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Supplementary Materials

Fabrication of Sm_2O_3/In_2S_3 photocatalyst for boosting Ciprofloxacin oxidation and Cr (VI) reduction: Process parameters and degradation mechanism

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Table S1. Crystallite size of different photocatalysts

Nanomaterial	Dislocation density $\delta \times 10^{-3}$ nm^{-2}	Microstrain $\varepsilon \times 10^{-3}$	Crystallite size (D) nm	Stacking fault (degree)
Sm_2O_3/20 wt% In_2S_3	1.96	13.26	22.58	0.009203
Sm_2O_3 /15wt% In_2S_3	1.21	4.85	28.69	0.00544
Sm_2O_3/10wt% In_2S_3	1.28	8.79	27.94	0.00603
Sm_2O_3/5wt% In_2S_3	1.53	5.77	25.41	0.003988
In_2S_3	2.07	12.62	24.27	0.008816
Sm_2O_3	1.69	6.08	21.98	0.006419

Text S1 Materials

All chemicals (analytical grade reagents), including the precursors, indium nitrate pentahydrate ($In(NO_3)_3.10H_2O$), samarium nitrate hexahydrate ($Sm(NO_3)_3.6H_2O$), urea ($CS(NH_2)_2$), sodium hydroxide (NaOH), hydrochloric acid (HCl, 37%), and model pollutants $K_2Cr_2O_7$ (99.0%), and ciprofloxacin ($C_{17}H_{18}FN_3O_3$) were purchased from Sigma Aldrich, India. Sodium hydroxide (NaOH, 40 g mol^{-1}), sodium chloride (NaCl, 58.44 g mol^{-1}), sodium sulfate (Na_2SO_4 142.04 g mol^{-1}), disodium hydrogen phosphate (Na_2HPO_4 141.96 g mol^{-1}), tri-sodium phosphate (Na_3PO_4, 169.93 g mol^{-1}) sodium carbonate (Na_2CO_3, 105.99 g mol^{-1}), and sodium bicarbonate ($NaHCO_3$, 84.01 g mol^{-1}) were also received from Sigma Aldrich, India. All chemicals and reagents were used directly without any further purification.

Text S2 Analytical Characterization

Powder X-ray diffraction (XRD) was used to determine the phase purity and crystalline structure of the prepared materials. X-ray powder diffraction (XRD) patterns were collected on PANalytical X'Pert PRO powder X-ray Diffractometer with Cu Kα radiation (λ=1.5418 Å) in the diffraction angle range 2θ = 20-80º. The accelerating voltage and emission current were 40 kV and 30 mA. Surface morphology and microstructure analysis were performed using CARL ZEISS scanning electron microscopy (SEM) and energy-dispersive X-ray analysis (EDS) using the AMETEK-EDAX (Z2e Analyzer) and Philips's transmission electron microscopy (PHILIPS CM 200 model). The qualitative elemental analysis and mapping were also obtained from an energy dispersive X-ray (EDS) spectrometer.

Optical properties of the synthesized materials were determined through UV–visible diffuse reflectance spectra (DRS), and these were recorded at room temperature by utilizing a Shimadzu UV-2450 spectrophotometer equipped with an integrating sphere using Ba_2SO_4 as the standard reflectance. Further, Brunauer-Emmett-Teller (BET) specific surface area of the samples were determined by nitrogen adsorption - desorption. Photoluminescence (PL) spectra were also recorded by using a Cary Eclipse fluorescence spectrometer. The detailed qualitative chemical analysis was carried out by X-ray photoelectron spectroscopy (XPS). XPS analysis was performed using a Thermo Scientific Multi-Lab 2000 instrument with an Al Ka monochromator (1486.6 eV) as a radiation source. Electrochemical impedance spectroscopy (EIS) analysis was determined on an electrochemical workstation CHI660E using a standard three-electrode system, with glassy carbon (GC) as the working electrode, platinum wire as the counter electrode and Ag/AgCl as the reference electrode.

