Electronic Supplementary Material (ESI) for Environmental Science: Nano.

Supplementary Material

Simultaneous photocatalytic tetracycline oxidation and chromate reduction via a jointed synchronous pathway upon Z-scheme $Bi_{12}O_{17}Cl_2$/AgBr: Insight into intermediates and mechanism

Zicheng Zhai[1], Kaixu Ren[1], Xiangyang Zheng[1], Yigang Chen[2, *], Yuming Dong[3], Haifeng Shi[1, 4, *]

[1] School of Science, Jiangnan University, Wuxi, 214122, P. R. China

[2] Department of General Surgery, The Affiliated Wuxi No.2 People's Hospital of Nanjing Medical University, Wuxi, 214002, P. R. China

[3] School of Chemical & Material Engineering, Jiangnan University, Wuxi, 214122, PR China

[4] National Laboratory of Solid State Microstructures, Nanjing University, Nanjing, 210093, P. R. China.

[*] E-mail addresses: wuxichen2512@njmu.edu.cn (Y. Chen), hfshi@jiangnan.edu.cn (H. Shi).

Determination of degradation intermediates:

The degradation products of TC were identified by the liquid chromatography-mass spectrometry (LC-MS) system. LC-MS was performed with an Agilent Technologies 6470 Triple Quad LC/MS system. The detection conditions were as follows: the capillary potential of 3.5 kV, cone voltage of 30 V. Nitrogen was used as the nebulizer gas. The column temperature was thermostated at 30℃. The mobile phase comprised buffer A (HPLC grade water + 0.1% (v/v) formic acid) and buffer B (HPLC grade acetonitrile). The flow rate was 0.2 mL/min. The eluent gradient started with 10% of eluent B gradually increasing to 90% in 10 min, and the system was then kept for 4 min, returning to 10% in 1 min and equilibrating for 1 min (returning to initial condition and re-equilibrating the column). Mass spectrometry (MS) analysis was performed in a positive mode. The mass range was 70-800 (m/z)

Table S1. Comparison of relative researches of simultaneous Cr (VI) reduction (a) and organics oxidation results with our work.

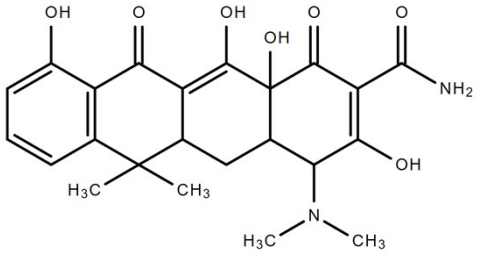
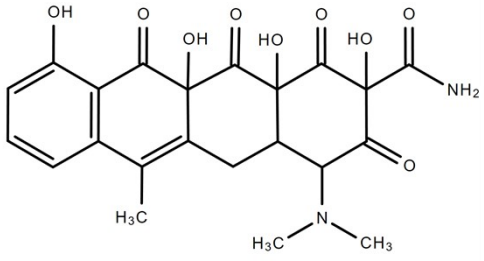
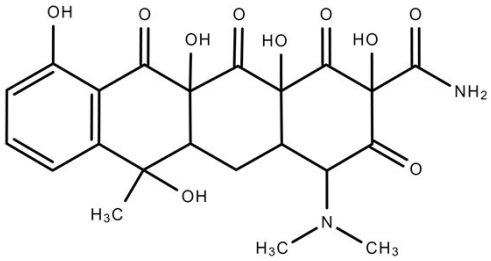
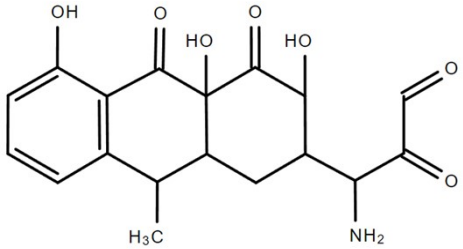
(a):

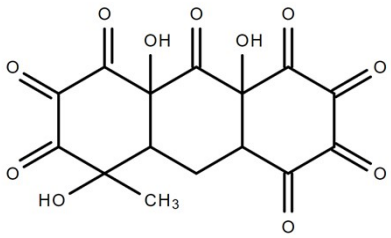
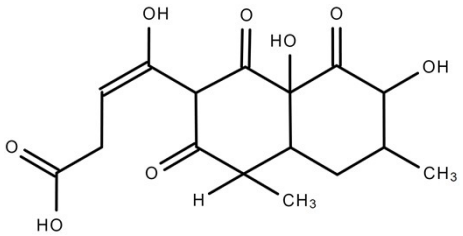
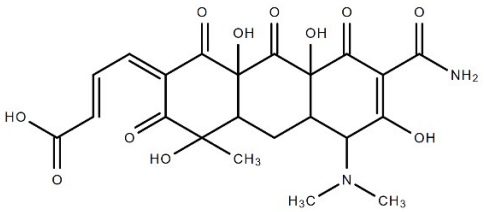
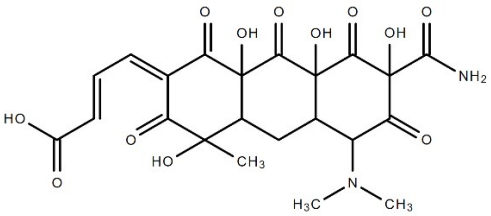
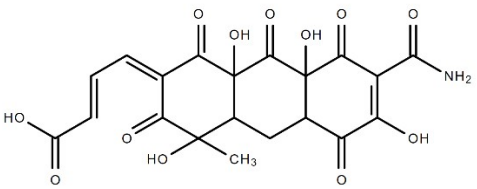
Photocatalyst	Concentration (Cr (VI), mg/L^{-1})	Dosage (g/L^{-1})	Time (min)	Removal (%)	Rate (min^{-1})	Light Source	Ref.
TiO_2/BiOCl 45%	15	1	180	98	0.0189	300 W XL (λ≥ 400 nm)	1
$BiVO_4$-4	10	1	90	83.42	——	300 W XL (λ≥420 nm)	2
0.3-AgI/$BiVO_4$	15	0.4	100	~70	——	500W XL (λ≥ 420nm)	3
1.5 ZnO/rGO	20	0.5	120	——	0.0159	two non-halogen lamps (24 V, 250 W)	4
MP9% （pH = 2.0）	10	0.25	120	100		300 W XL	5
B_{12}/AB 1:1	**10**	**0.5**	**60**	**92.6**	**0.0442**	**300W XL (λ≥ 420 nm)**	**Our work**

