Electronic Supplementary Material (ESI) for New Journal of Chemistry.

Supporting Information:

β-$NaYF_4$:Yb,Er,Gd Nanorods@1T/2H-MoS_2 for 980 nm NIR-Triggered Photocatalytic Bactericidal Properties

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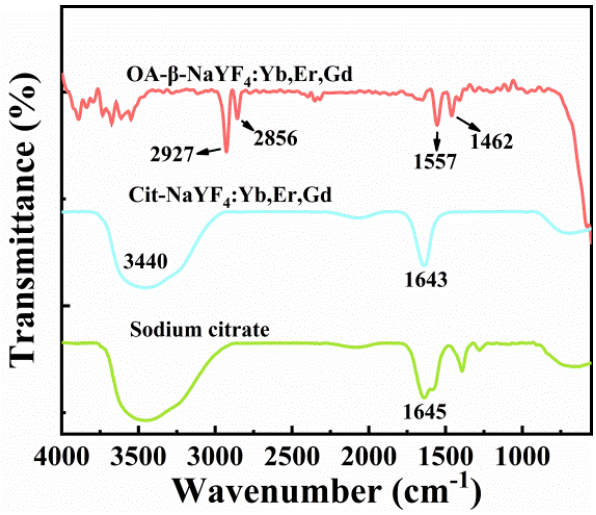
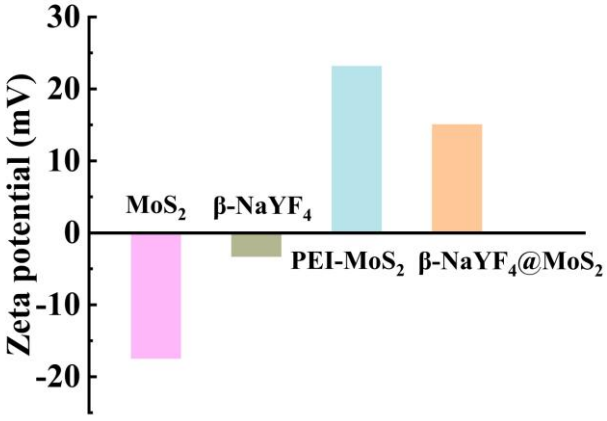


Figure S1: FT-IR spectra of OA-β-$NaYF_4$:Yb,Er,Gd, citrate-β-$NaYF_4$:Yb,Er,Gd and sodium citrate. The broad band at 3440 cm^{-1} for both the Cit-β-$NaYF_4$:Yb,Er,Gd and sodium citrate can be attributed to the O-H stretching vibration. For OA-β-$NaYF_4$:Yb,Er,Gd, the peaks at 2927 and 2856 cm^{-1} are assigned to the asymmetric and symmetric stretch vibrations of methylene (−CH_2−) in the long alkyl chain of OA. The band at 1557 and 1462 cm^{-1} are attributed to stretch vibrations of COO bond. The results indicate that OA was coated on the surface of the β-$NaYF_4$:Yb,Er,Gd nanorods. After the ligand replacement, the strong absorption band at 1643 cm^{-1} can be assigned to the asymmetric stretching vibrations carboxylic groups of the surface coated citric acid molecules, the results are consistent with the FTIR spectrum of sodium citrate.



