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Construction of SnS_2/TiO_2 S-scheme heterostructure photocatalyst for highly efficient photocatalytic degradation of tetracycline hydrochloride

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Analysis of TRPL spectra

The decay curves fitted by according to the exponential function [1]:

$$I = y_0 + B_1 e^{-t/\tau_1} + B_2 e^{-t/\tau_2} + B_3 e^{-t/\tau_3} + B_4 e^{-t/\tau_4} \quad \text{(S1)}$$

The normalized pre-exponential value is calculated by equation [2]:

$$B_i = \frac{B_i}{\sum_{i=1}^{n} B_i} \quad \text{(S2)}$$

The weighted average lifetime was calculated by the equation [3]:

$$\tau_{ave} = \sum_{i=1}^{n} B_i \tau_i \quad \text{(S3)}$$

The fitted lifetimes and the corresponding percentages of TiO_2, and ST-30 are shown in Table S1.

Fig.S1

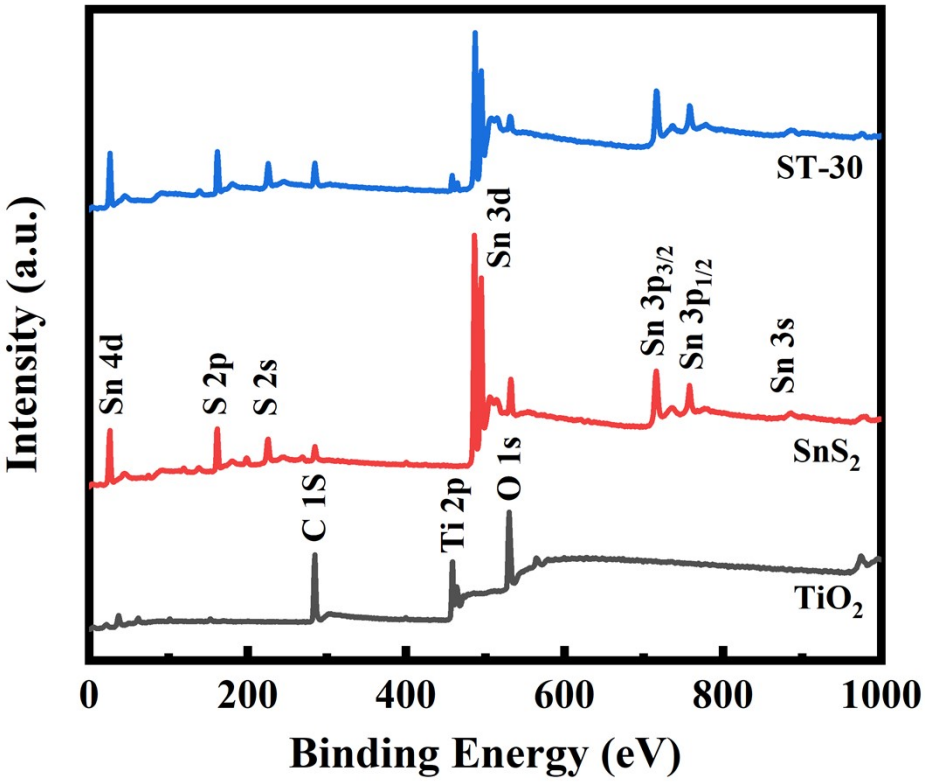


Fig.S1 XPS spectra of TiO_2, SnS_2 and ST-30.

