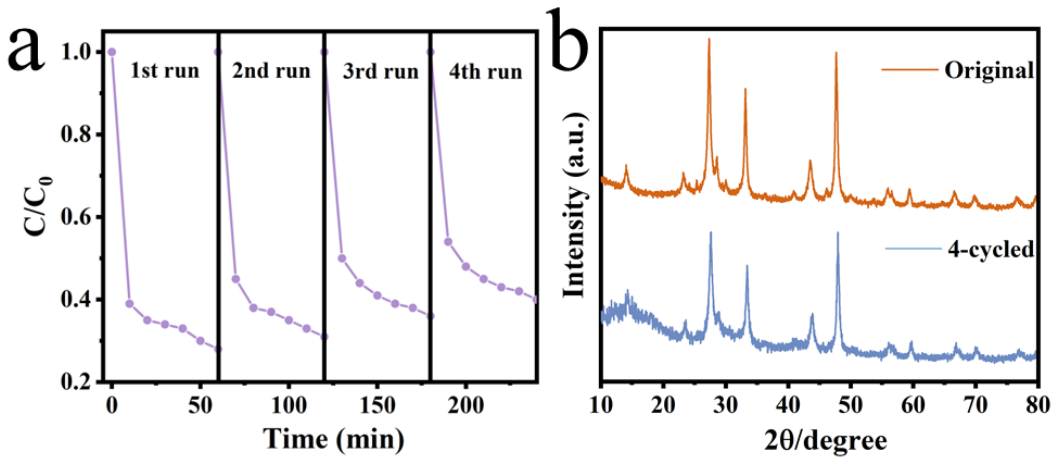

Fig. S4. (a) Photocatalytic stability test of GFYE(30)/MIS under $\lambda \geq 400$ nm light. (b) XRD patterns of GFYE(30)/MIS before and after photocatalytic reaction