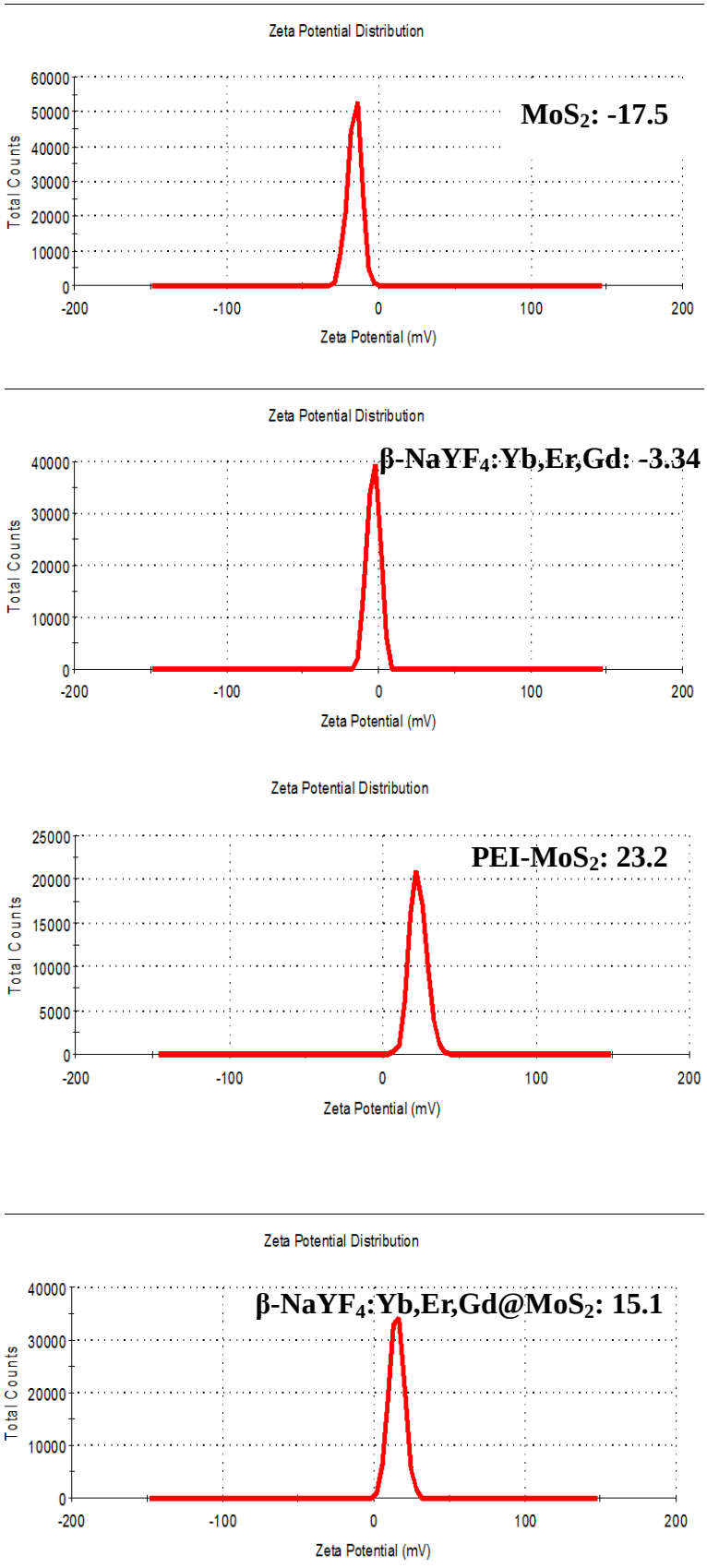


Figure S2: Zeta potential of MoS_2, β-$NaYF_4$:Yb,Er,Gd, PEI-MoS_2, β-$NaYF_4$:Yb,Er,Gd @MoS_2

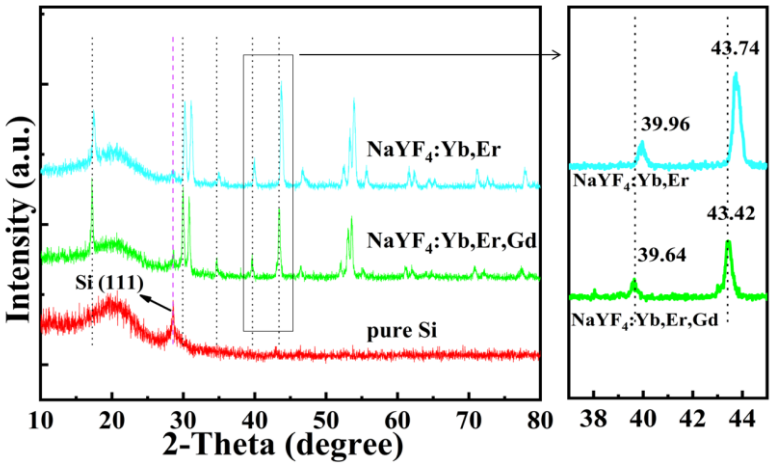


Figure S3: X-ray powder diffraction (XRD) patterns of $NaYF_4$:Yb,Er,Gd (green), $NaYF_4$:Yb,Er (blue), and pure Si (111) as internal standard (red).