Fig.S2

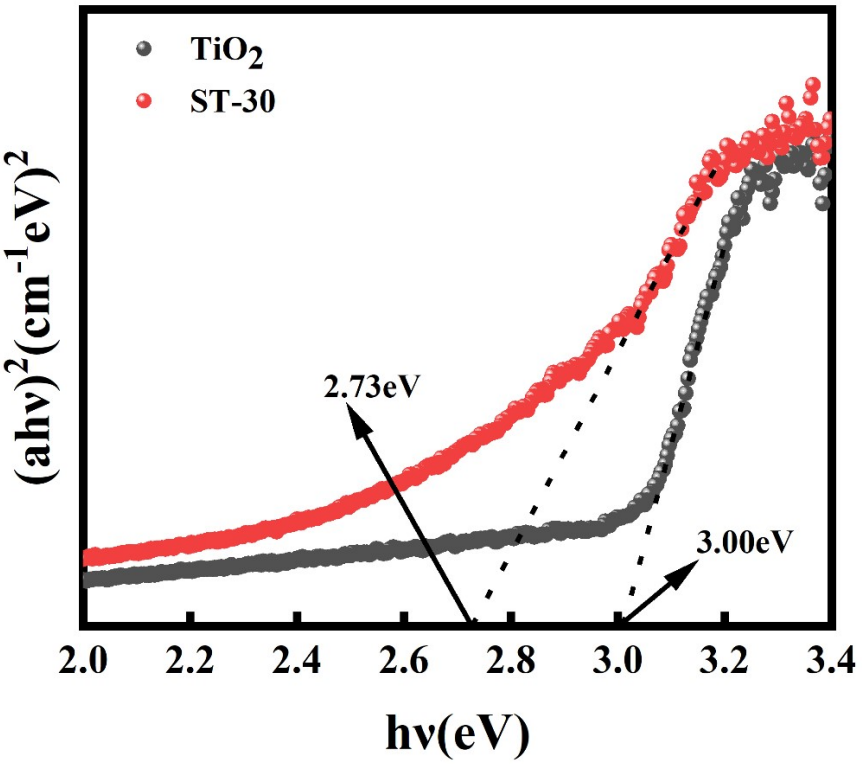


Fig.S2 Absorption edges of TiO_2 and ST-30.

Table.S1

	TiO_2	ST-30
τ_1	6.67E-10	5.95E-10
B_1	1.99E-02	1.82E-02
τ_2	6.26E-10	5.54E-10
B_2	2.12E-02	2.03E-02
τ_3	7.62E-09	8.37E-09
B_3	1.86E-04	1.38E-04
τ_4	1.62E-11	1.80E-11
B_4	4.04	3.30
τ_{ave}	2.28E-11	2.48E-11

Table.S1 The fitted lifetimes and the corresponding percentages of TiO_2 and ST-30.

Fig.S3

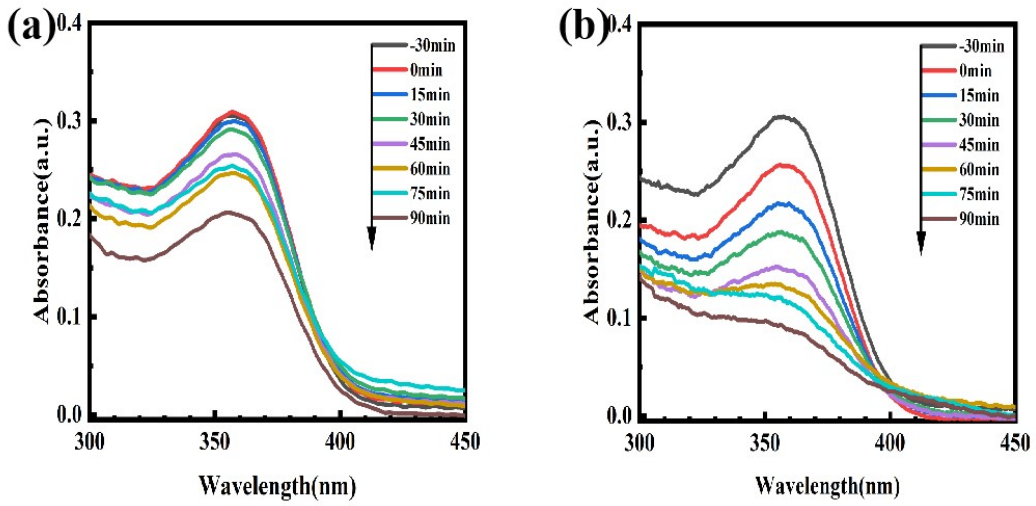


Fig.S3 The degradation curves of (a) TiO_2 and (b) ST-30.

