Supporting Materials

Decorating Pt@cyclodextrin nanoclusters on C_3N_4/MXene for boosting the photocatalytic H_2O_2 production

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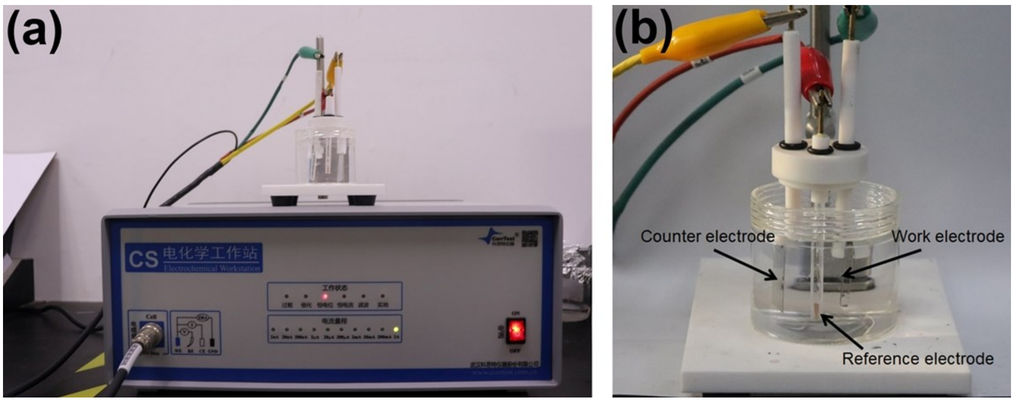

Figure S1. Digital photographs of the CS380 electrochemical workstation (a) and the three-electrode cell (b).

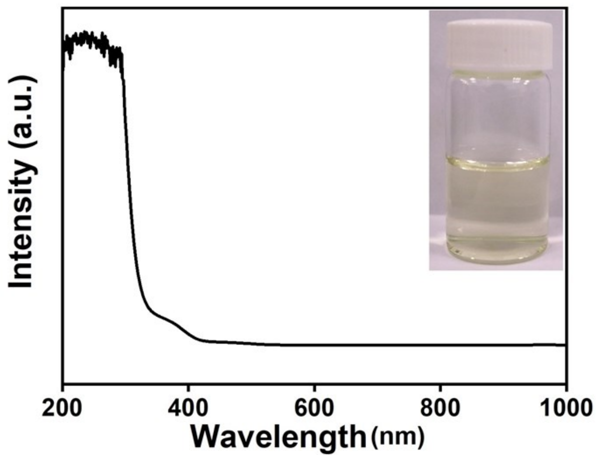

Figure S2. UV-vis absorption spectrum of the Pt(II)-β-CD complexes and the image of the corresponding sample solution (inset).

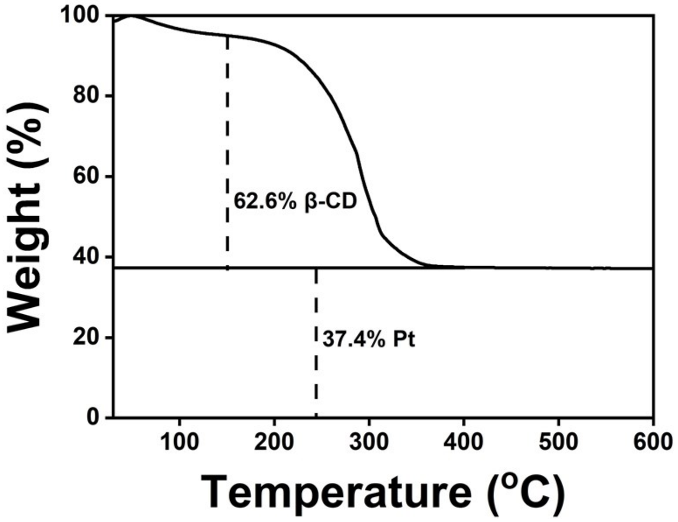

Figure S3. The TGA curve of Pt@β-CD NCs.