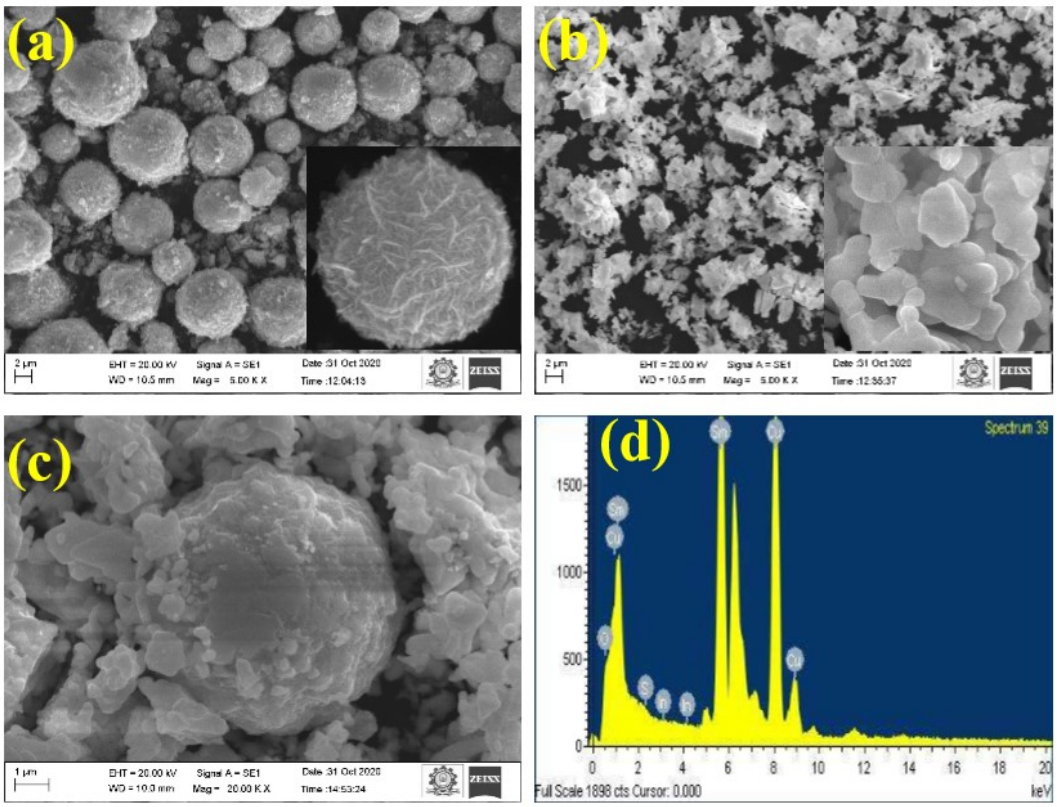


Figure S1. SEM images of (a) In_2S_3, (b) Sm_2O_3, (c) Sm_2O_3/15 wt % In_2S_3 and (d) EDS spectrum of Sm_2O_3/15 wt % In_2S_3.

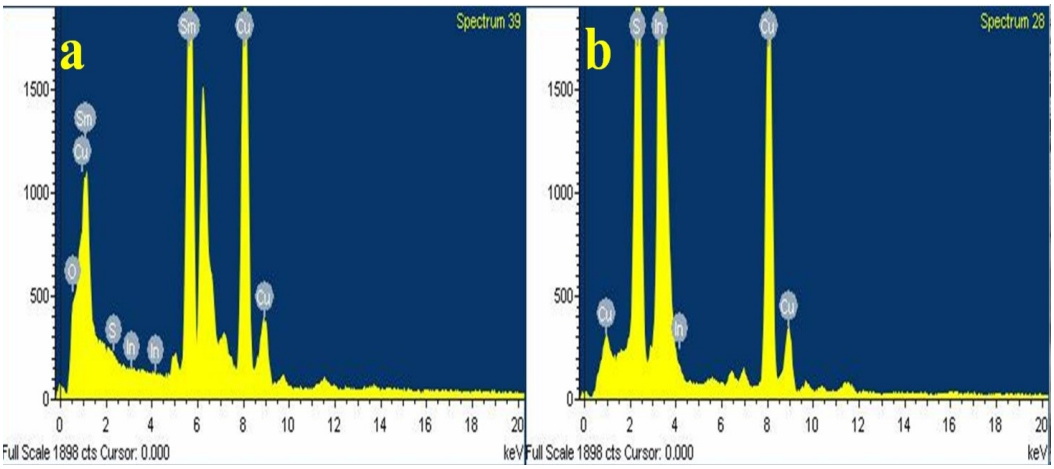
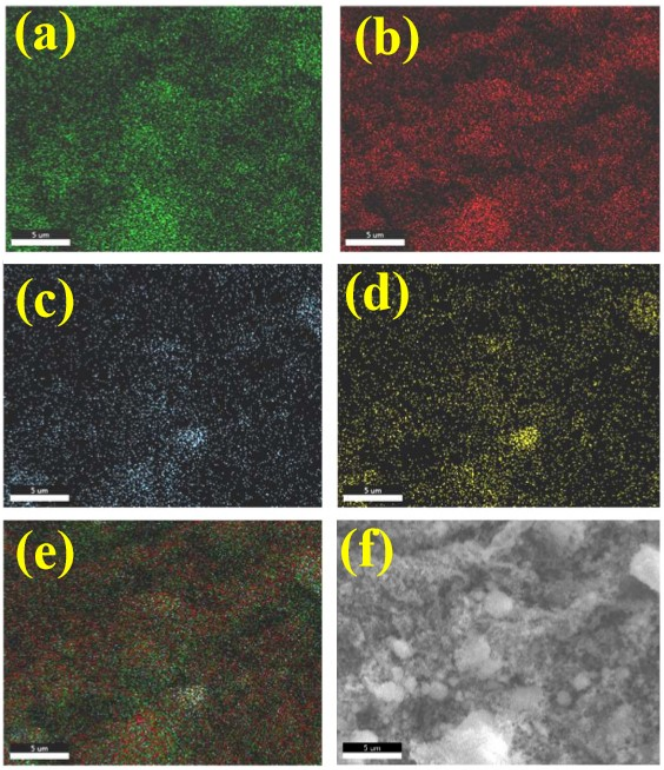