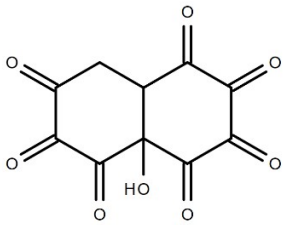
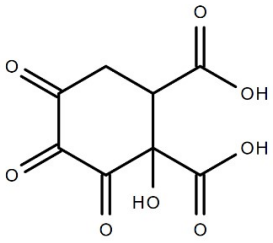
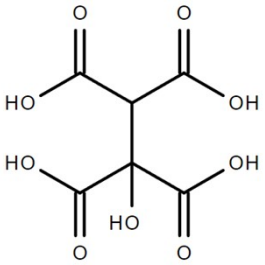
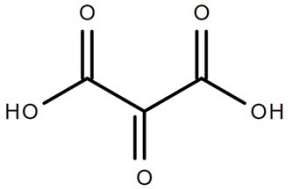
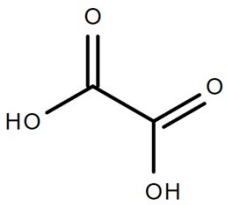
(b):

Photocatalyst	Concentration (mg/L^{-1})	Dosage (g/L^{-1})	Time (min)	Removal (%)	Rate (min^{-1})	Light Source	Ref
TiO_2/BiOCl 45%	30	1	240	97	0.0115	300W XL (λ≥ 400 nm)	1
$BiVO_4$-4	20	1	90	81.22	——	300W XL (λ≥ 420 nm)	2
0.3-AgI/$BiVO_4$	20	0.4	100	~88	——	500W XL (λ≥ 420nm)	3
1.5 ZnO/rGO	20	0.5	120	——	0.0096	two non-halogen lamps (24 V, 250 W)	4
MP9% （pH = 2.0）	10	0.25	120	84		300W XL	5
B_{12}/AB 1:1	**50**	**0.5**	**60**	**74.83**	**0.0275**	**300W XL (λ≥ 420nm)**	**Our work**

Table S2 Possible degradation intermediates identified by LC–MS.

Number	Formula	RT (min)	m/z	Proposed structure
TC	$C_{22}H_{24}N_2O_8$	5.10	445.02	
P1	$C_{22}H_{24}N_2O_9$	5.30	459.13	
P2	$C_{22}H_{24}N_2O_{10}$	4.09	476.16	
P3	$C_{18}H_{18}NO_7$	3.66	362.13	

P4	$C_{15}H_9O_{11}$	2.09	373.06	
P5	$C_{16}H_{20}O_8$	4.56	340.18	
P6	$C_{23}H_{24}N_2O_{11}$	8.61	516.11	
P7	$C_{23}H_{24}N_2O_{12}$	7.97	521.21	
P8	$C_{21}H_{17}NO_{12}$	6.39	488.94	

P9	$C_{10}H_4O_8$	5.47	262.17	
P10	$C_8H_6O_8$	3.21	240.12	
P11	$C_{10}H_{12}O$	8.61	218.18	
P12	$C_3H_2O_5$	9.70	114.63	
P13	$C_2H_2O_4$	9.33	90.82	

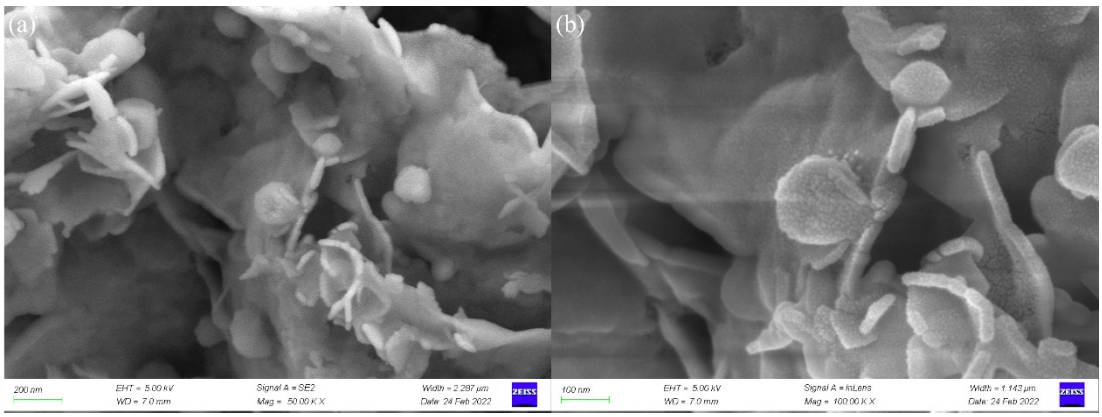


Fig. S1. SEM images of B_{12}/AB 1:1.

