Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

Supporting information

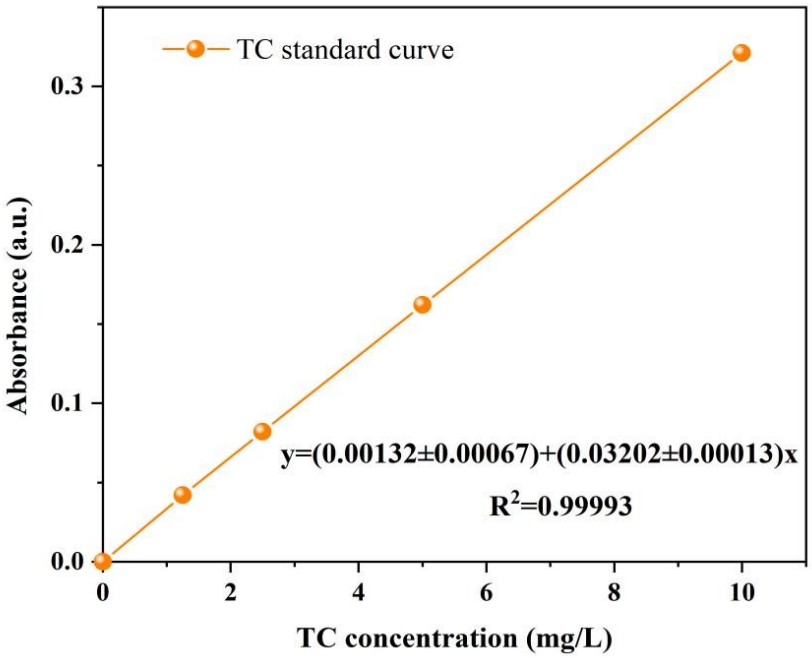

Figure S1. TC standard curve for absorbance and concentration.

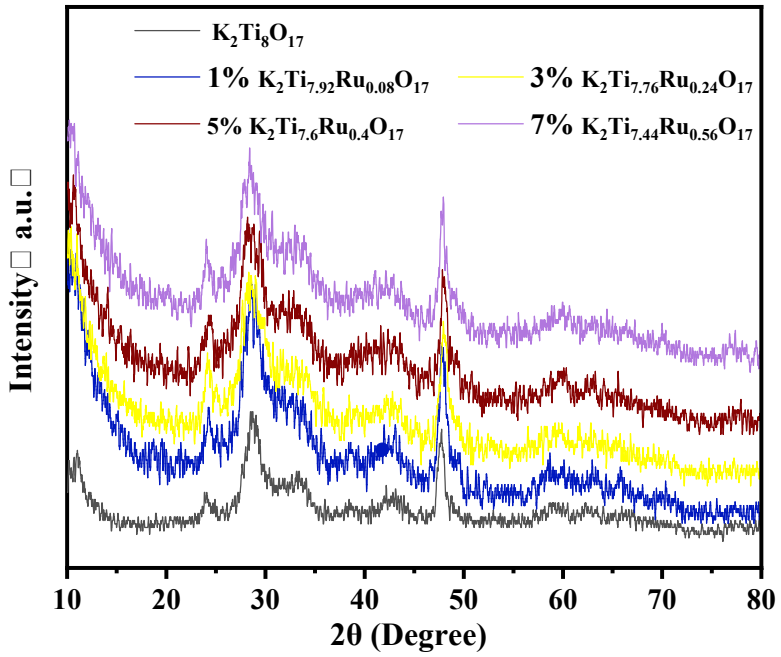

Figure S2. The powder XRD patterns of the $K_2Ti_{8-x}Ru_xO_{17}$ precursors with different doping concentrations (Ru:(Ru+Ti)=0%, 1%, 3%, 5%, 7%).