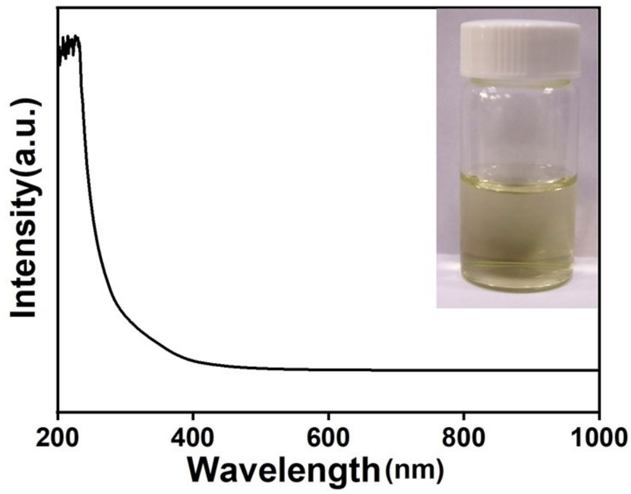

Figure S4. UV-vis absorption spectrum of the Pt(II)-β-CD complexes after $NaBH_4$-reduction and the image of the corresponding sample solution (inset).

Note: The optical absorption spectrum and solution color are similar to that of Pt(II)-β-CD complexes before $NaBH_4$-reduction (Figure S2), indicating unsuccessful formation of Pt NCs@β-CD using $NaBH_4$ as reducing agent.

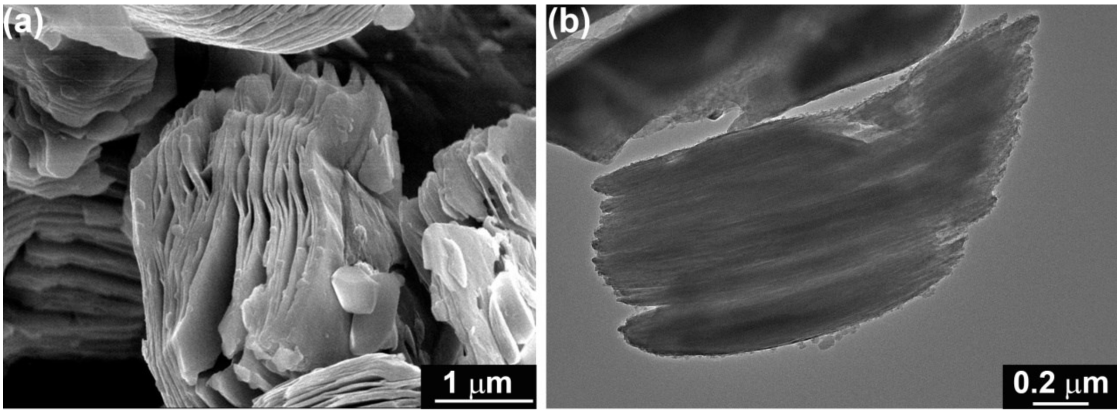

Figure S5. SEM image (a) and TEM image (b) of the as-prepared MXene (Ti_2C_3).