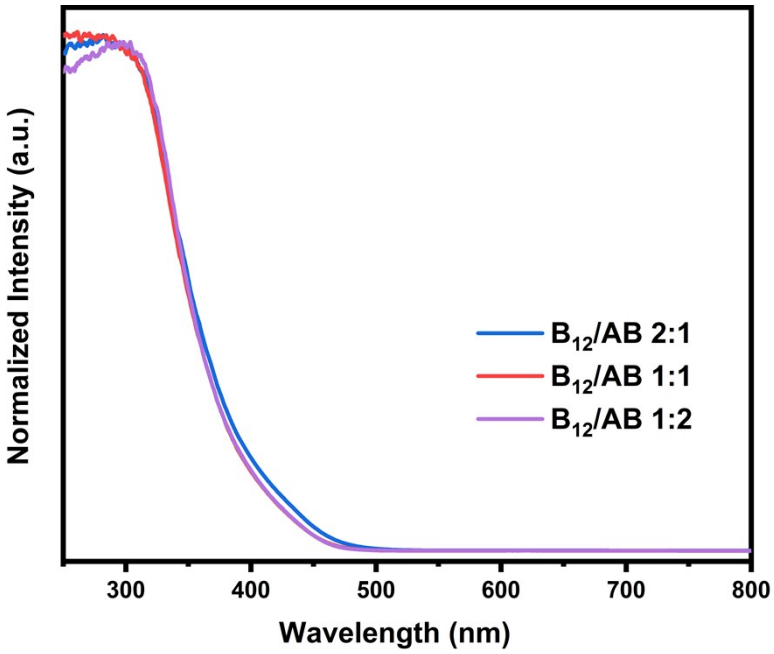


Fig. S2. Normalized UV Diffuse Reflectance Spectra of B12/AB x.

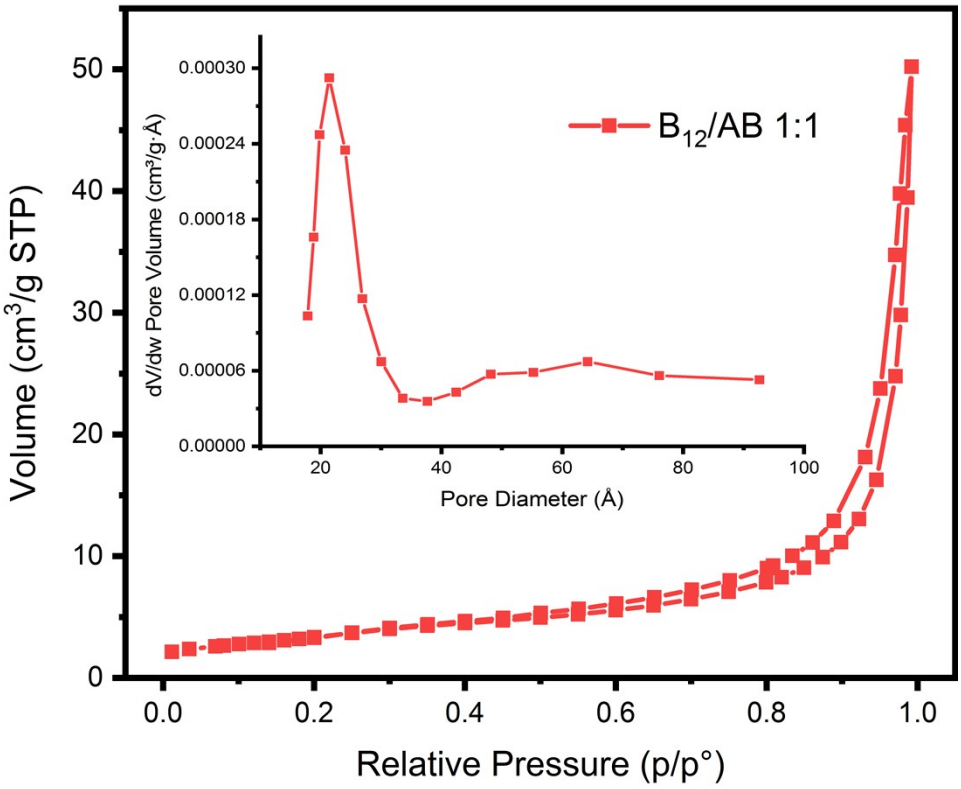


Fig. S3. N_2 adsorption-desorption isotherm of B_{12}/AB 1:1.