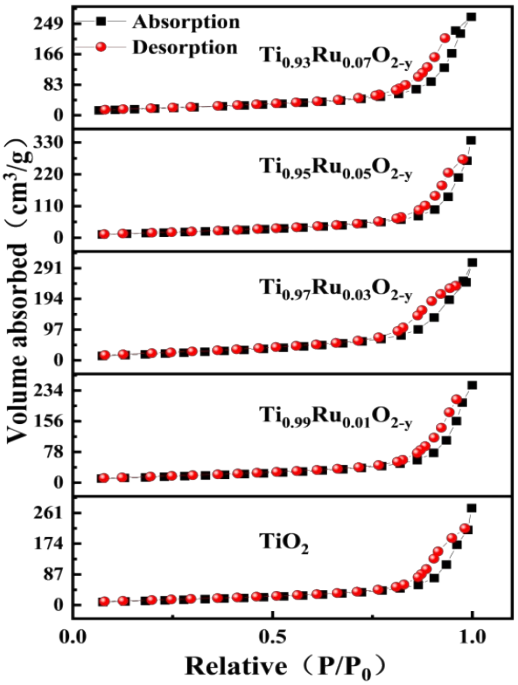

Figure S3. N_2 adsorption-desorption isotherms of $Ti_{1-x}Ru_xO_{2-y}$ with different molar ratios (Ru:(Ru+Ti)=0%, 1%, 3%, 5%, 7%).

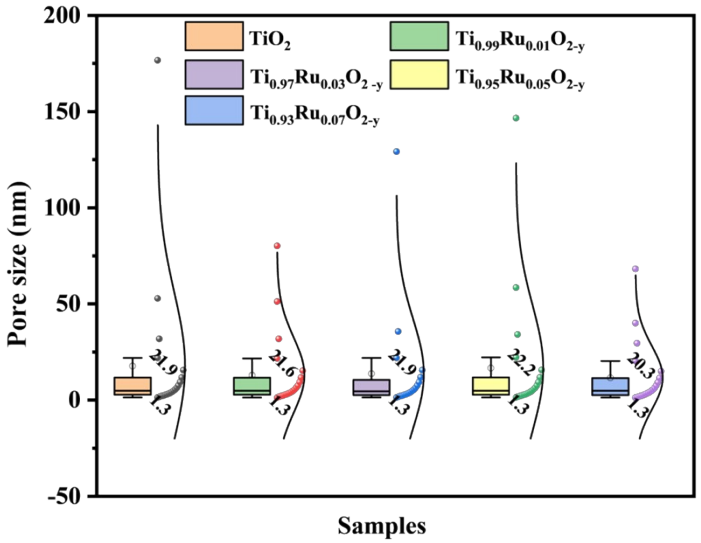

Figure S4. Pore size distribution of $Ti_{1-x}Ru_xO_{2-y}$ with different molar ratios (Ru:(Ru+Ti)=0%, 1%, 3%, 5%, 7%).

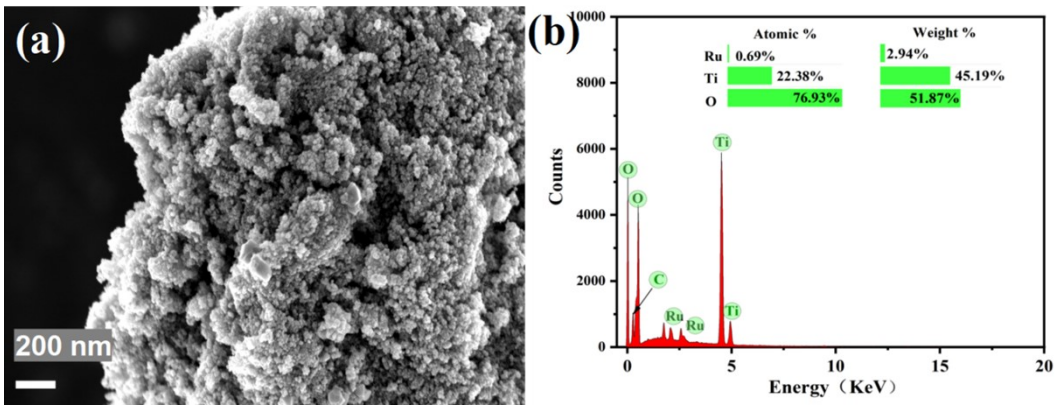

Figure S5. (a) SEM of $Ti_{0.95}Ru_{0.05}O_{2-y}$. (b) EDS of $Ti_{0.95}Ru_{0.05}O_{2-y}$.