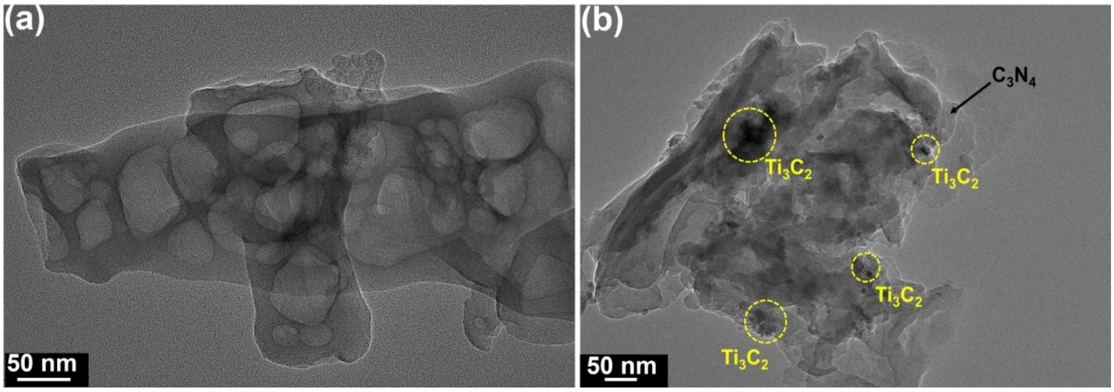

Figure S6. TEM images of C_3N_4 before (a) and after (b) deposition of MXene (Ti_3C_2).

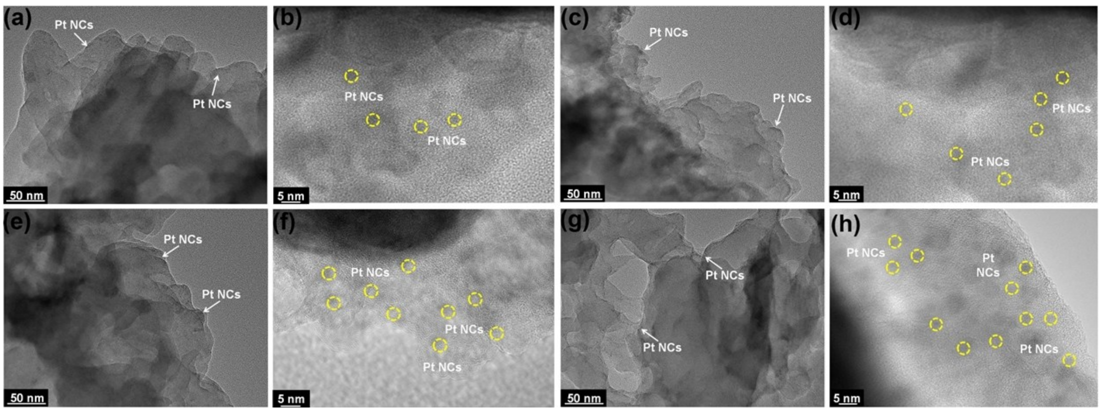

Figure S7. TEM and corresponding HRTEM images of Pt@β-CD/C_3N_4-1 (a-b), Pt@β-CD/C_3N_4-2 (c-d), Pt@β-CD/C_3N_4-3 (e-f), and Pt@β-CD/C_3N_4-5 (g-h). Note: the HRTEM image of Pt@β-CD/C_3N_4-4 is displayed in the inset of Figure 2b.

