The photo-catalytic performance of Ag_2S under visible and near-infrared light irradiation and its degradation mechanism

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The file includes:

Figure S1-S5

Fig. S1

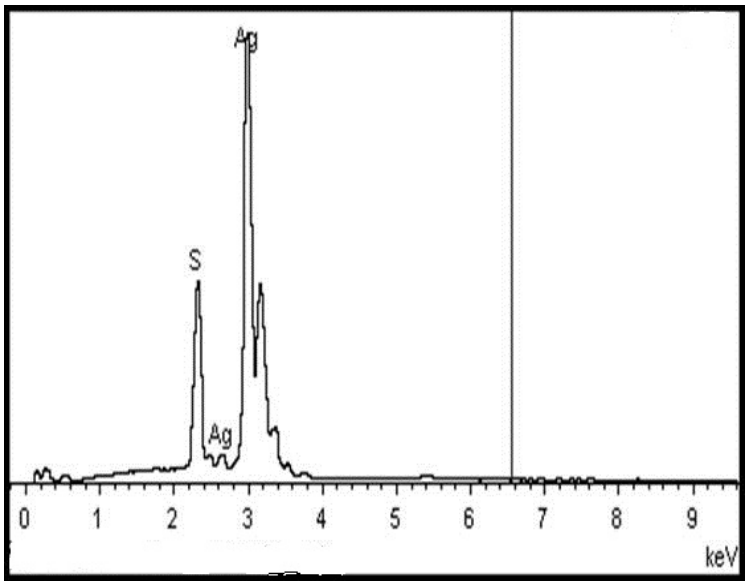

Fig. S1 EDS result of Ag_2S

The main components of Ag_2S sample were determined by Energy Dispersive Spectrometer (JSM－7500F). The EDS result shown in Fig. S1 confirmed that no other impurity atoms such as N or Na were detected. Only Ag and S atoms were determined.

Fig. S2

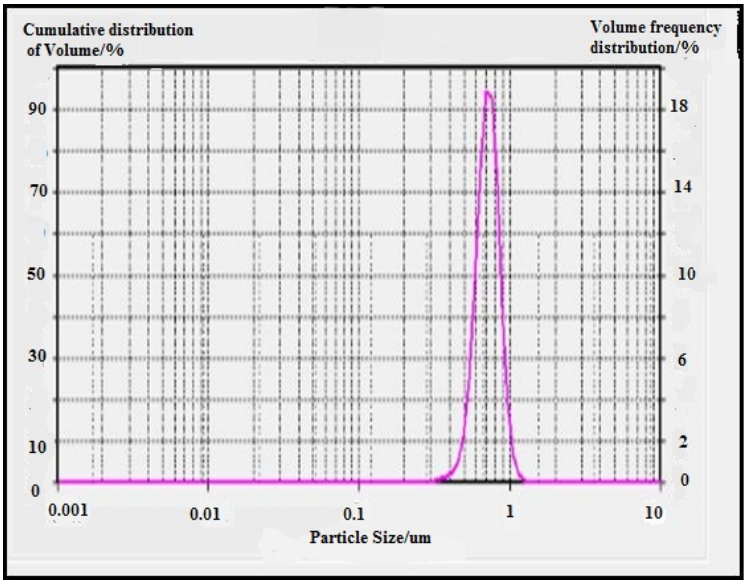

Fig. S2 The particle size distribution of Ag_2S.

The particle size distribution of prepared Ag_2S samples was determined with a JL-1198 laser particle size analyser (Chengdu Jingxin powder analyser instruments Co., Ltd.). The result in Fig. S2 confirmed that the main particle size distribution of as-prepared Ag_2S samples was ranged from 0.5395μm to 0.8602μm, and the average particle size was 0.7226μm.

Fig. S3

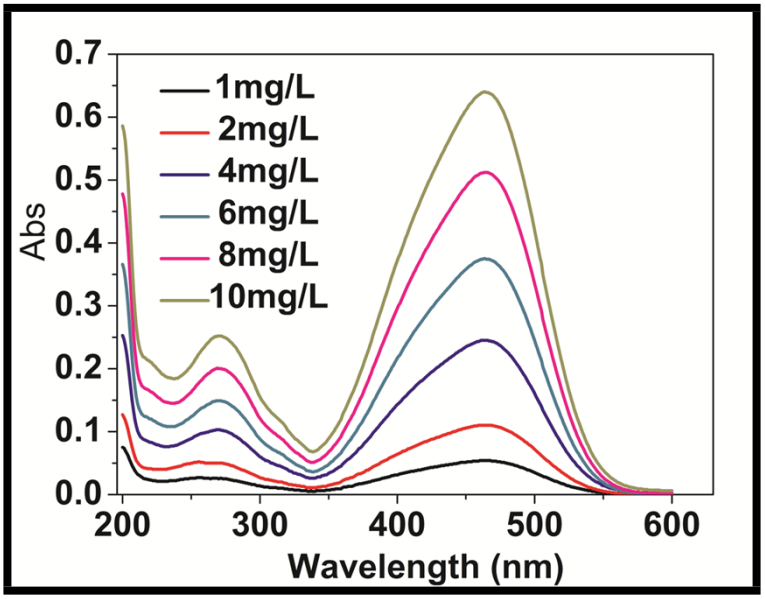

Fig. S3 The spectrum of methyl orange solution with different concentration

Methyl orange solution was chosen as the photo-decomposition target in experiment for evaluating the photo activity of Ag_2S photo-catalysts. A series of MO solution with different MO concentration, including 1mg/L, 2mg/L, 4mg/L, 6mg/L, 8mg/L, and 10mg/L, were configured and determined with UV-Vis spectrophotometer (TU-1901, Ge Beijing spectrometer China).