Figure. S2. EDX Spectra of (a) In_2S_3 and (b) Sm_2O_3



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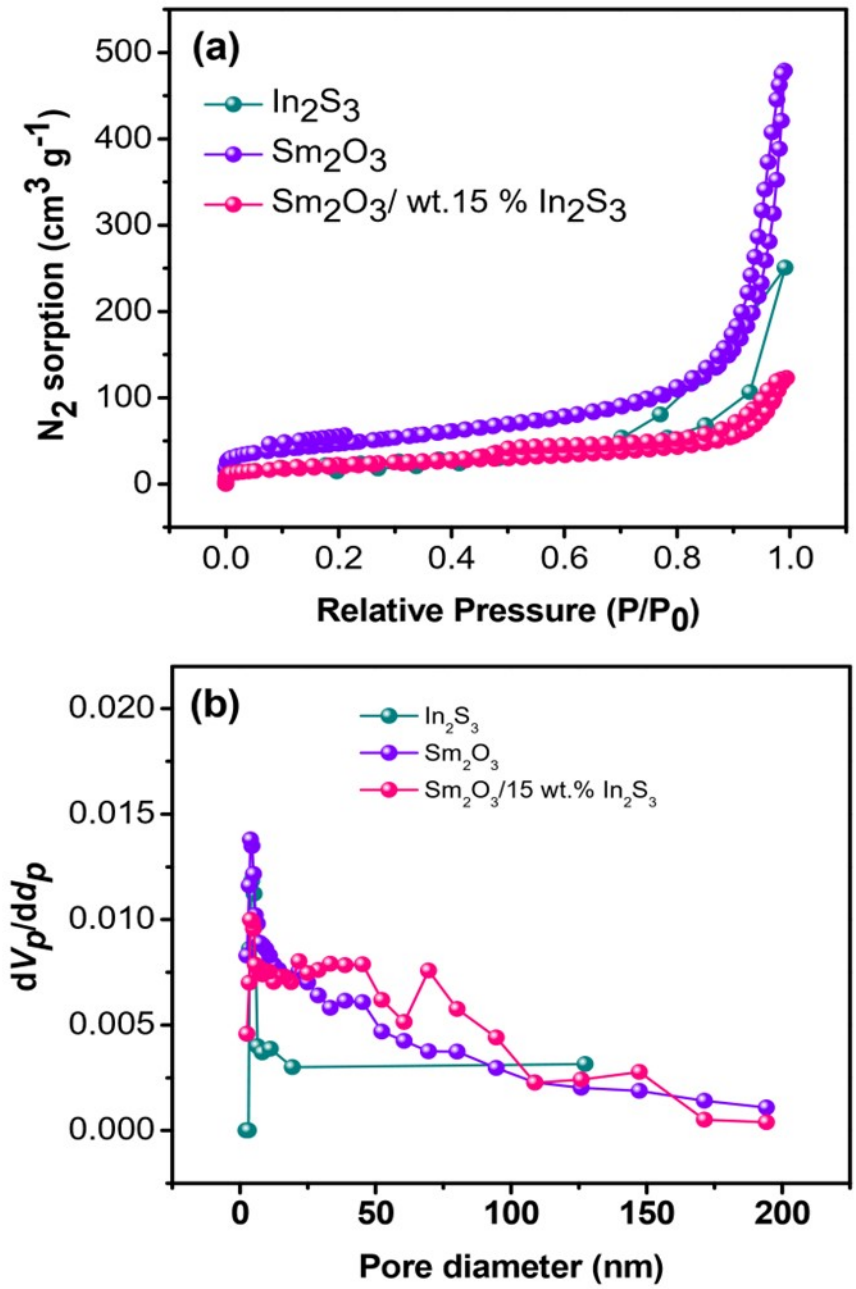