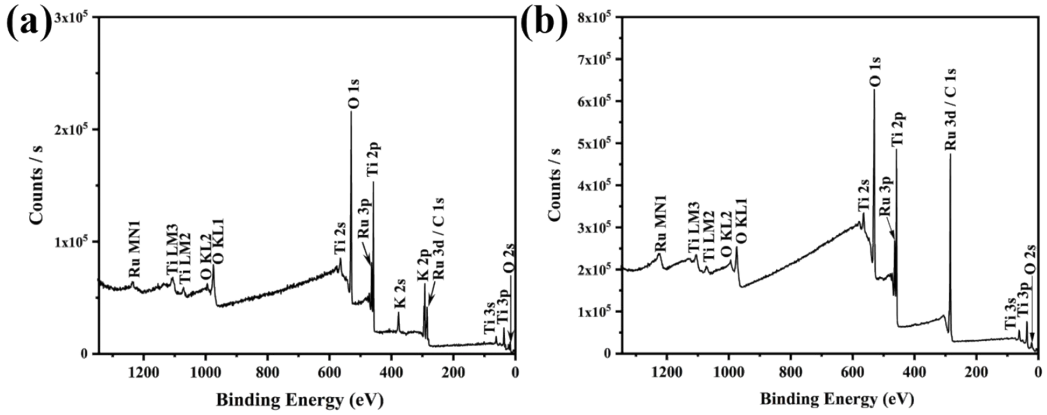

Figure S6. XPS survey spectra of (a) $K_2Ti_{7.6}Ru_{0.4}O_{17}$ and (b) $Ti_{0.95}Ru_{0.05}O_{2-y}$.

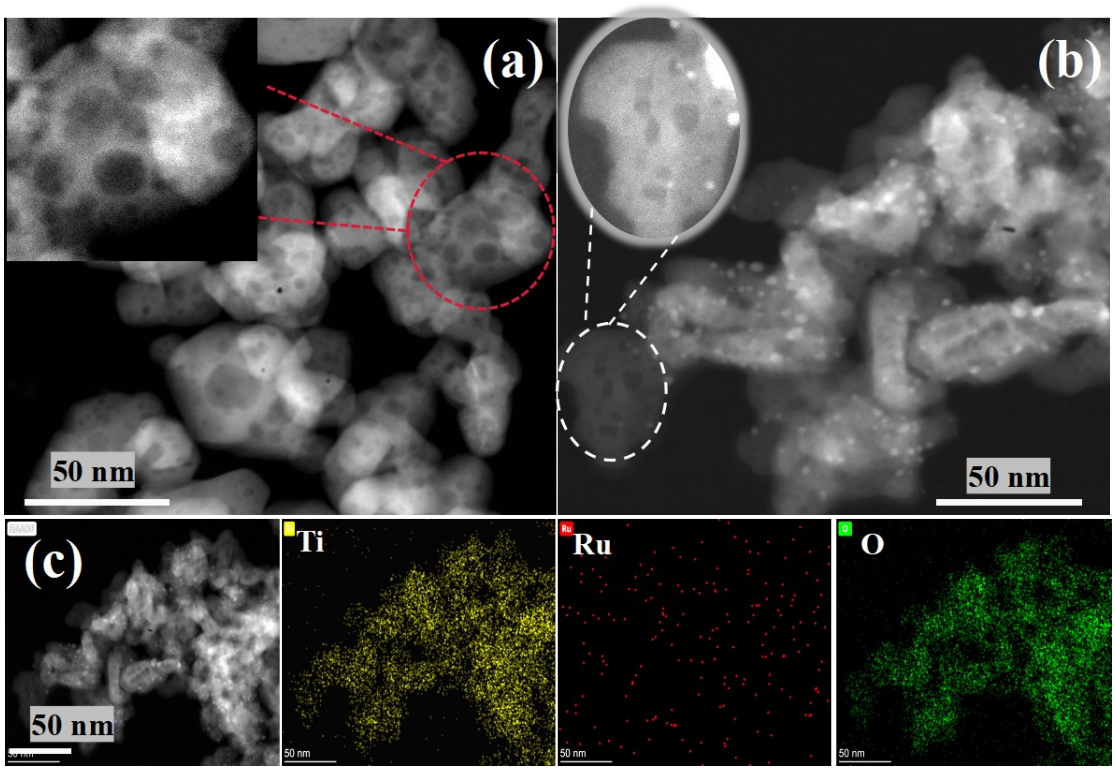

Figure S7. (a) High-angle annular dark-field scanning transmission electron microscopy (HAADF-STEM) of TiO_2. (b) HAADF-STEM of $Ti_{0.95}Ru_{0.05}O_{2-y}$. (c) Mapping of $Ti_{0.95}Ru_{0.05}O_{2-y}$.