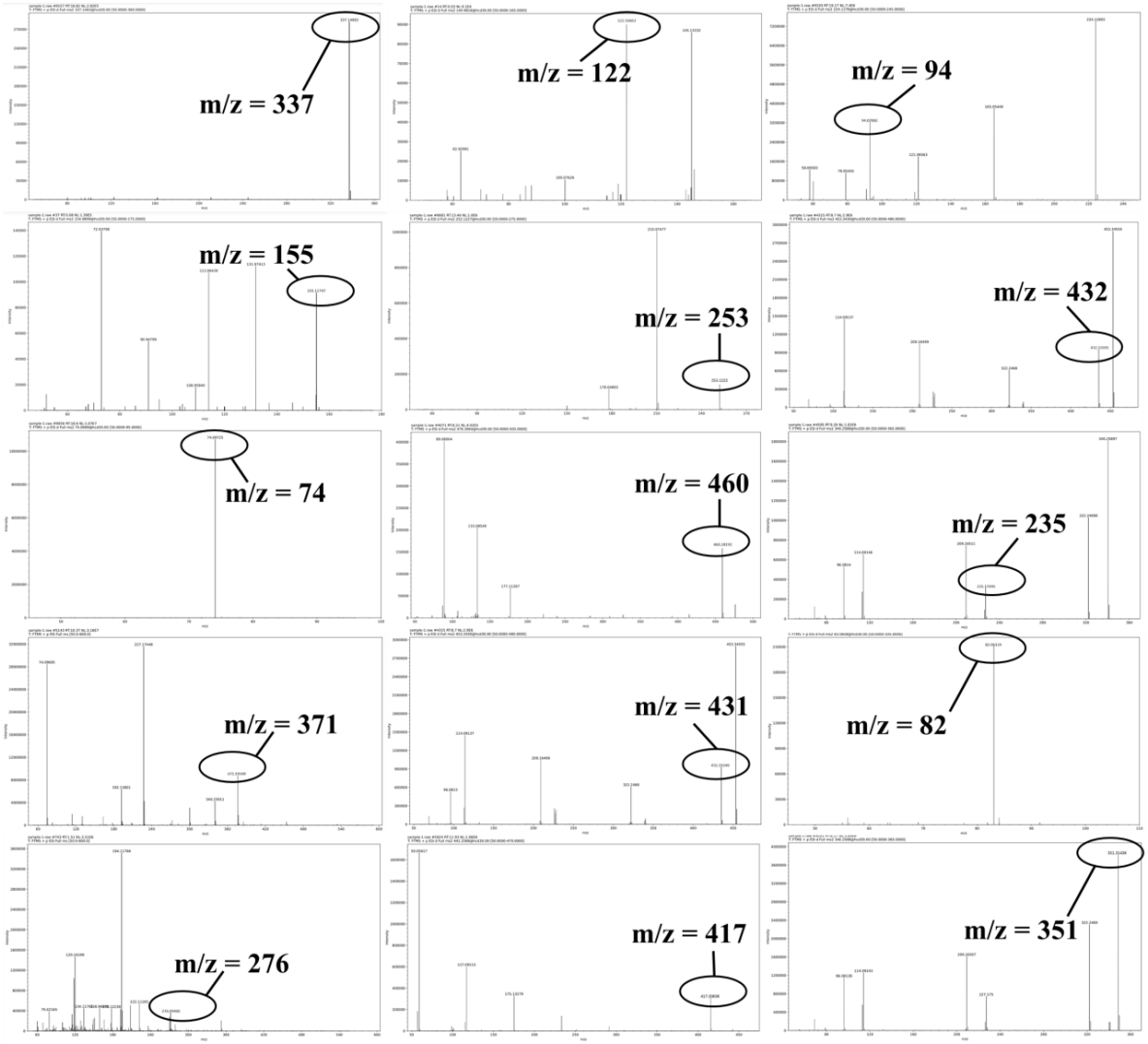

Fig. S5. LC-MS spectra of the degraded products of TCH

Table S1. Different samples' surface area and pore volume

Catalysts	S (m^2/g)	Pore volume (cm^3/g)
GdF_3:Yb^{3+},Er^{3+}/$MgIn_2S_4$	68.3341	0.241951
$MgIn_2S_4$	58.5251	0.226379

Table S2. Fitting results of fluorescence decay curve in 524nm

Model	**ExpDec2**	**ExpDec2**
Equation	$I(t)=A_1\exp(-t/\tau_1) + A_2\exp(-t/\tau_2)$	$I(t)=A_1\exp(-t/\tau_1) + A_2\exp(-t/\tau_2)$
Drawing	GFYE	GFYE (30)/MIS
A_1	0.52067 ± 0.12637	0.34686 ± 0.0689
τ_1	325967.79486 ± 27997.10125	90875.97167 ± 9737.49826
A_2	0.49309 ± 0.12758	0.33538 ± 0.43741
τ_2	588019.77981 ± 42148.14129	277444.65676 ± 148456.75144
Reduced Chi-Sqr	1.18444E-4	6.51264E-5
R-squared (COD)	0.99594	0.99082
Adjusted R-squared	0.99593	0.9908

Table S3. Fitting results of fluorescence decay curve in 538nm

Model	**ExpDec2**	**ExpDec2**
Equation	$I(t)=A_1\exp(-t/\tau_1) + A_2\exp(-t/\tau_2)$	$I(t)=A_1\exp(-t/\tau_1) + A_2\exp(-t/\tau_2)$
Drawing	GFYE	GFYE (30)/MIS
A_1	1.00948 ± 0.01274	0.36553
τ_1	403027.17353 ± 3476.43139	293968.36147
A_2	0.04315 ± 0.01309	0.3495
τ_2	1084814.75255 ± 165689.93331	381908.04343
Reduced Chi-Sqr	3.00794E-5	3.94247E-5
R-squared (COD)	0.99893	0.99831
Adjusted R-squared	0.99893	0.9983

Table S4. Antibiotic degradation comparison table of upconversion photocatalytic materials

Photocatalyst	**Initial concentration**	**Light**	**Time (min)**	**Removal efficiency**	**Reference**
$MgIn_2S_4$	10 mg/L 50 ml TCH	300 W xenon lamp λ > 400 nm	60	58 %	This work ($MgIn_2S_4$)
$MgIn_2S_4$	20 mg/L 150 ml TC	300 W xenon lamp λ > 420 nm	100	17 %	Chemosphere (2022)

$MgIn_2S_4$	20 mg/L 100 ml TCH	300 W metal halide lamp λ > 420 nm	20	15 %	Applied Surface Science(2022)
$MgIn_2S_4$	20 mg/L 50 mL OTC	300 W xenon lamp λ > 420 nm	60	57 %	Journal of Colloid and Interface Science(2020)
GdF_3:Yb^{3+},Er^{3+} /$MgIn_2S_4$	10 mg/L 50 ml TCH	300 W xenon lamp λ > 400 nm	60	72 %	This work (GdF_3:Yb^{3+},Er^{3+} /$MgIn_2S_4$)
FeOOH/$MgIn_2S_4$	20 mg/L 150 ml TC	300 W xenon lamp λ > 420 nm	100	70 %	Chemosphere (2022)
BiOCl/$MgIn_2S_4$	10 mg/L 50 ml CBZ	50 W LED lamp	120	65 %	Chemosphere (2021)