Fig.S4

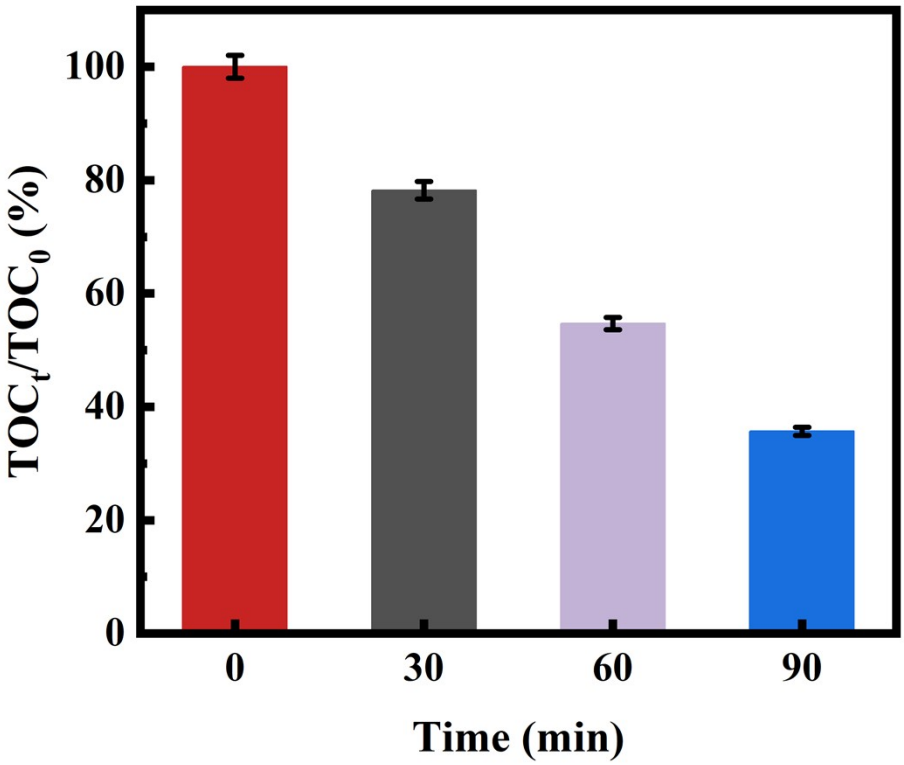


Fig.S4 Mineralization of TC-HCl by ST-30 at different degradation times.

