

Supporting Information

**Mn₃O₄ nanozyme coating accelerates nitrate reduction and decreases
N₂O emission during photoelectrotrophic denitrification by
Thiobacillus denitrificans-CdS**

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This supporting information contains 12-page document, including 9 figures, 2 tables
and this cover page.

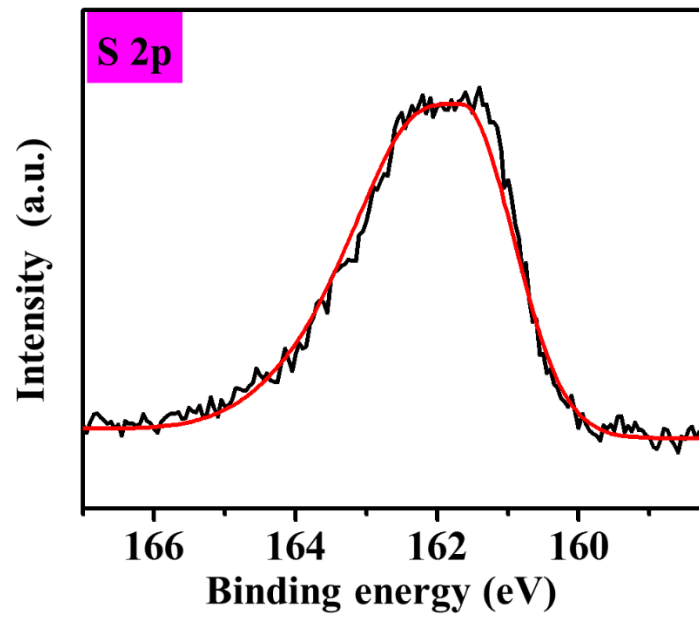


Figure S1 XPS spectra of S 2p in *T. denitrificans*-CdS@Mn₃O₄.

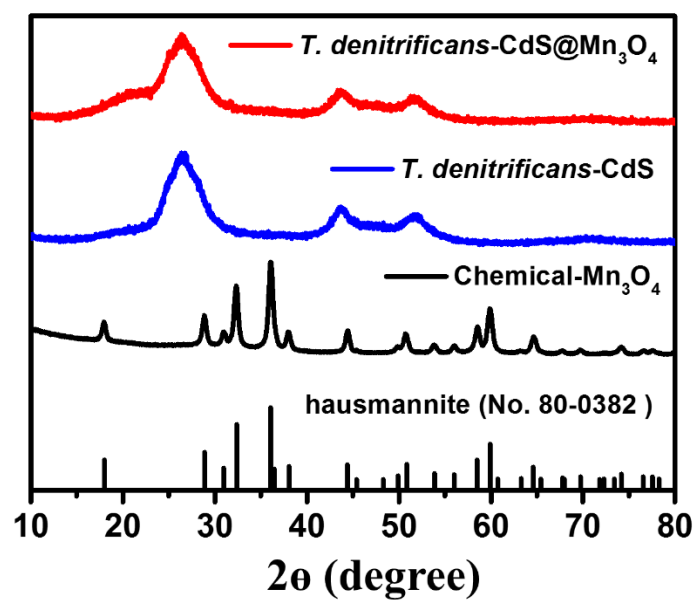


Figure S2 XRD patterns of the *T. denitrificans*-CdS@Mn₃O₄, *T. denitrificans*-CdS and Chemical-Mn₃O₄ (reference peak from JCPDS data card No. 80-0382).