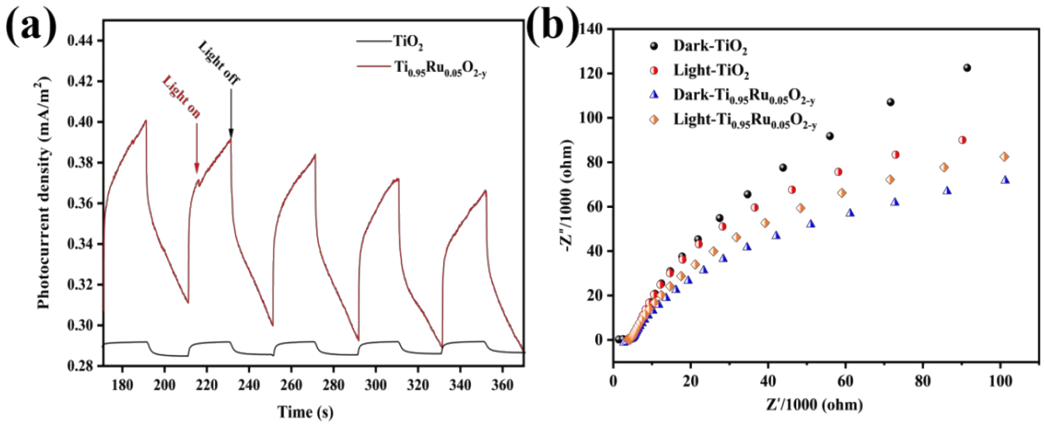

Figure S8. (a) Transient photocurrent response and (b) the EIS Nyquist plots of TiO_2 and $Ti_{0.95}Ru_{0.05}O_{2-y}$.

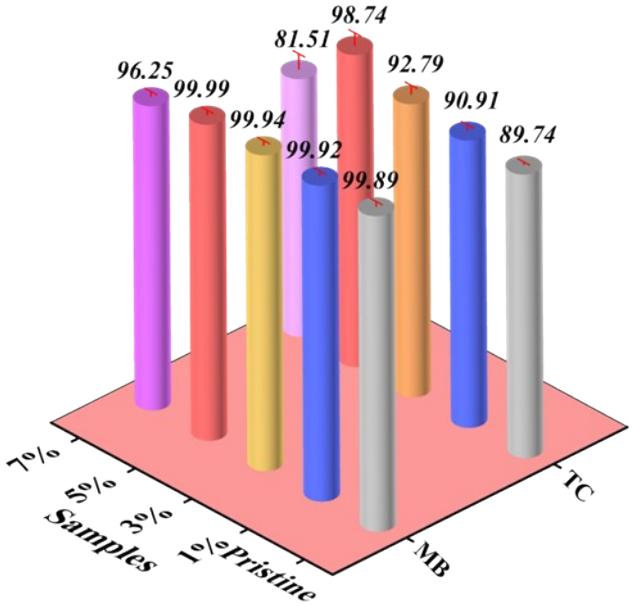

Figure S9 The photocatalytic degradation rate statistics of TC and MB by $Ti_{1-x}Ru_xO_{2-y}$.

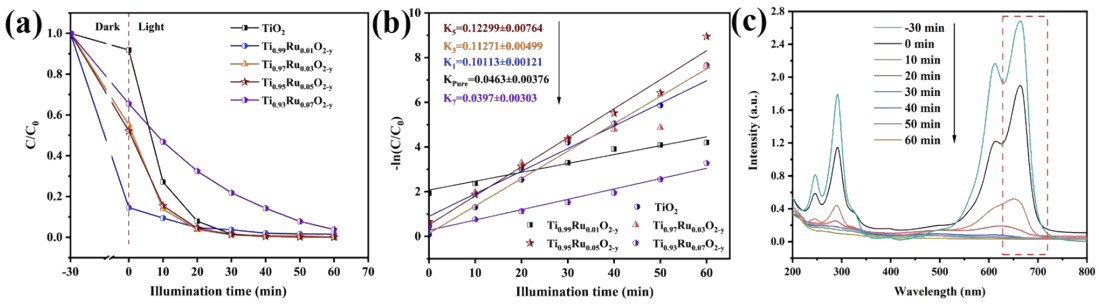

Figure S10. Photocatalytic degradation of MB of $Ti_{1-x}Ru_xO_{2-y}$ under simulated sunlight: (a) degradation efficiency of MB (Initial conditions: 20 mg/L MB, 1 g/L catalysts.). (b) reaction kinetics of MB photodegradation curve. (c) UV-vis absorption spectrum of $Ti_{0.95}Ru_{0.05}O_{2-y}$ photocatalytic degradation of MB.