Fig.S5

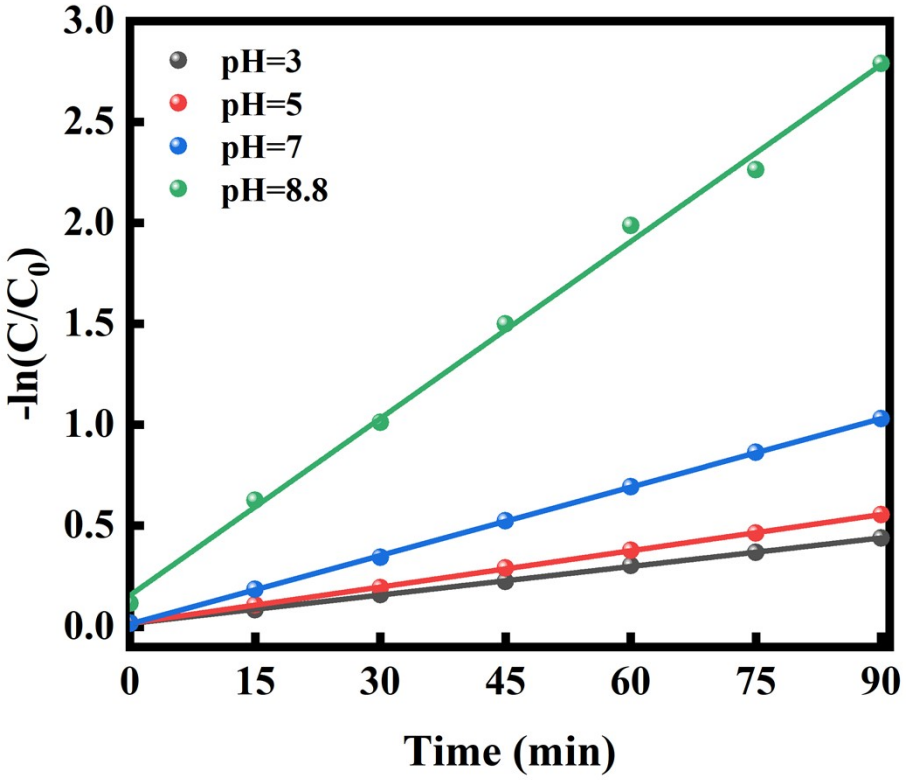
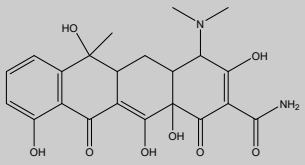
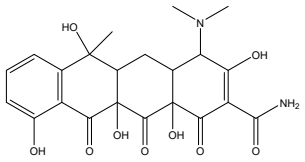
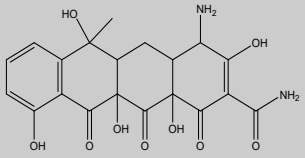
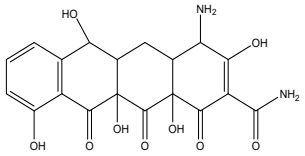
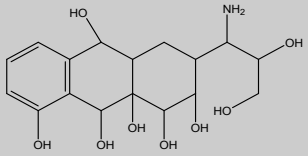
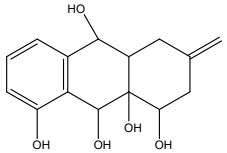
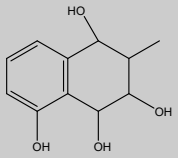
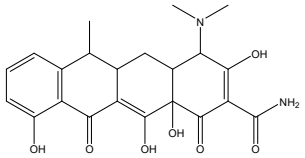
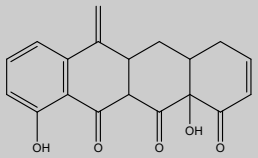
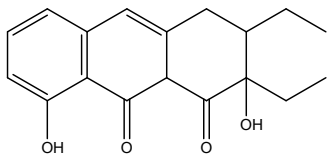


Fig.S5 The kinetic curves of ST-30 under different pH.

Table.S2 Detailed information of tetracycline hydrochloride and its intermediates

Compounds	m/z	Formula	Proposed structure
P0	445	$C_{22}H_{24}N_2O_8$	
P1	461	$C_{22}H_{24}N_2O_9$	
P2	433	$C_{20}H_{20}N_2O_9$	
P3	419	$C_{19}H_{18}N_2O_9$	
P4	371	$C_{17}H_{25}NO_8$	
P5	279	$C_{15}H_{18}O_5$	
P6	210	$C_{11}H_{14}O_4$	
P7	427	$C_{22}H_{24}N_2O_7$	
P8	324	$C_{19}H_{16}O_5$	
P9	299	$C_{18}H_{20}O_4$	

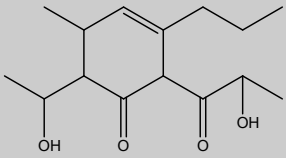
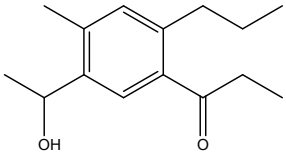
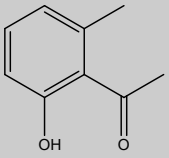
P10	268	$C_{15}H_{24}O_4$	
P11	234	$C_{15}H_{22}O_2$	
P12	149	$C_9H_{10}O_2$	