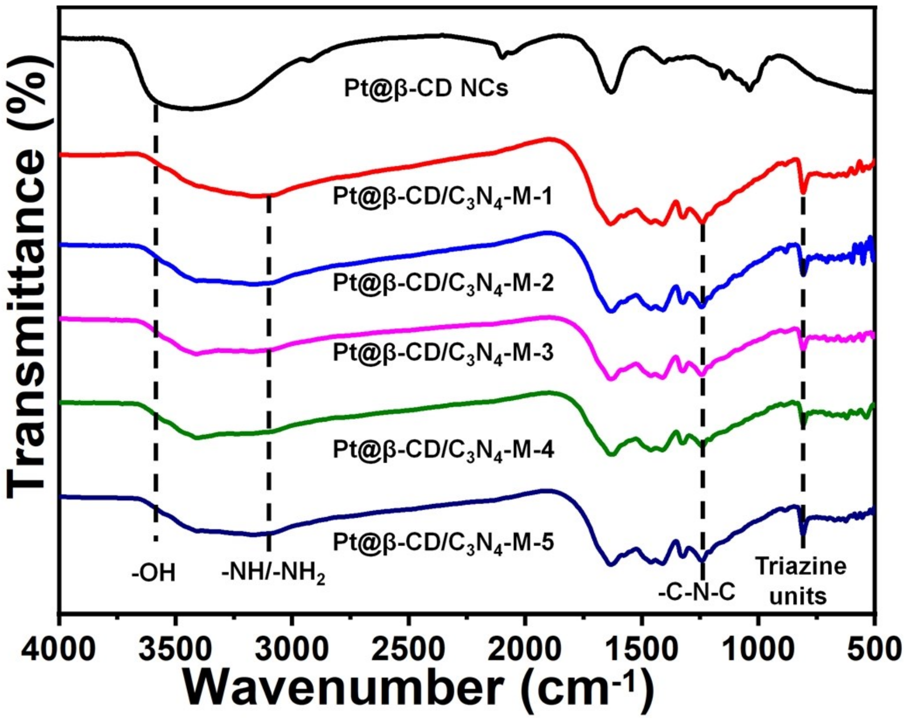

Figure S8. FTIR spectra of the pristine Pt@β-CD NCs and five Pt@β-CD/C_3N_4-M samples with the loading of 1-5 wt.% Pt species.

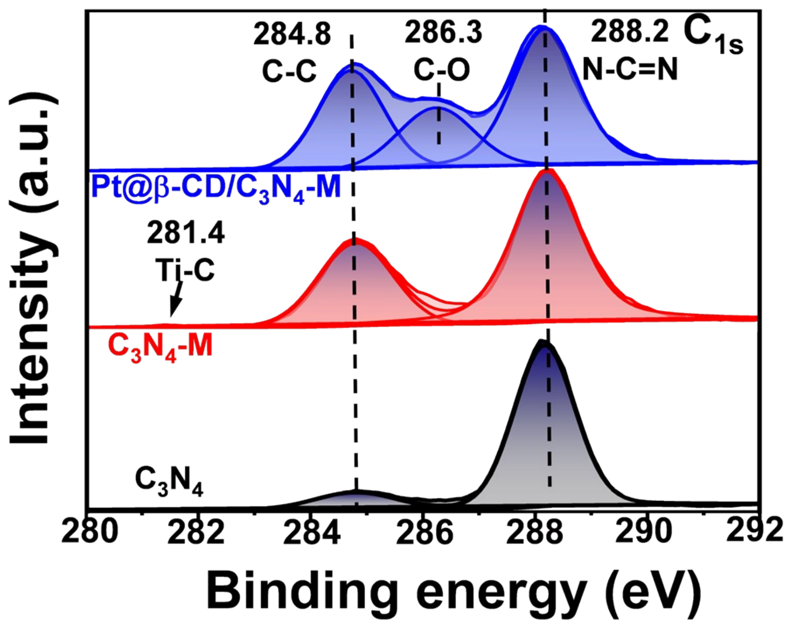

Figure S9. XPS survey of C 1S of the pristine C_3N_4, C_3N_4-M, and Pt@β-CD/C_3N_4-M photocatalyst.

