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Electronic Supplementary Information (ESI)

Controllable one-pot synthesis of nest-like $Bi_2WO_6/BiVO_4$ composite with enhanced photocatalytic antifouling performance under visible light irradiation

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1. Photocatalytic antifouling performance

Table S1 Comparison to other photocatalysts for antifouling performances.

Catalyst	Bacteria	Antibacterial rate	Time (h/min)	Light resource	References
$Bi_2WO_6/BiVO_4$	*P. aeruginosa*, *E. coli* and *S. aureus*	99.99%	30 min	Visible light	This work
TiO_2 nanotubes	*E. coli* and *S. aureus*	*E. coli* (97.53%) and *S. aureus* (99.94%)	24 h	UV	S1
Vancomycin-functionalized Ag@TiO_2	*Sulphate Reducing Bacteria*	99.99%	1 h	UV	S2
$BiVO_4$	*E. coli*	99.99%	5 h	Visible light	S3
Bi_2WO_6	*E. coli*	95%	120 min	Visible light	S4
Ag_2S/Bi_2S_3	*E. coli*	99.9%	100 min	Solar light	S5
$Bi_2O_2CO_3/Bi_3NbO_7$	*E. coli*	99.99%	5 h	Visible light	S6
AgBr-Ag-Bi_2WO_6	*E. coli*	99.99%	15 min	Visible light	S7

2. Fluorescence microscopy characterization of bacterial cells

The survival status of *P. aeruginosa* was observed by a fluorescence microscopy (Olympus BX-51 with image software of Cellsens, Japan) after staining with AO. Briefly, bacteria suspension was withdrawn and transferred into the AO solution (100 μg/mL) for 30 min, and washed slightly with sterilized seawater for 3 times. Subsequently, the samples were added onto a slide and covered by a coverslip. Then the samples were observed on fluorescence microscopy utilizing an exciter filter of 490 nm and barrier filter of 530 nm.

To further confirm the photocatalytic antifouling performance of the $Bi_2WO_6/BiVO_4$-1 composite for *P. aeruginosa*, the fluorescence microscopy images of *P. aeruginosa* during the photocatalytic reaction were observed, as shown in **Fig. S1**. It can be seen in **Fig. S1(A)** that the untreated bacteria cells exhibited intense green fluorescence, showing their well survival state. After

15 min photocatalytic reaction, it can be seen in **Fig. S1(B)** that parts of bacteria cells showed red fluorescence and the number of bacterial cells decreased, indicating that some bacteria were killed during the photocatalytic reaction. When the reaction time prolonged to 30 min, almost all of the bacteria cells were killed, no living bacteria were observed in **Fig. S1(C)**. In addition, only about 0.01% of bacterial cells were still survived after 30 min reaction, which was calculated by the image software. These results further demonstrate the excellent photocatalytic antifouling performance of the $Bi_2WO_6/BiVO_4$-1 composite under visible light irradiation.

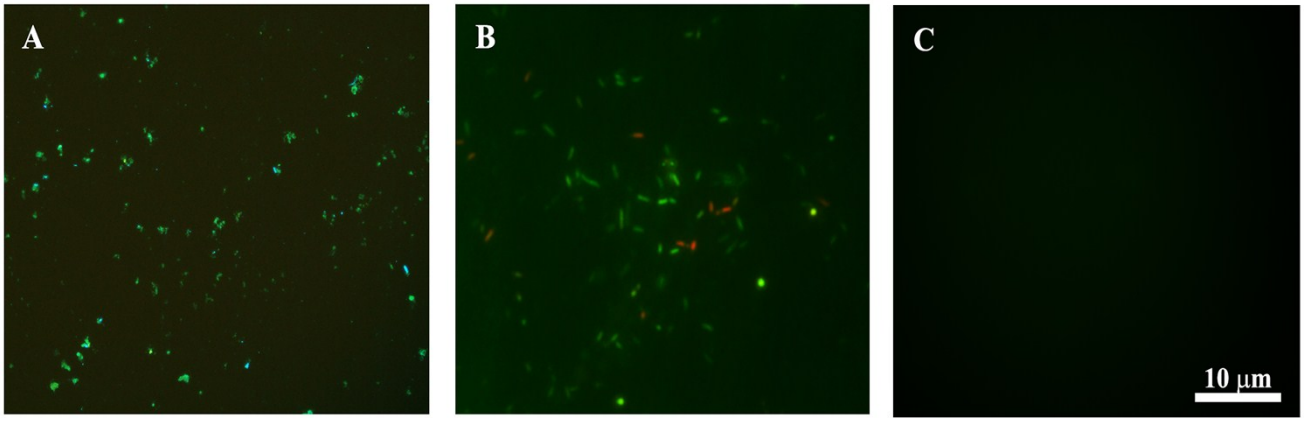

Fig. S1 Fluorescence microscope images of *P. aeruginosa* untreated (A), treated 15 min (B), and treated 30 min with $Bi_2WO_6/BiVO_4$-1 under visible light irradiation (C).