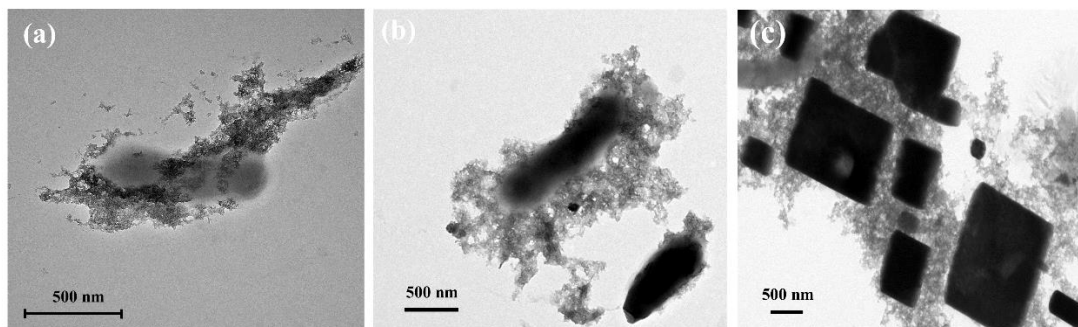


Figure S3 TEM images of *T. denitrificans*-CdS@Mn₃O₄, *T. denitrificans*@Mn₃O₄ and Chemical-Mn₃O₄.

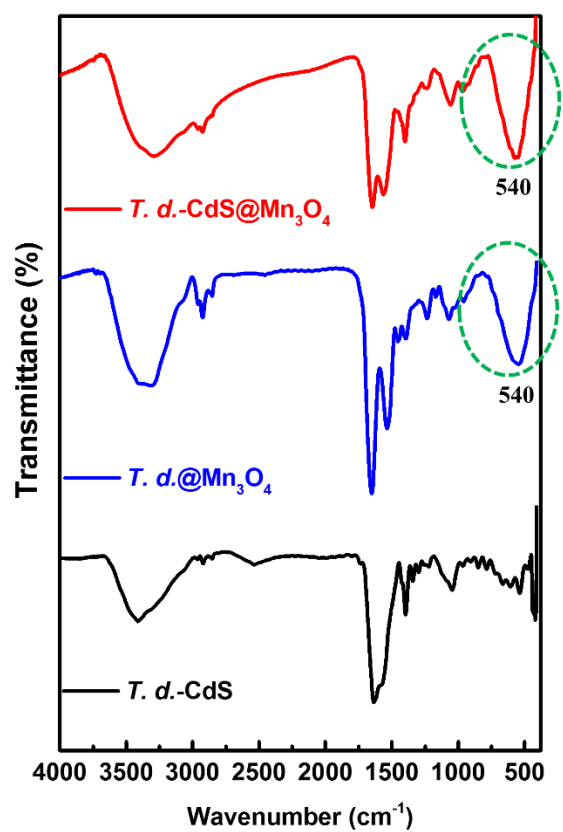


Figure S4 FTIR spectra of *T. denitrificans*-CdS@Mn₃O₄, *T. denitrificans*@Mn₃O₄ and *T. denitrificans*-CdS.

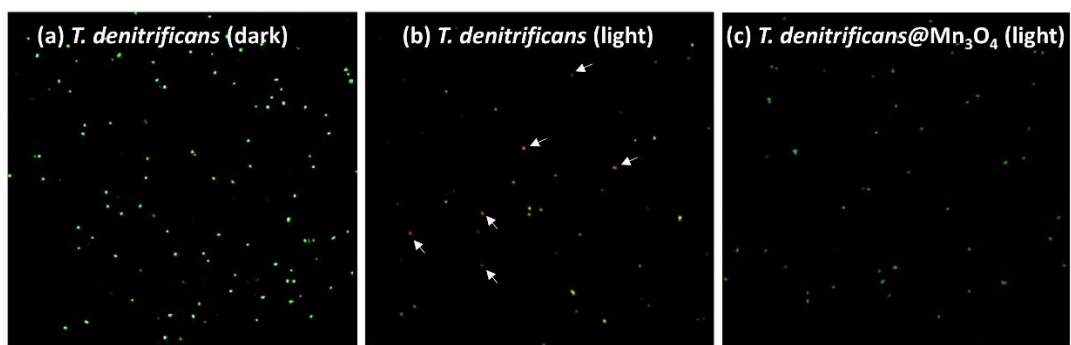


Figure S5 LIVE/DEAD staining of *T. denitrificans* (dark) (a), *T. denitrificans* (light) (b), and *T. denitrificans*@Mn₃O₄ (light) (c) after 72 hours of reaction.