Fig.S6

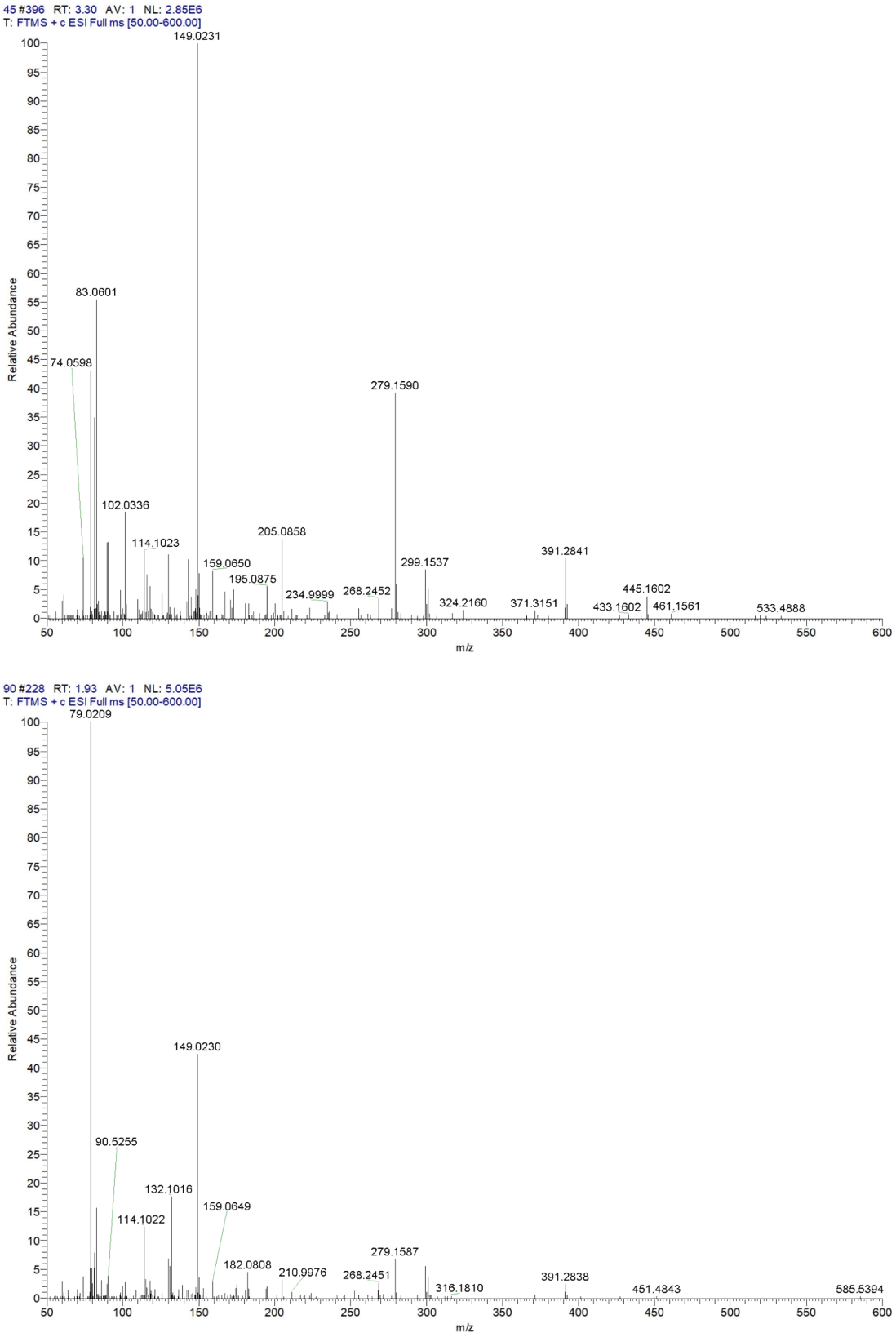


Fig.S6 MS spectra of the tetracycline hydrochloride at 45min and 90min over ST-30.

Table.S3 Toxicological values of tetracycline hydrochloride and intermediates predicted by TEST.