Figure. % In_2S_3.

Figure. S4 (a) N_2 adsorption/desorption, and (b) pore size distribution profiles of In_2S_3, Sm_2O_3, and Sm_2O_3/15 wt % In_2S_3 nanocomposite.

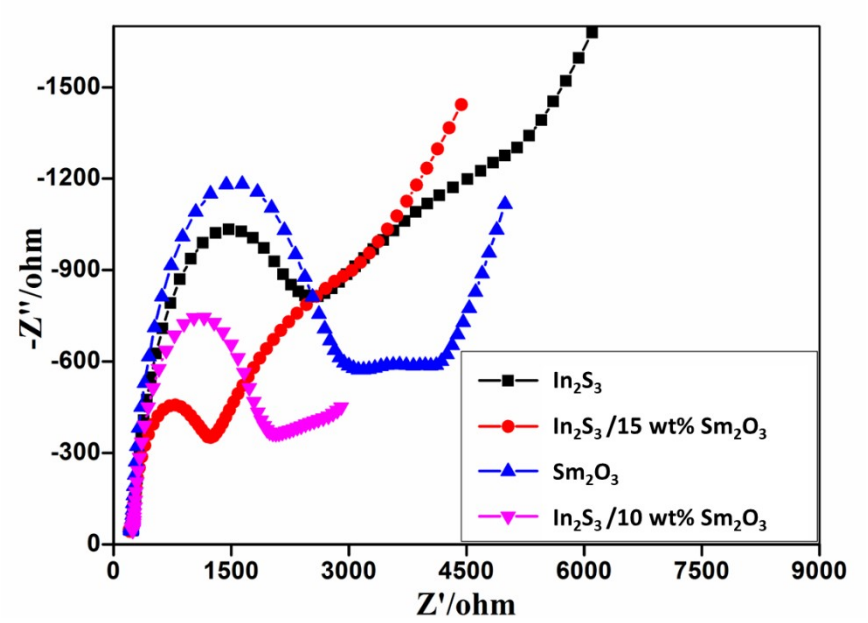

Figure. S5 Electrochemical impedance spectra of different photocatalyst.

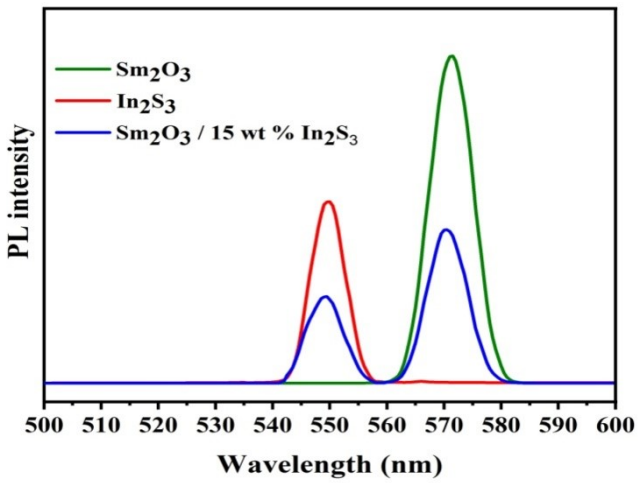

Figure. S6 Photoluminescent emission spectra of Sm_2O_3, In_2S_3, and Sm_2O_3/ 15 wt % In_2S_3