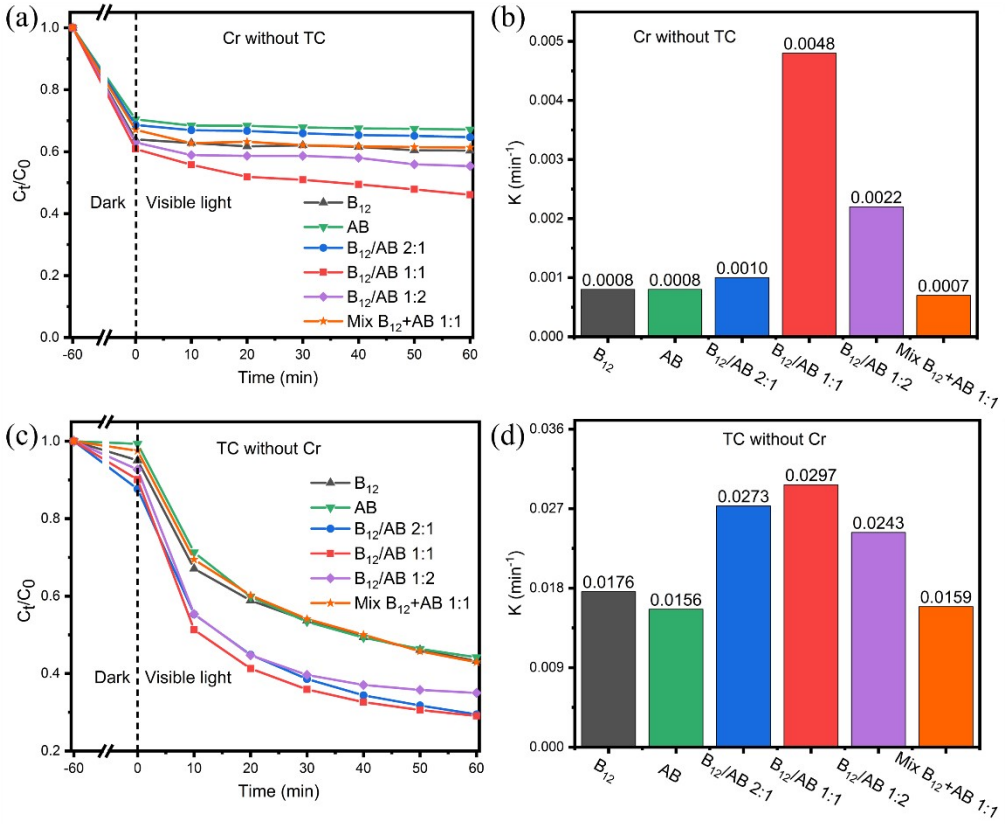


Fig. S4. Dynamic curves and the fitted kinetic constant K (min^{-1}) of photocatalytic reduction of Cr (VI) (a, b), degradation of TC (c, d) in individual Cr (VI), TC solutions.

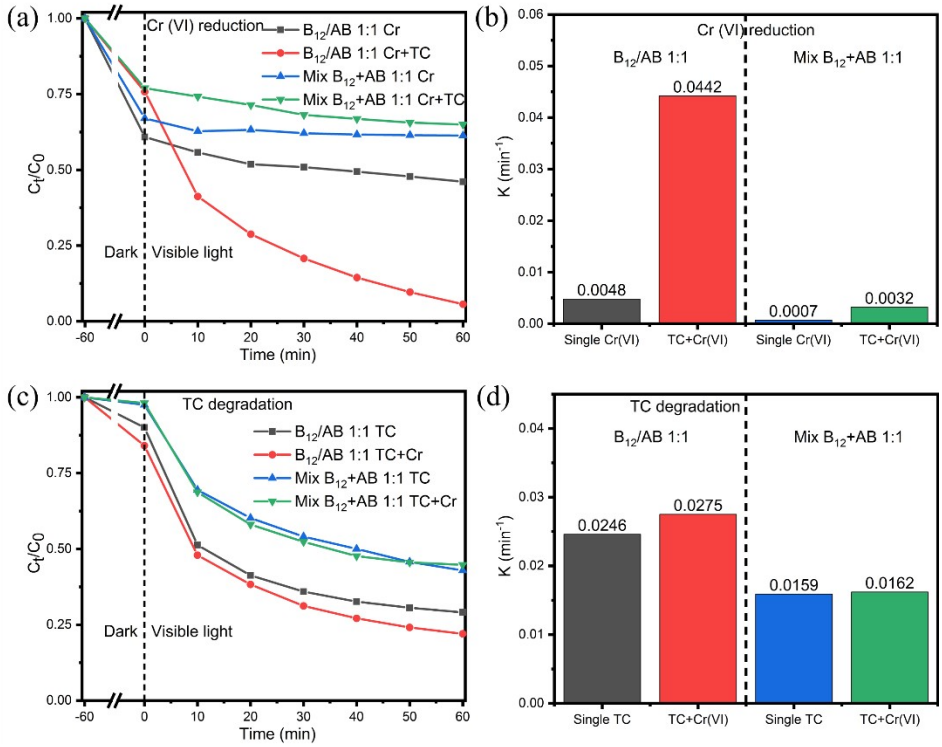


Fig. S5. Simultaneous removal of Cr (VI) (a, b) and TC (c, d) over B_{12}/AB 1:1 and Mix B_{12}+AB 1:1