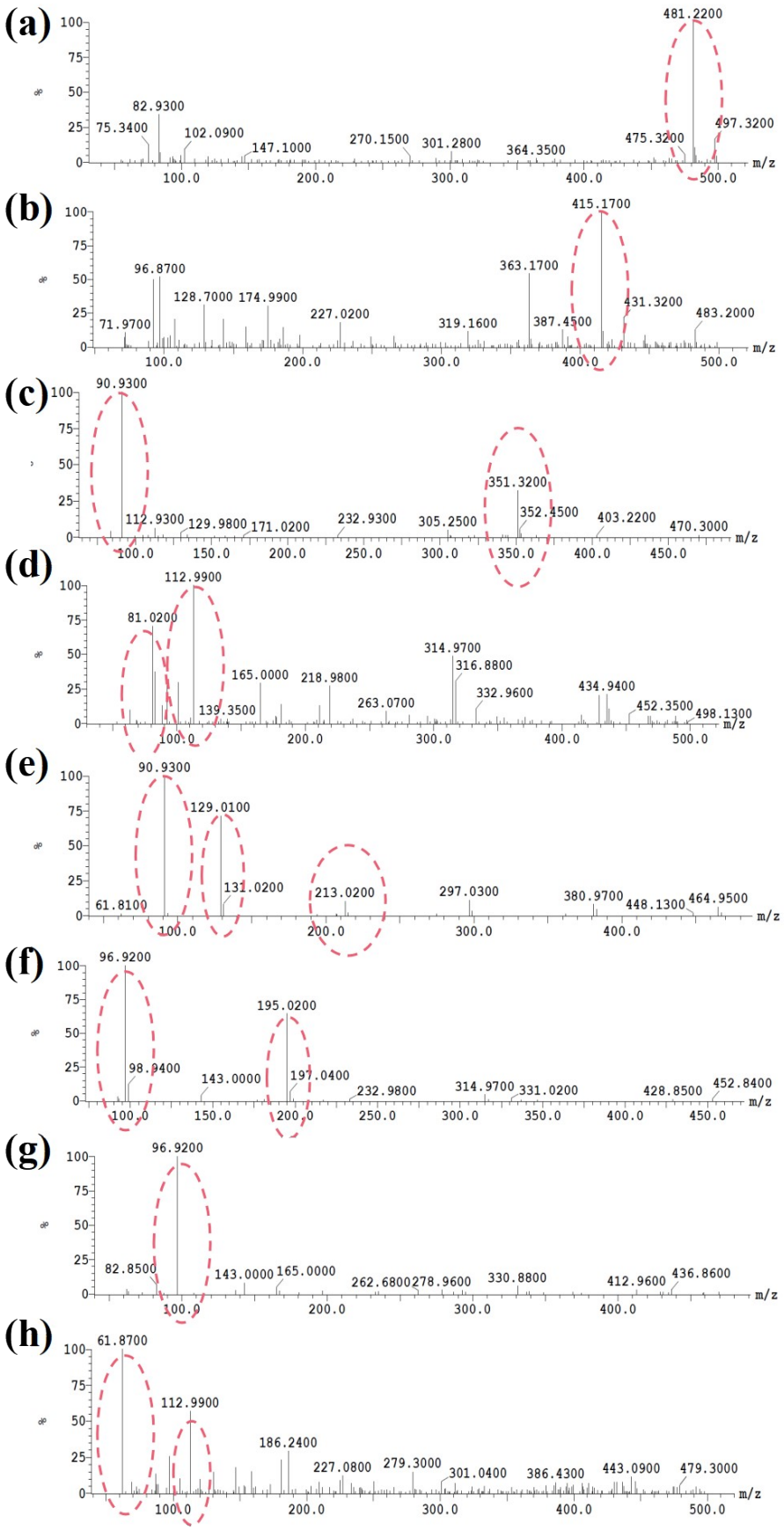

Figure S11 HPLC-MS of photocatalytic degradation TC by $Ti_{0.95}Ru_{0.05}O_{2-y}$ in different reaction time periods. (a) 30 min, peak time: 7.38 min. (b) 40 min, peak time: 10.50 min. (c) 40 min, peak

time: 15.07 min. (d) 70 min, peak time: 2.52 min. (e) 50 min, peak time: 8.72 min. (f) 50 min, peak time: 1.67 min. (g) 70 min, peak time: 1.68 min. (h) 50 min, peak time: 7.82 min.