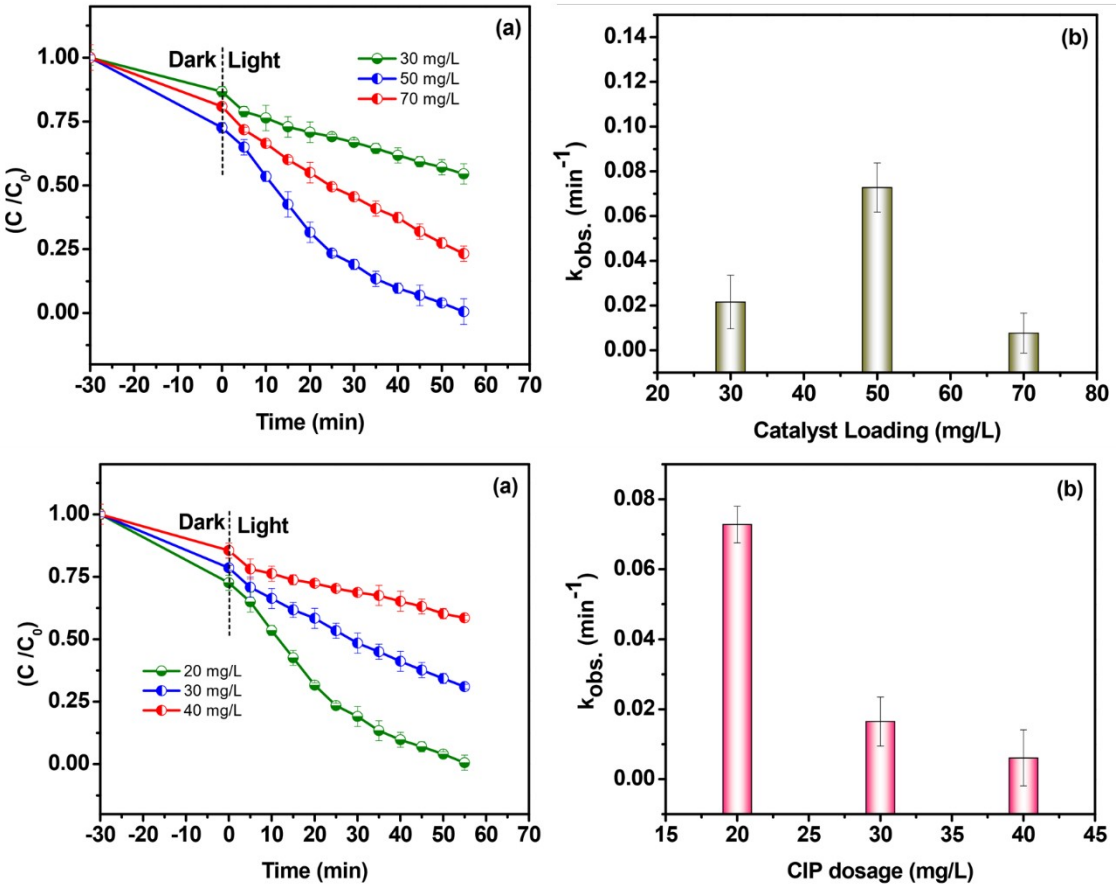

Figure. S7. Normalized CIP concentration profile at different catalyst (Sm_2O_3/ 15wt % In_2S_3) loading with constant CIP dosage = 20 mg/L (a); and different CIP dosage at 50 mg/L catalyst loading (c). Pseudo-first order rate constant ($k_{obs.}$) for the photocatalytic degradation of CIP by different catalyst (b) and various CIP dosage (d).