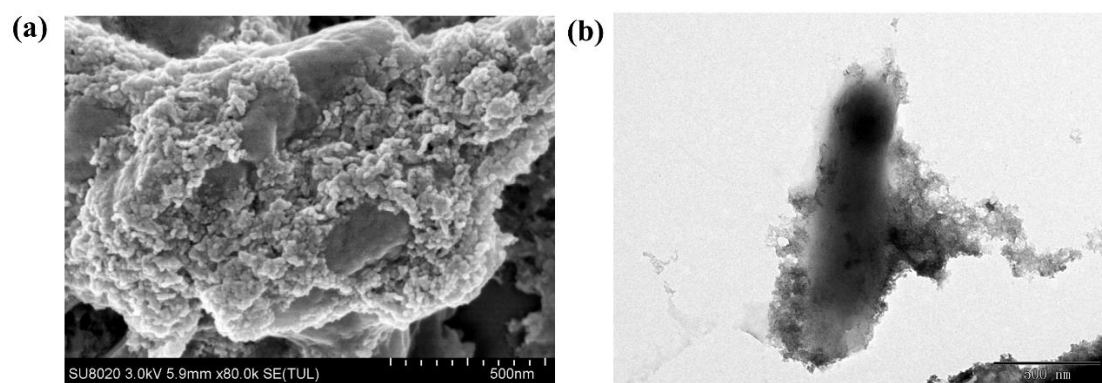


Figure S6 (a) SEM and **(b)** TEM images of *T.denitrificans*@Mn₃O₄.

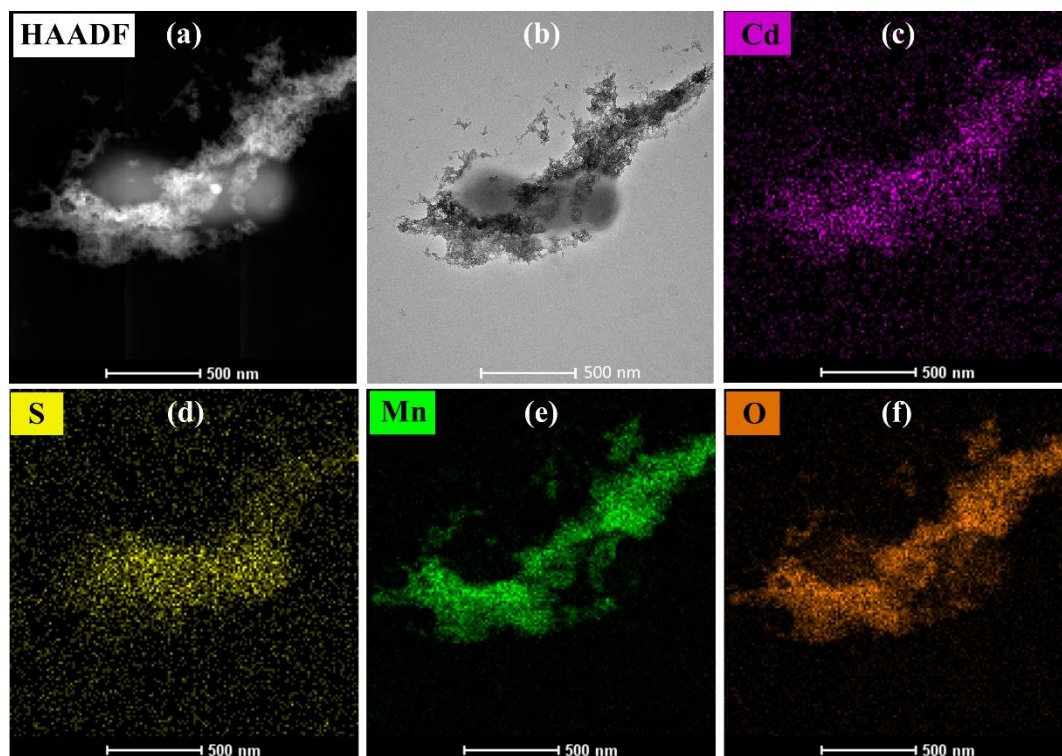


Figure S7 (a) HAADF and (b) TEM image of *T. denitrificans*-CdS@Mn₃O₄; (c-f) EDS mapping of elements Cd, S, Mn and O.