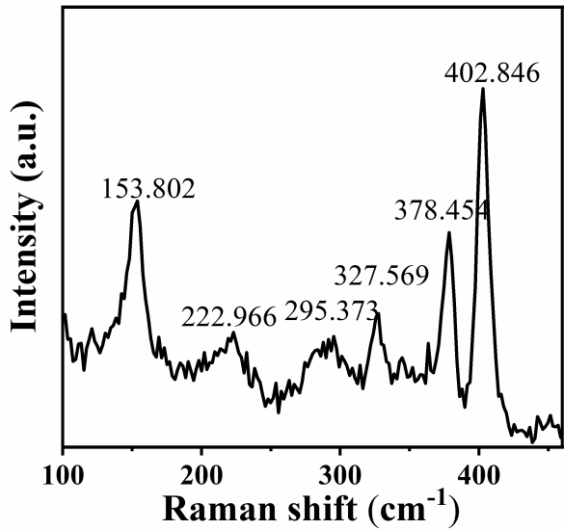
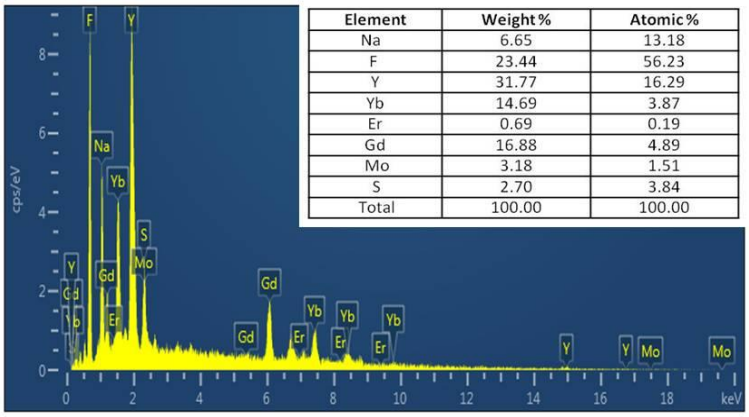


Figure S4: Raman spectra of MoS_2 indicate the presence of 1T and 2H phase.



Element	Weight%	Atomic%
Na	6.65	13.18
F	23.44	56.23
Y	31.77	16.29
Yb	14.69	3.87
Er	0.69	0.19
Gd	16.88	4.89
Mo	3.18	1.51
S	2.70	3.84
Total	100.00	100.00

Figure S5: EDS spectrum of the β-$NaYF_4$:Yb,Er,Gd@1T/2H-MoS_2.

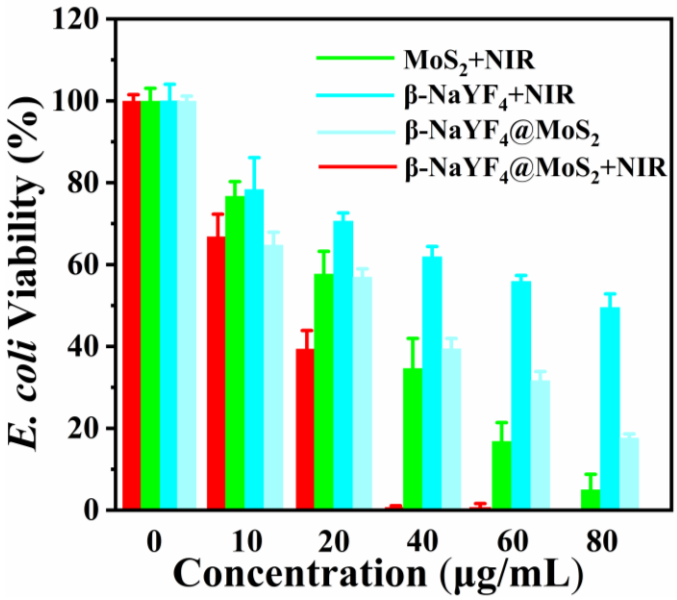


Figure S6: Concentration dependent viability of the *E. coli* K12 cells incubated with MoS_2+NIR, β-$NaYF_4$:Yb,Er,Gd+NIR, β-$NaYF_4$:Yb,Er,Gd @1T/2H-MoS_2, and β-$NaYF_4$:Yb,Er,Gd@1T/2H-MoS_2+NIR.