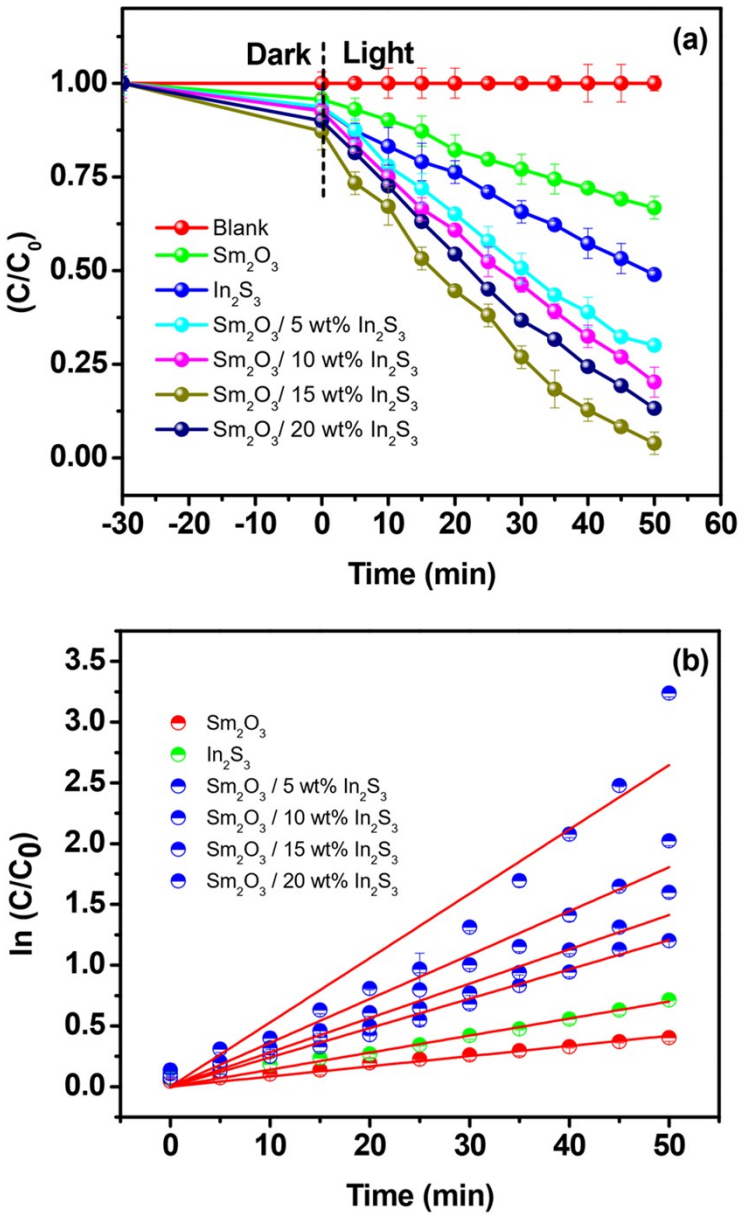

Figure. S8 Photocatalytic reduction of Cr(VI) by different catalyst, and (b) pseudo-first order kinetic profiles . Catalyst loading = 50 mg/L, and Cr (VI) = 40 mg/L.

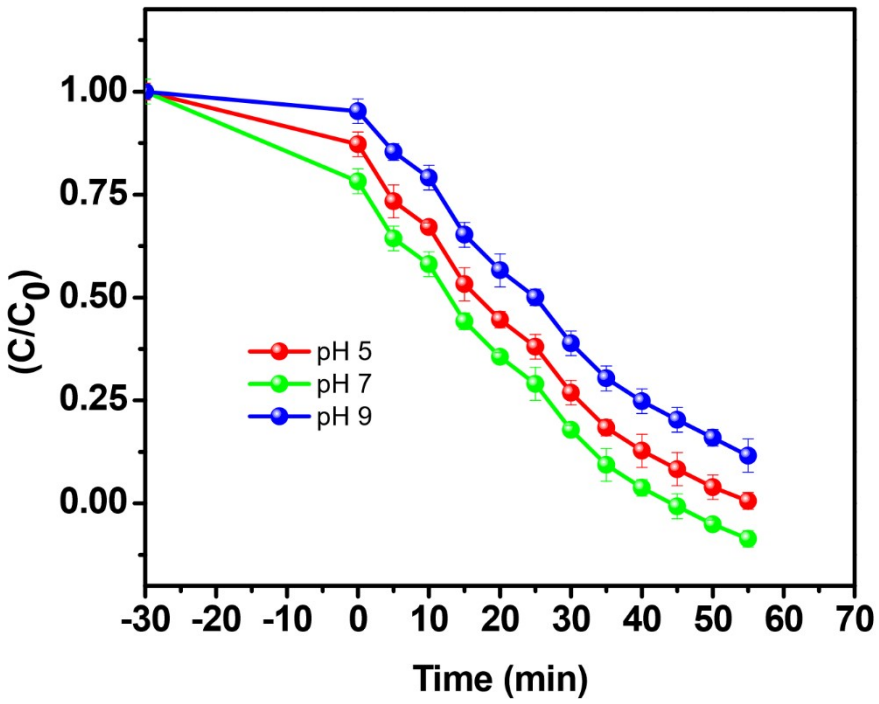

Figure. S9 Effect of pH on Cr (VI) degradation in Sm_2O_3/ 15 wt % In_2S_3, photocatalysis.