3. FESEM and TEM characterization of bacterial cells

The morphology change of bacteria was observed by FESEM (Hitachi S-4800) and TEM (JEOL JEM-1200). Normally, for FESEM characterization, the bacteria cells prior to photocatalytic treatment and after treatment were collected and dripped onto a treated glass slide. Then the bacterial cells were immediately fixed with glutaraldehyde (2.5%) solution for 2 h in a refrigerator. Afterwards, the cells were soaked in cacodylate buffer to remove excess fixative. Then the cells were dehydrated by successive soakings in 50, 70 and 95% (v/v) ethanol for 15 min each and then three soakings in 100% ethanol for 15 min each. After dried with critical point drier, the samples were observed by FESEM. For TEM observations, the bacterial cells prior to photocatalytic treatment and after treatment were collected and fixed with glutaraldehyde (2.5%) solution for 2 h

in a refrigerator. Then the mixing suspensions were dripped onto the copper grids with a holey carbon film. Finally, the grids were dried under natural conditions and examined by TEM.

Fig. S2(A)~Fig. S2(D) display the TEM images of *P. aeruginosa* cells changed at the different stages during the photocatalytic process. Before the photocatalytic reaction, *P. aeruginosa* cells exhibited a well-defined cell structure with the cell membrane and interior material, which would be absorbed on the surface of $Bi_2WO_6/BiVO_4$-1 after mixed together in dark. When the system was irradiated under visible light, it can be seen that the stained interior of the cell became white and the cell wall was destroyed gradually with the increase in irradiation time, leading to the release of the interior component and further death of the cells.

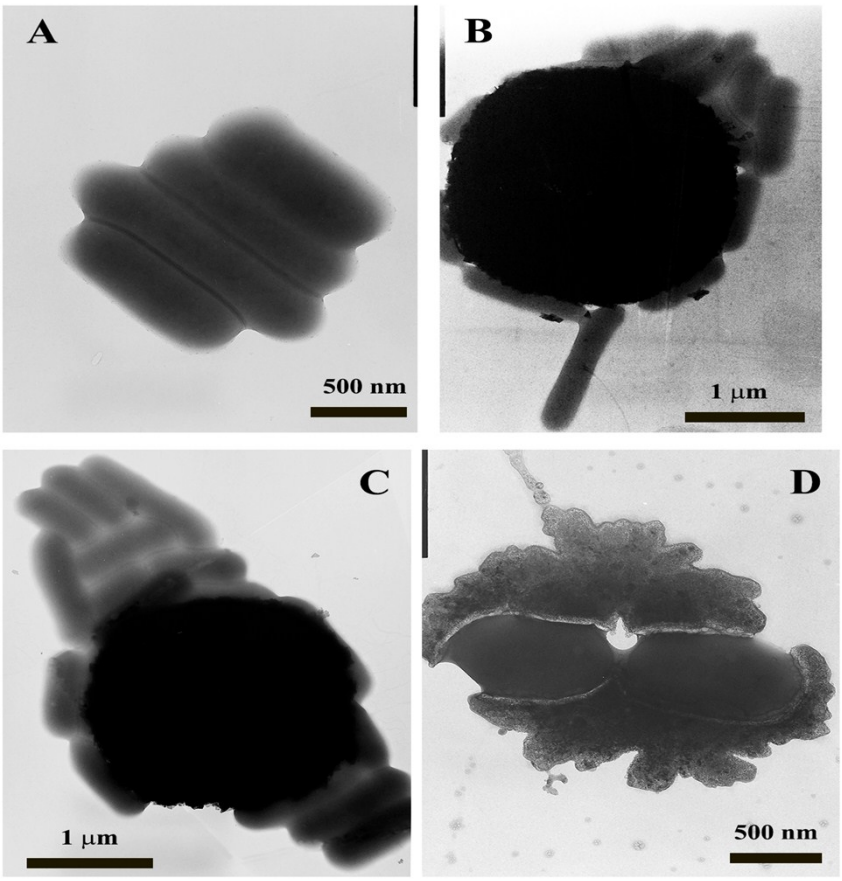

Fig. S2 TEM images of untreated *P. aeruginosa* cells (A) and untreated *P. aeruginosa* cells in dark with $Bi_2WO_6/BiVO_4$-1 for 30 min (B), treated *P. aeruginosa* cells under visible light irradiation with $Bi_2WO_6/BiVO_4$-1 for 15 min (C) and for 30 min (D).

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