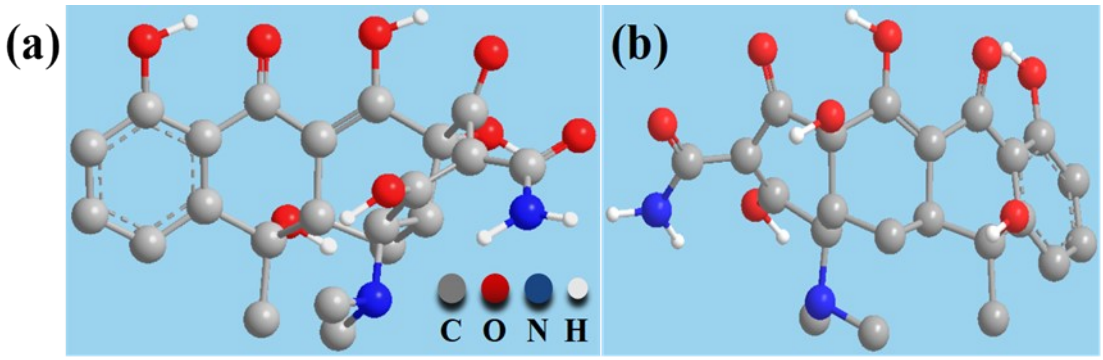

Figure S12 (a) and (b) Chemical structural formula of tetracycline hydrochloride from different perspective.

Table S1. Specific surface area of $Ti_{1-x}Ru_xO_{2-y}$ with different molar ratios.

$Ti_{1-x}Ru_xO_{2-y}$	TiO_2	$Ti_{0.99}Ru_{0.01}O_{2-y}$	$Ti_{0.97}Ru_{0.03}O_{2-y}$	$Ti_{0.95}Ru_{0.05}O_{2-y}$	$Ti_{0.93}Ru_{0.07}O_{2-y}$
Specific surface area (m^2/g)	55.74	73.74	69.34	71.86	79.63

Table S2. Related parameters of ICP-AES

Samples	Element	Weight/g	Volume/ ml	Dilution factor	Instrument indication mg/L	Concentration/ mg/kg
$K_2Ti_{7.6}Ru_{0.4}O_{17}$	Ru	0.0408	50	50	0.592	36116.1208
$K_2Ti_{7.6}Ru_{0.4}O_{17}$	Ti	0.0408	50	50	5.7969	355203.6788
$Ti_{0.95}Ru_{0.05}O_{2-y}$	Ru	0.0563	50	10	7.225	64165.8035
$Ti_{0.95}Ru_{0.05}O_{2-y}$	Ti	0.0563	50	50	14.1216	627069.8474

Table S3. The degradation rates of TC, kinetic constants k value and correlation coefficient under different catalysts.

Photocatalysts	Light source	Degradation rate	k /min^{-1}	References
Bi_2WO_6	Visible	77.1%	0.021	[24]
$NaTaO_3@WO_3$	Visible	60.9%	None	[25]
Sb_2O_3	UV	80.6%	None	[26]
g-C_3N_4/$LaCoO_3$	UV-Vis	92.0%	0.019	[27]
$Pb_4(BO_3)_2SO_4$	UV-Vis	90.6%	0.216	[28]
l-$ZnFe_2O_4$	Visible	84.1%	0.067	[29]
N-TiO_2	UV	94.8%	0.038	[30]
Ag@SnO_2/TiO_2	Simulated sunlight	83.1%	0.057	[31]
Ag-Bi_2MoO_6/TiO_2	Simulated sunlight	90.8%	0.020	[32]
TiO_2/GO	Visible	53.6%	None	[33]
$Ti_{0.95}Ru_{0.05}O_{2-y}$	Simulated sunlight	98.7%	0.078	This work