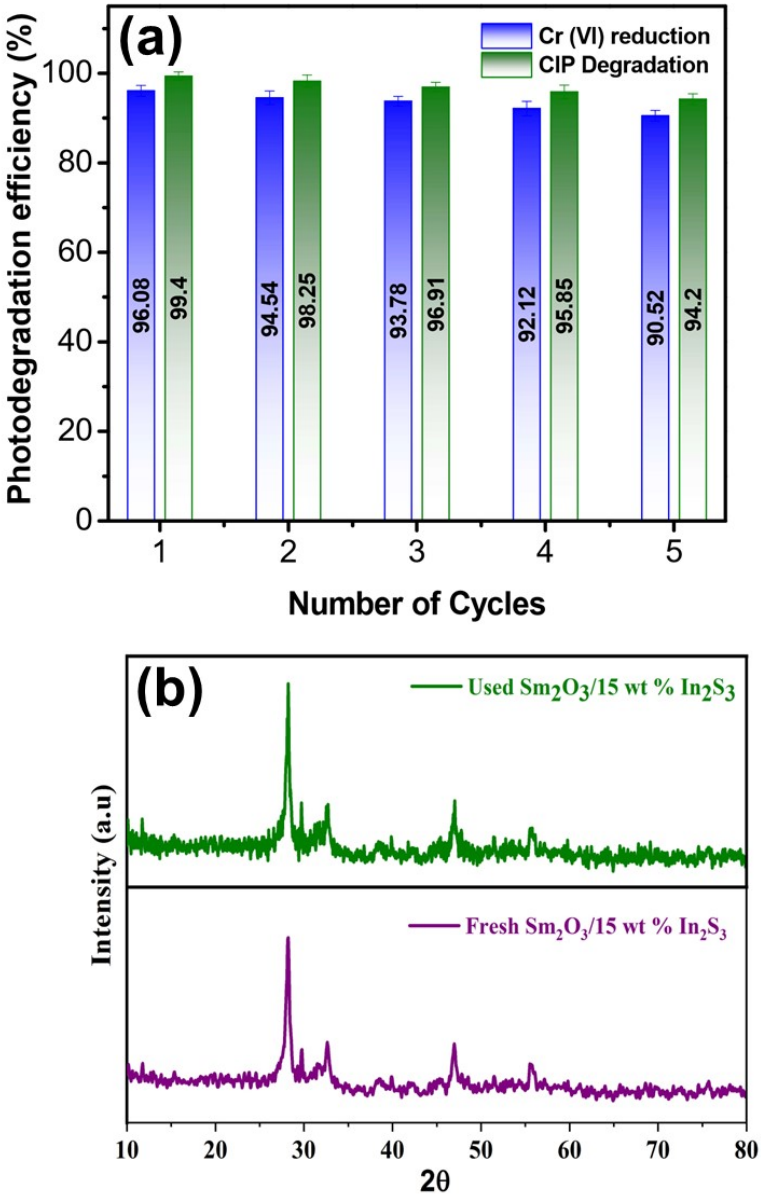

Figure. S10. (a) Reusable test for the photocatalytic degradation of CIP and Cr(VI) reduction using recycled Sm_2O_3/15wt% In_2S_3 photocatalyst. (b) XRD patterns of Sm_2O_3/15wt% In_2S_3 before and after the photocatalysis experiments.