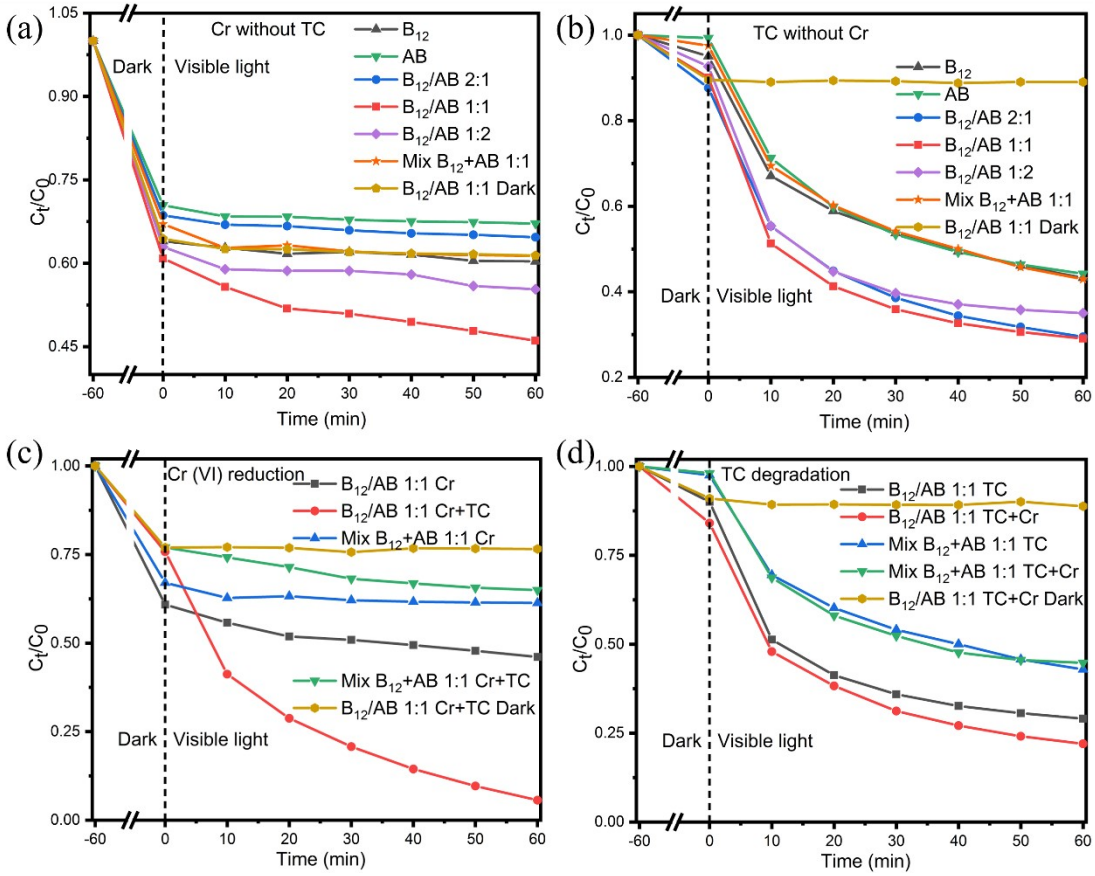


Fig. S6. Dynamic curves of photocatalytic activities with adsorption included.

