Electronic Supplementary Material (ESI) for Dalton Transactions.

Supporting Information

Highly efficient visible-light-driven photocatalytic degradation of Tetracycline by a Z-Scheme g-C_3N_4/Bi_3TaO_7 nanocomposite photocatalyst

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Result and discussion

Figure S1 showed the typical FT-IR spectra of g-C_3N_4/Bi_3TaO_7 composites. As can be seen, the peaks at 1250 cm^{-1}, 1324 cm^{-1}, 1420 cm^{-1}, 1573 cm^{-1}, and 1637 cm^{-1} could be contributed to the typical stretching modes of CN heterocycles[1], while the peak at 810 cm^{-1} could be contributed to the characteristic breathing mode of triazine units in g-C_3N_4[2]. For bare Bi_3TaO_7, the bands at about 1630 cm^{-1} can be assigned to water molecules adsorbed on the surface of the catalysts. The peaks located at 500-1000 cm^{-1} are mainly derived from the Bi-O, Ta-O-Ta stretching vibrations, especially, and the characteristic adsorption peak at 661cm^{-1} is attributed to stretching vibrations of Ta-O.[3-5]

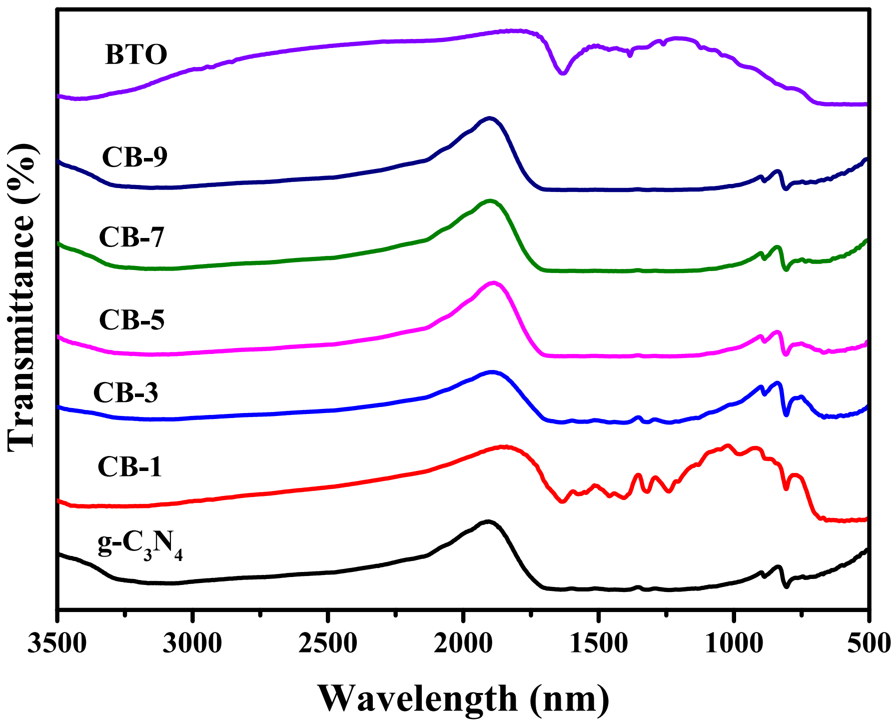

Figure S1 FTIR spectra of the pure $g-C_3N_4$, BTO, and $g-C_3N_4/Bi_3TaO_7$ composites with different mass ratio.

The EDS patterns for the pure Bi_3TaO_7, $g-C_3N_4$ and CB-5 composite were detected, as shown in Fig S2. According to the Fig. S2a and S2b, the product consists of O, Ta and Bi element for Bi_3TaO_7, C and N element for $g-C_3N_4$. In addition, it can be seen that C, N, O, Ta and Bi element were existed in the CB-5, no other impurity element signals were detected, suggesting that the as-prepared $g-C_3N_4/Bi_3TaO_7$ composite is free of impurity (Fig. S2c).

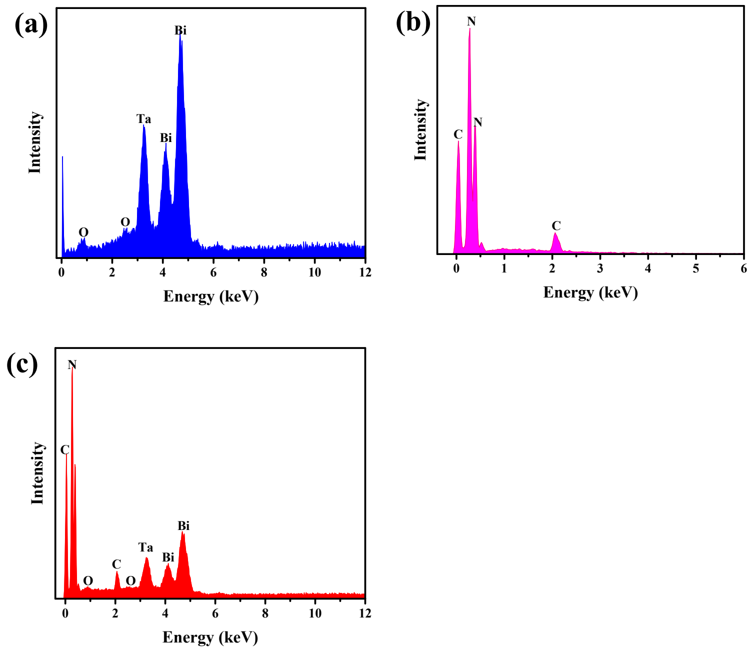

Fig. S2 EDS spectra of (a) pristine Bi_3TaO_7;(b) g-C_3N_4 and (c) CB-5 composite.