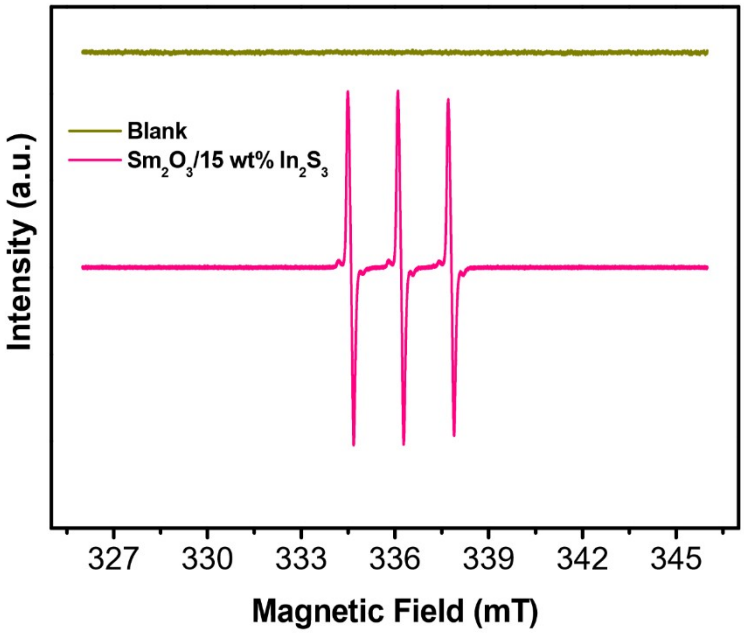

Figure. S11 EPR spectra of TMP adduct from Sm_2O_3 / 15wt % In_2S_3.TMP = 50 mM, Catalyst loading = 50 mg/L and CIP dosage = 20 mg/L.

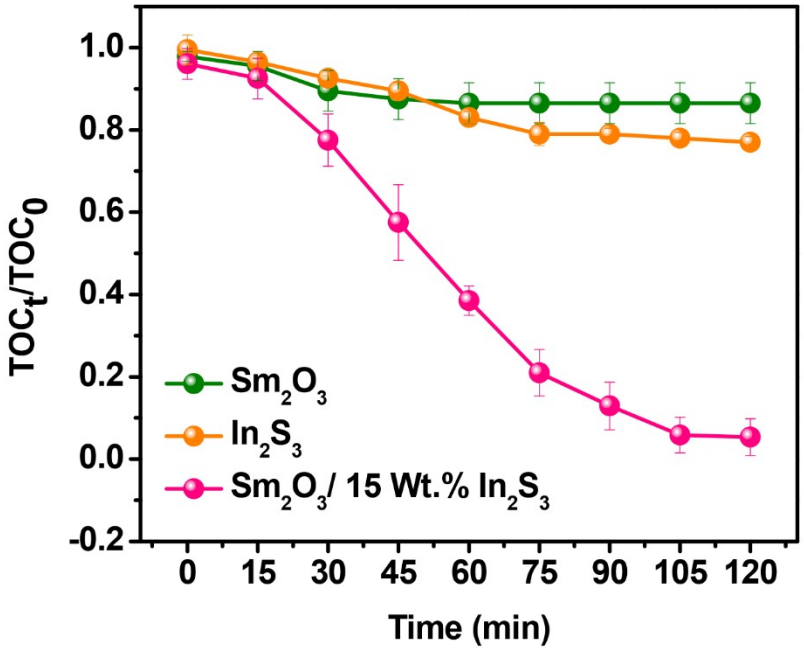

Fig. S12 Total organic carbon reduction at different photocatalysts. Catalyst loading = 50 mg/L, and CIP dosage = 20 mg/L.

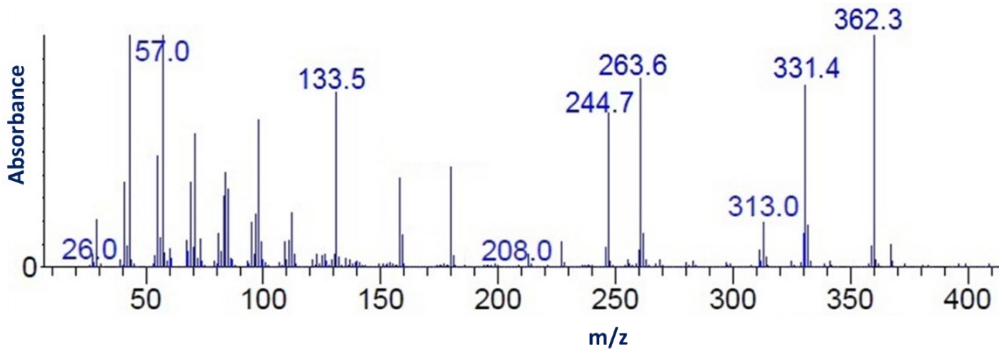

Figure. S13. LC-MS spectra of different photocatalytic system Sm_2O_3 / 15wt % In_2S_3.