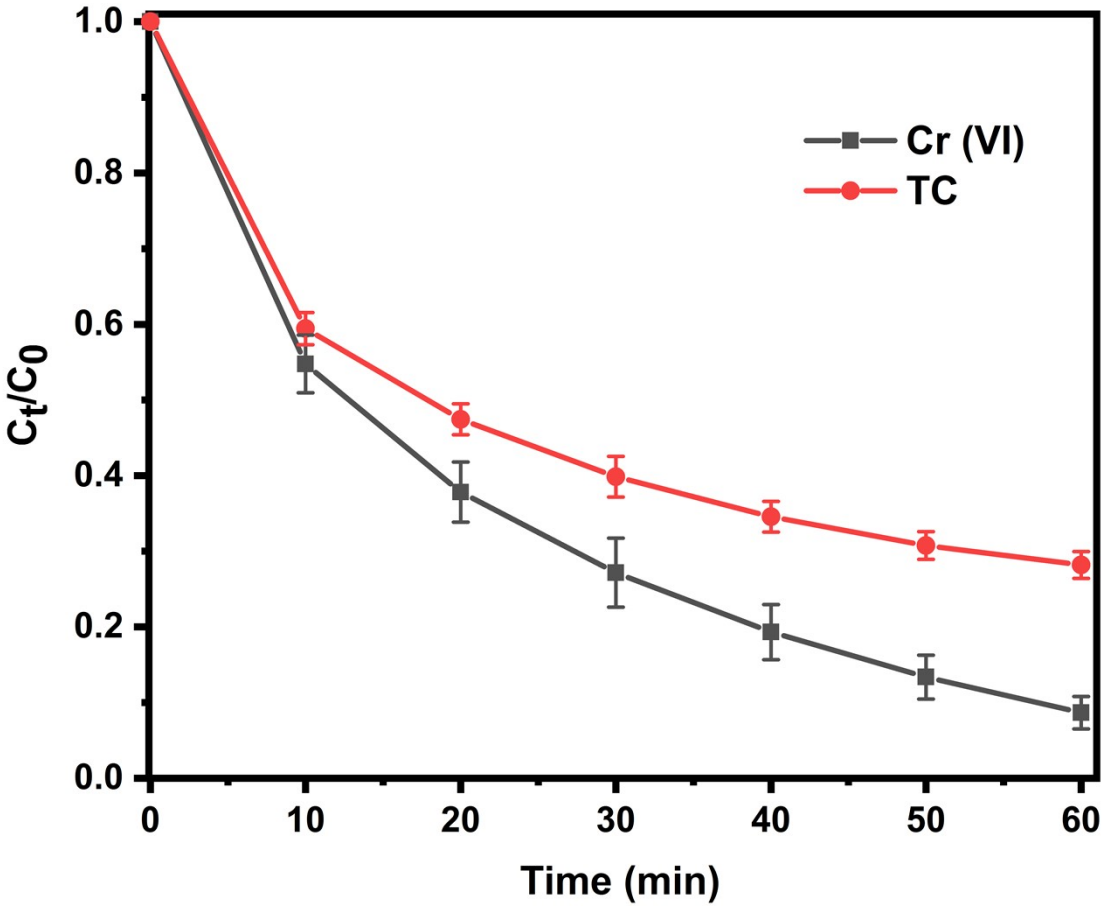


Fig. S7. Error curve of three-times repeated simultaneous Cr (VI) and TC removal over B_{12}/AB 1:1.

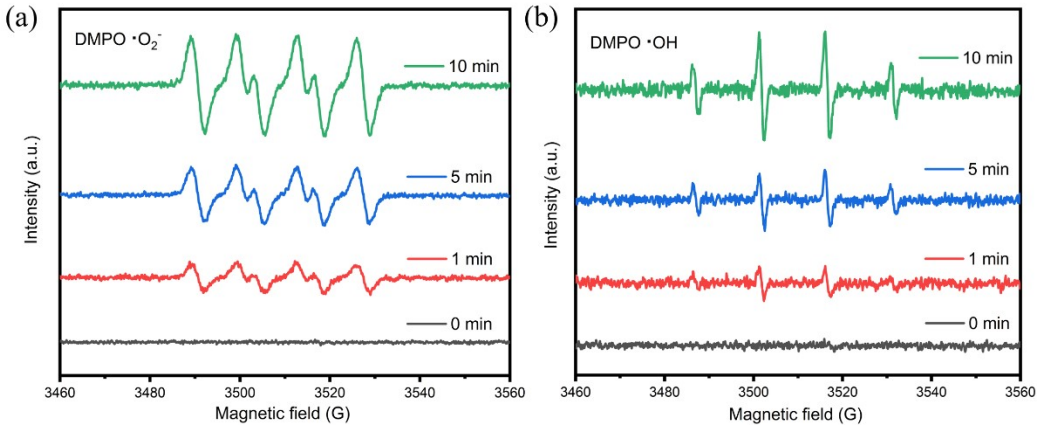


Fig. S8. EPR spectra of B_{12}/AB 1:1 under visible light irradiation ($\lambda \geq 420$ nm)

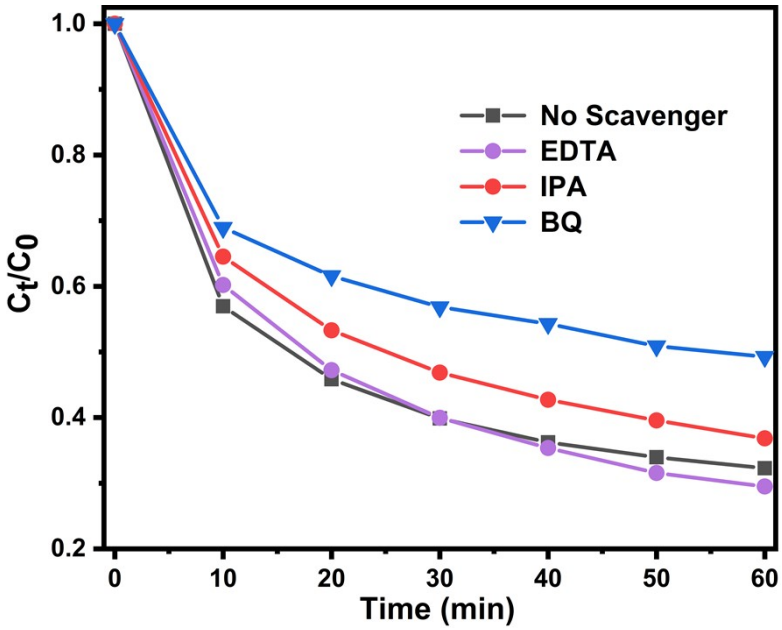


Fig. S9. Active species scavenger experiment of photocatalytic TC degradation over B_{12}/AB 1:1