Photoluminescence spectra of g-C_3N_4 and CB-5 composite was shown in the Figure S3. As illustrated in Figure S3a, a strong emission peak was observed at 396 nm for pure Bi_3TaO_7 and 459 nm for g-C_3N_4. And other composites exhibited two major peaks. Fig S3b showed the PL spectrum for different composite species. The order of peak intensity of various composites can be listed as follows: CB-9＞CB-1＞CB-7＞CB-3＞CB-5. The PL emission intensity of CB-5 composite got an obvious decrease compared with bare g-C_3N_4, Bi_3TaO_7 and other composites, which suggested that the charge recombination can be efficiently prevented, resulting in the improvement of photocatalytic performance. [6]

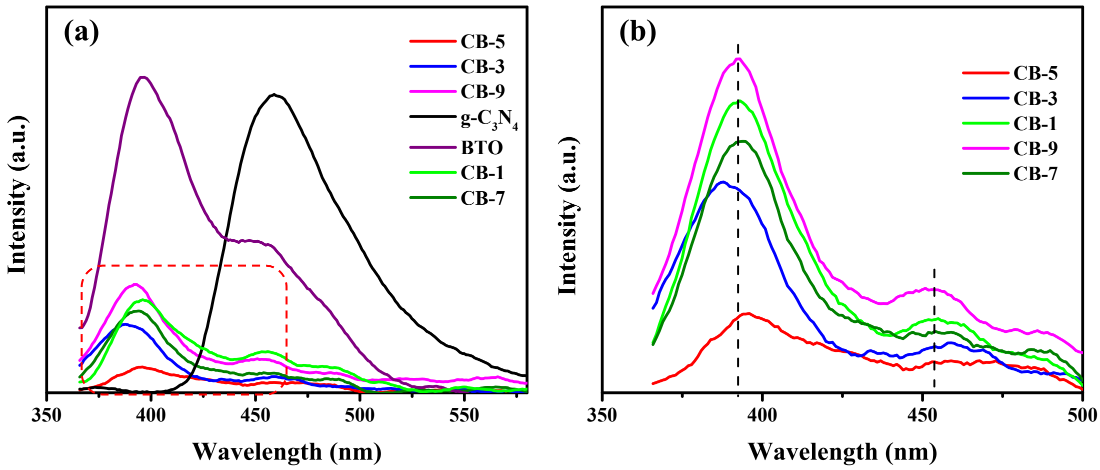

Figure S3 (a) Photoluminescence spectra of as-prepared samples with excitation wavelength of 337 nm;(b) Photoluminescence spectra of CB-1, CB-3, CB-5, CB-7, CB-9.

The stability of photocatalyst is an important factor for its application. Therefore, the recycle experiments of Bi_3TaO_7 and 50 wt% g-C_3N_4/Bi_3TaO_7 photocatalysts were conducted, as shown in Figure S3. For Bi_3TaO_7, after five cycles for the degradation of TC, the catalyst does not exhibit any significant loss of activity, which means that the catalyst is stable during the photocatalytic oxidation of the pollutant molecules. In addition, the degradation rate of TC over g-C_3N_4/Bi_3TaO_7 shows a slight decline after five cycles, where the photocatalytic efficiency reduces only 4.1%, revealing that g-C_3N_4/Bi_3TaO_7 composite photocatalyst is stable during the photocatalytic process. Therefore, the g-C_3N_4/Bi_3TaO_7 composite photocatalyst can be employed as an efficient visible-light photocatalyst that can be recycled for their application.

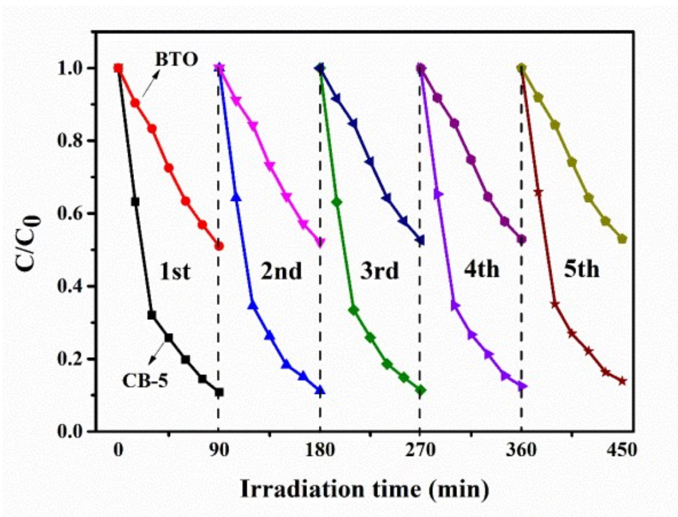

Figure S4 The cycling experiments for the degradation of TC over Bi_3TaO_7 and CB-5 composite.

References

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