Fig. S4

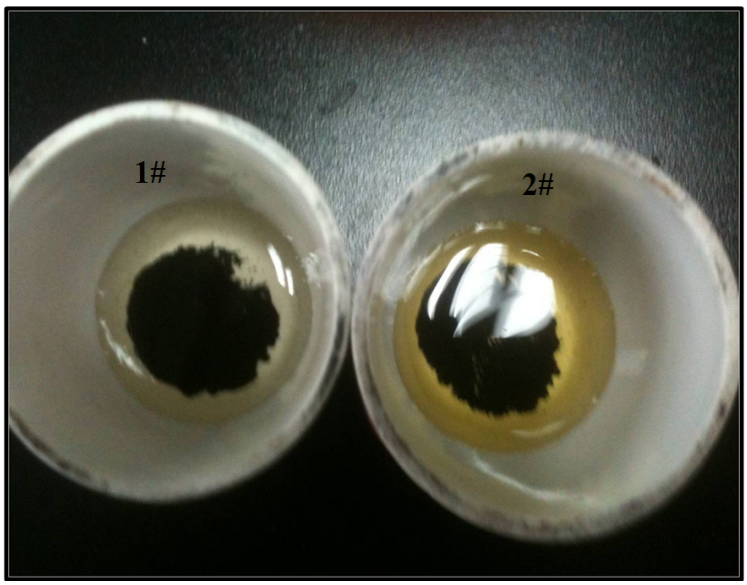

Fig. S4 Extraction of adsorbed MO on Ag_2S with DI water: left-with light irradiation; right-in darkness

Here two Ag_2S samples were immersed into MO solution for adsorbing MO. After reaching MO adsorption equilibrium, one was exposed in light for 30 minutes (1#), and the other was kept in darkness. After that, the two Ag_2S samples were filtered and washed with deionized water 3 times to remove the remaining MO on the surface of Ag_2S. Finally, the two samples were soaked in the deionized water overnight and the phenomenon was shown in Fig. S4.

It can be found that the water of left sample almost kept colorless, whereas water of right sample has turned light yellow obviously. This confirmed that no MO was leached from Ag_2S after light irradiation, and the adsorbed MO of Ag_2S with light irradiation was released. This comparison verified that after light irradiation treatment, the adsorbed MO on the surface of Ag_2S should have been decomposed, which was in agreement to the results of FT-IR analysis.

Fig. S5

The repeatability experiments of MO degradation over Ag_2S was conducted to evaluate the stability of Ag_2S. The results displayed in Fig. S5 showed that after three recycling runs under the visible light or near-infrared light irradiation, the decolorization rate of MO only slightly decreased 7%. Such slight decrease indicated that the photocatalytic activity of the Ag_2S was reproducible. The reduction in the degradation efficiency during the cycles can be explained by the decrease of the surface area of Ag_2S since the BET results of Ag_2S before and after recycling decreased from 6.062 m^2/g to 3.706 m^2/g.

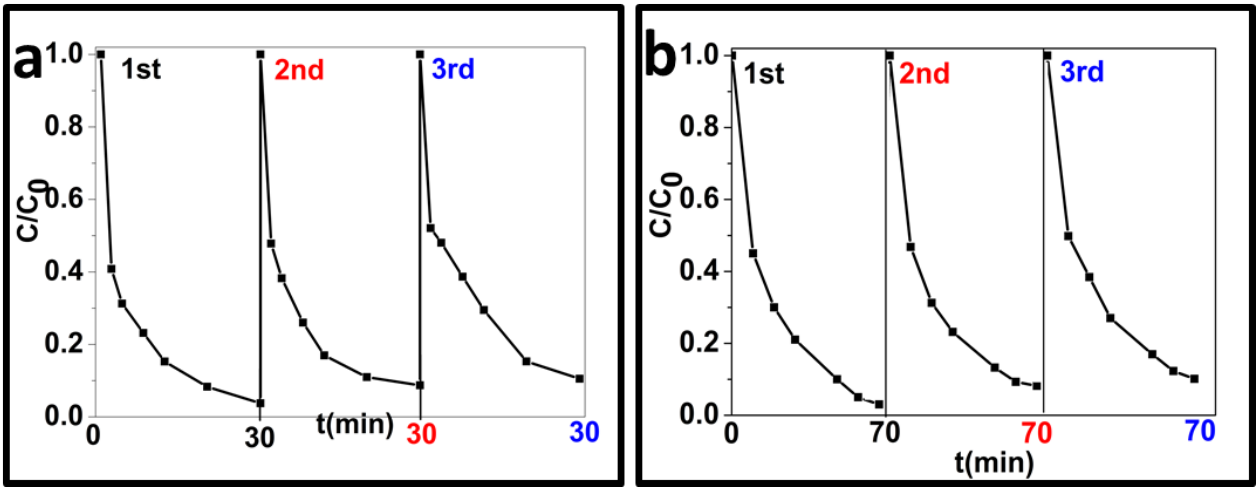

Fig. S5 Three cycles of photodegradation of MO by Ag_2S **(a)** under visible light; **(b)** under near-infrared light.