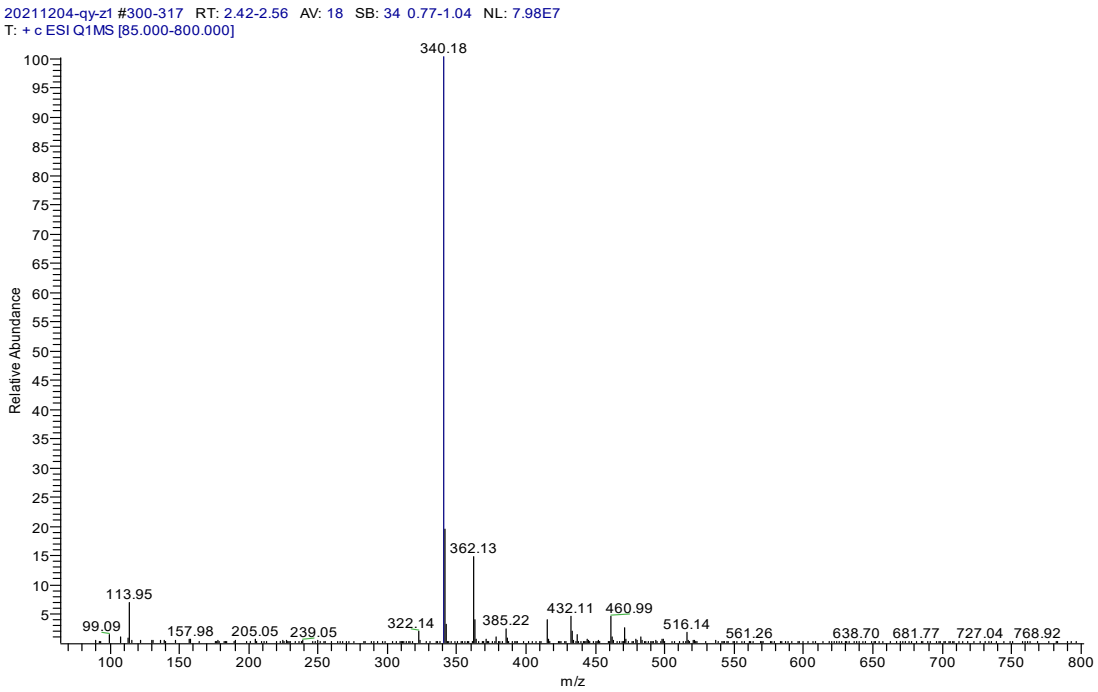


Fig. S10. Mass spectra of degradation intermediates of TC after 20 min degradation at 2.42-2.56 min retention time.

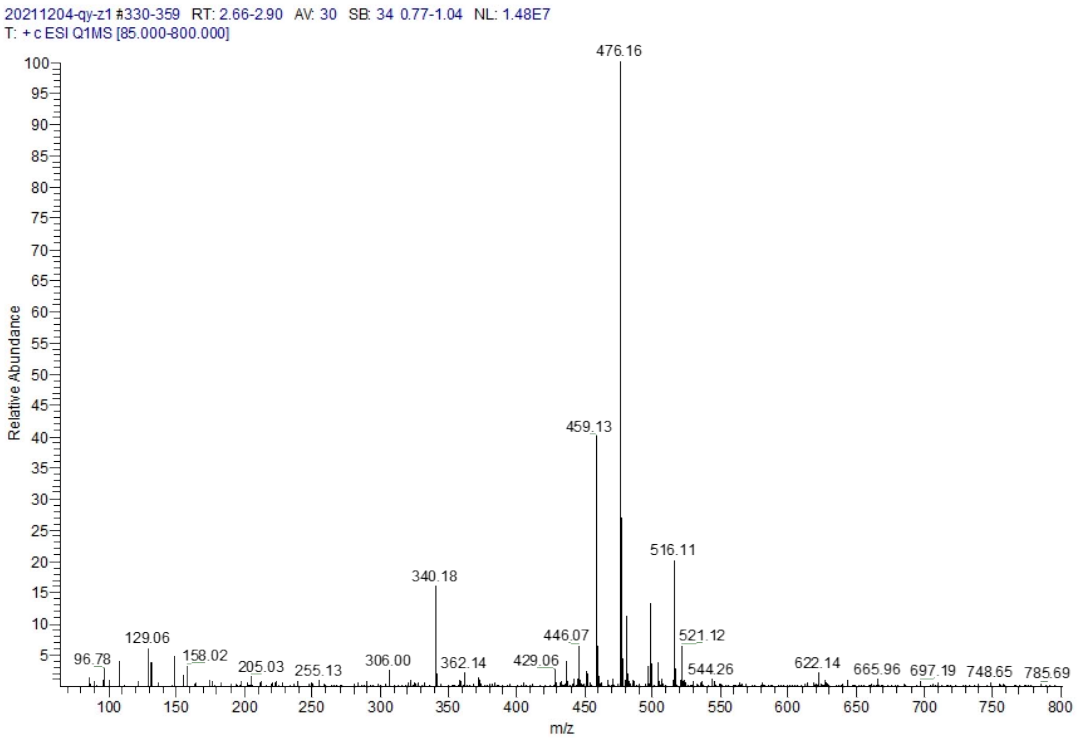


Fig. S11. Mass spectra of degradation intermediates of TC after 20 min degradation at 2.66-2.90 min retention time.