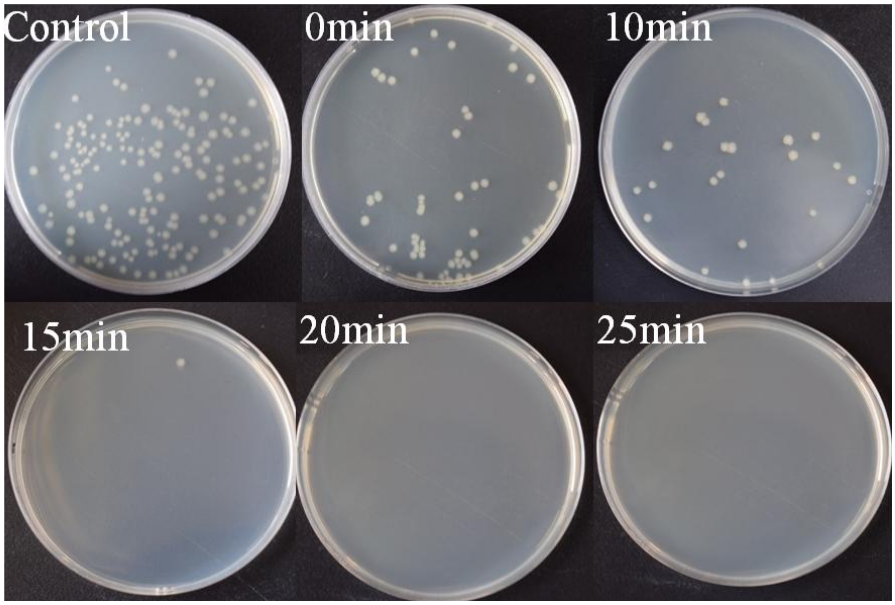


Figure S7: Photographs of colony-forming units of *E. coli* treated with β-$NaYF_4$:Yb,Er,Gd Nanorods@1T/2H-MoS_2 (40 μg/mL) agent under the 980 nm NIR irradiation for 0, 10, 15, 20, and 25 min, respectively.

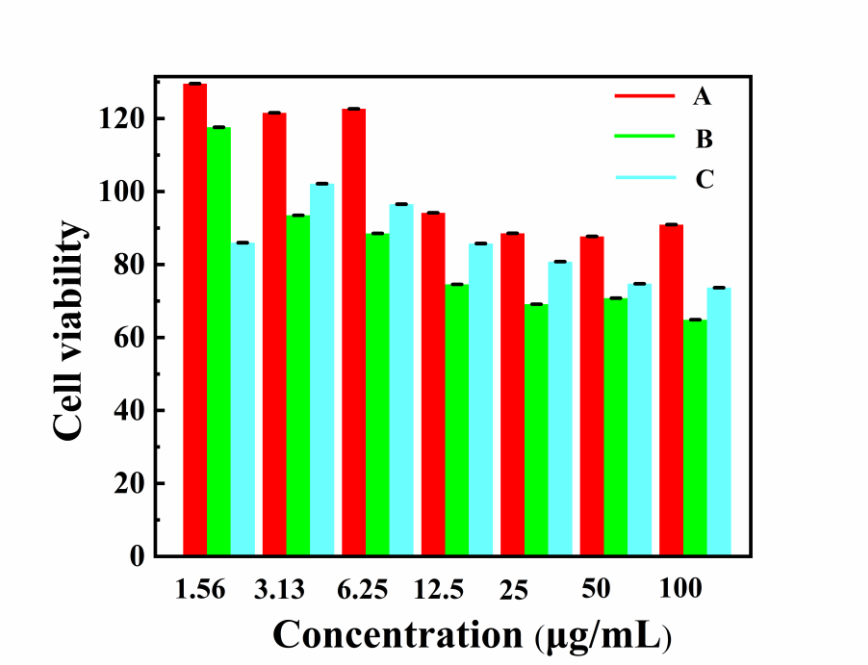


Figure S8: Cytotoxicity of 1T/2H-MoS_2 (A), β-$NaYF_4$:Yb,Er,Gd (B), β-$NaYF_4$:Yb,Er,Gd@1T/2H-MoS_2 (C) in HEK 293 cells.