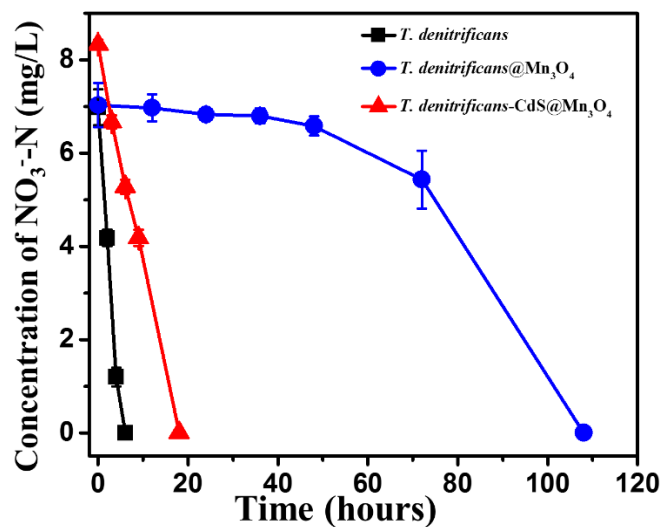


Figure S8 Time curves of NO₃-N reduction during denitrification by *T. denitrificans* and *T. denitrificans*@Mn₃O₄ using sodium thiosulfate as the electron donor. For *T. denitrificans*-CdS@Mn₃O₄, photoelectron was used as the electron donor.

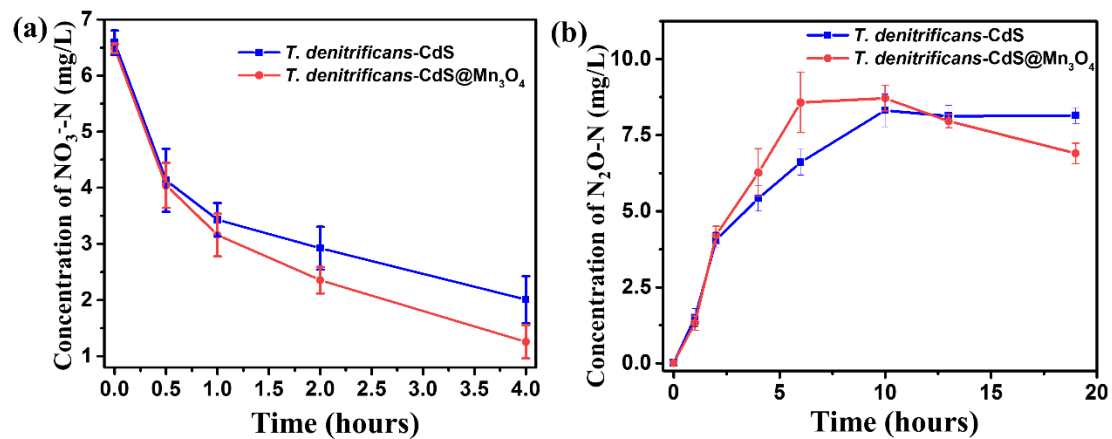


Figure S9 (a) Time curves of NO₃⁻-N reduction during PEDeN by *T. denitrificans*-CdS and *T. denitrificans*-CdS@Mn₃O₄. (b) Time curves of N₂O-N generation during PEDeN by *T. denitrificans*-CdS and *T. denitrificans*-CdS@Mn₃O₄.

Table S1 Analysis of the concentrations of Cd and Mn in *T. denitrificans*-CdS@Mn₃O₄.

Element	Concentration (mg/L)
Mn	451 ± 10
Cd	78 ± 5

Table S2 BET surface area of *T. denitrificans*-CdS and *T. denitrificans*-CdS@Mn₃O₄

Sample	BET surface area (m² g⁻¹)
<i>T. denitrificans</i> -CdS	11.6 ± 0.1
<i>T. denitrificans</i> -CdS@Mn ₃ O ₄	11.3 ± 0.2