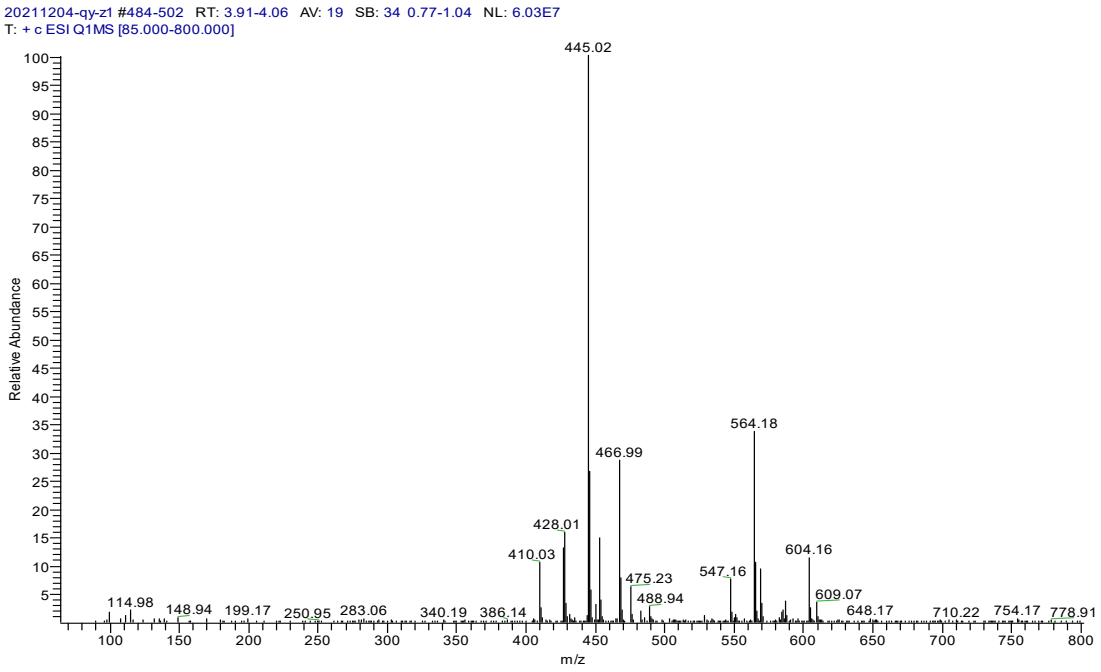


Fig. S12. Mass spectra of degradation intermediates of TC after 20 min degradation at 3.91-4.06 min retention time.

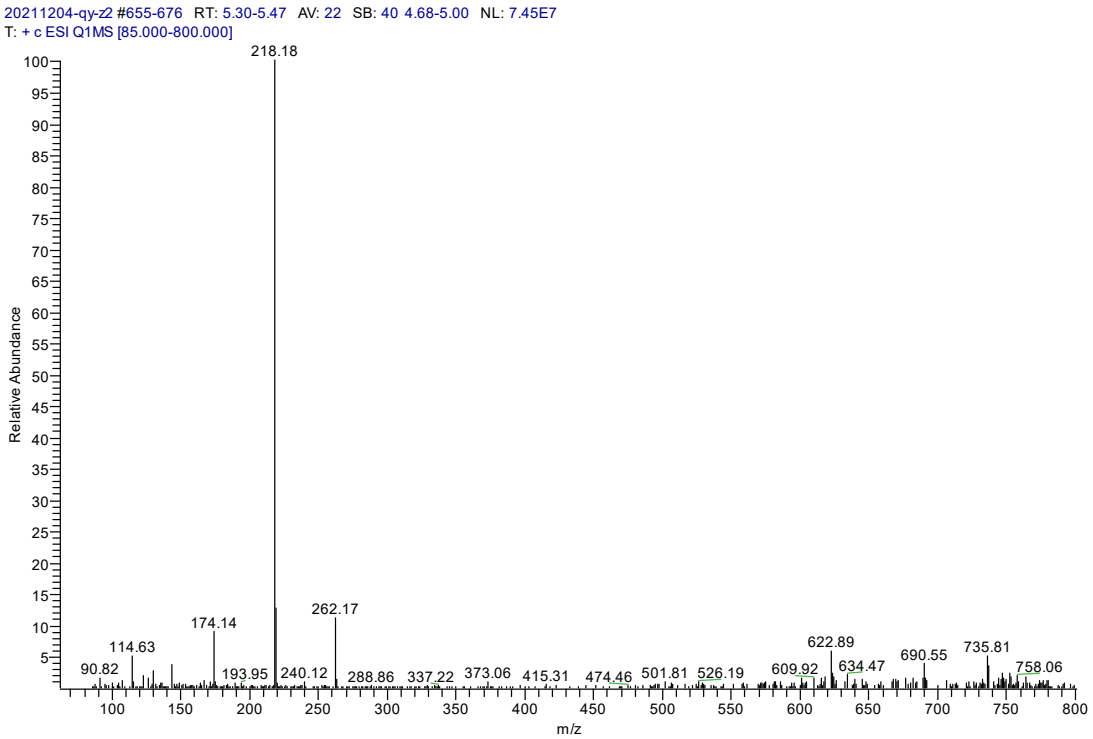


Fig. S13. Mass spectra of degradation intermediates of TC after 60 min degradation at 5.30-5.47 min retention time.

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