Product	m/z	Fathead minnow LC_{50} 96 hr (mg/L)	Daphnia magna LC_{50} (48 hr) (mg/L)	Oral rat LD_{50} (mg/kg)	Developmental Toxicity	Mutagenicity
P0	445	0.90	8.73	1068.64	0.86	0.60
P1	461	7.44	34.62	1529.48	0.85	0.66
P2	433	12.12	35.94	2090.36	0.94	0.70
P3	419	1.65	18.72	2129.54	0.91	0.84
P4	371	33.28	120.54	4130.20	0.44	0.69
P5	279	11.01	8.02	N/A	0.68	0.45
P6	210	200.06	41.05	777.59	0.66	0.07
P7	427	0.33	1.68	1363.25	0.90	0.64
P8	324	0.37	12.18	2232.11	0.85	0.44
P9	299	0.21	12.72	356.51	0.89	0.48
P10	268	14.55	154.92	314.80	0.75	0.06
P11	234	2.26	7.33	1073.70	0.75	0.20
P12	149	22.88	5.03	1480.12	0.49	0.04

Fig.S7

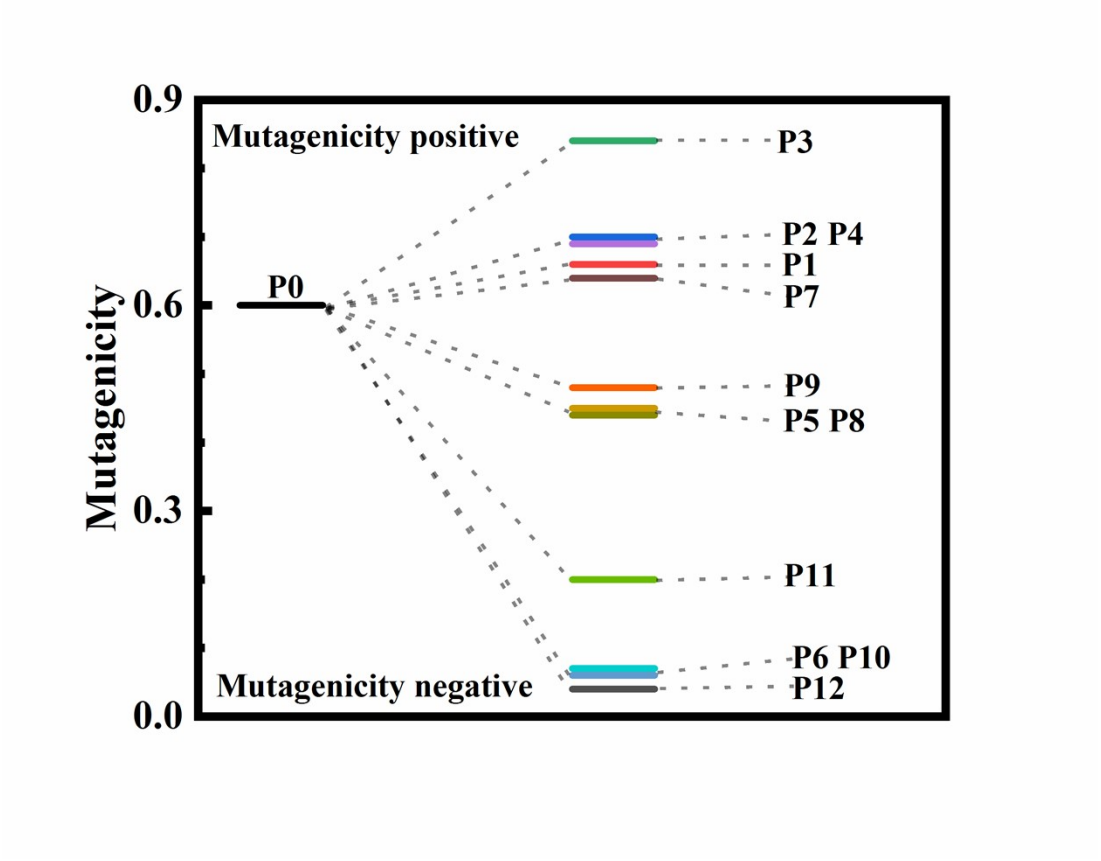


Fig.S7 Toxicity evaluation results of mutagenicity.