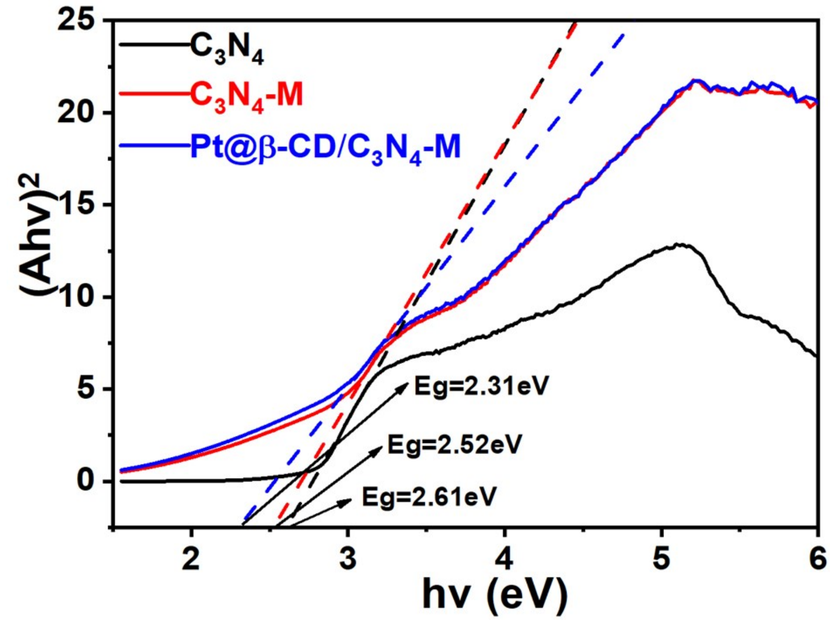

Figure S10. The calculated energy gap (Eg) of the pristine C_3N_4, C_3N_4-M, and Pt@β-CD/C_3N_4-M photocatalyst according to their corresponding UV-Vis DRS absorption spectra.

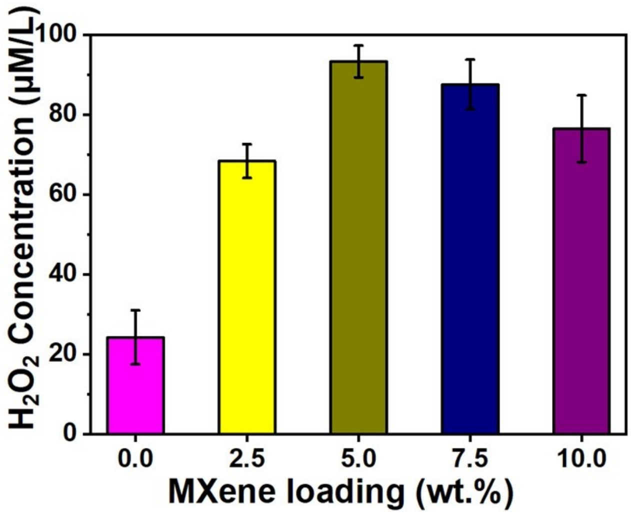

Figure S11. The MXene loading influence of C_3N_4-M on the photocatalytic H_2O_2 production within 60 min.

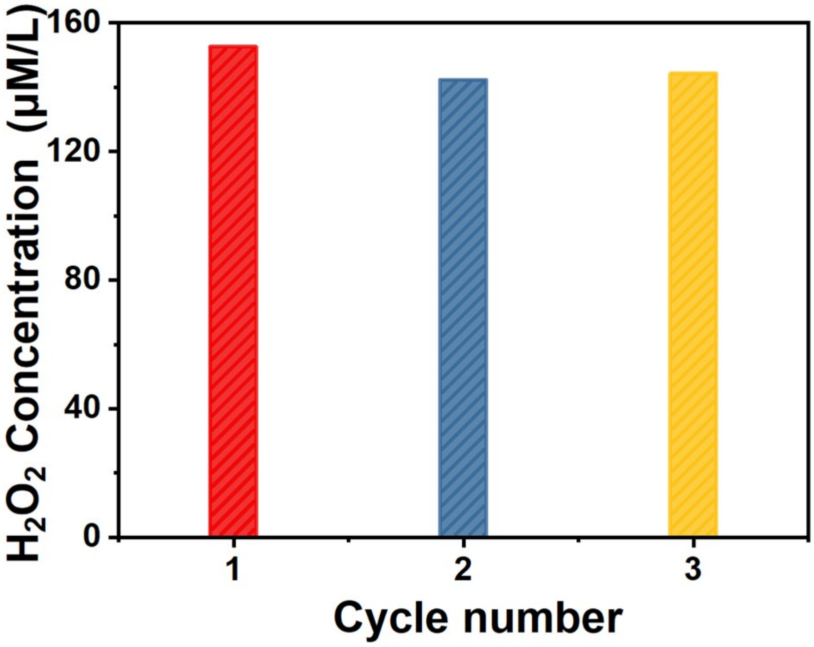

Figure S12. Durability test of the Pt@β-CD/C_3N_4-M in photocatalytic H_2O_2 production.

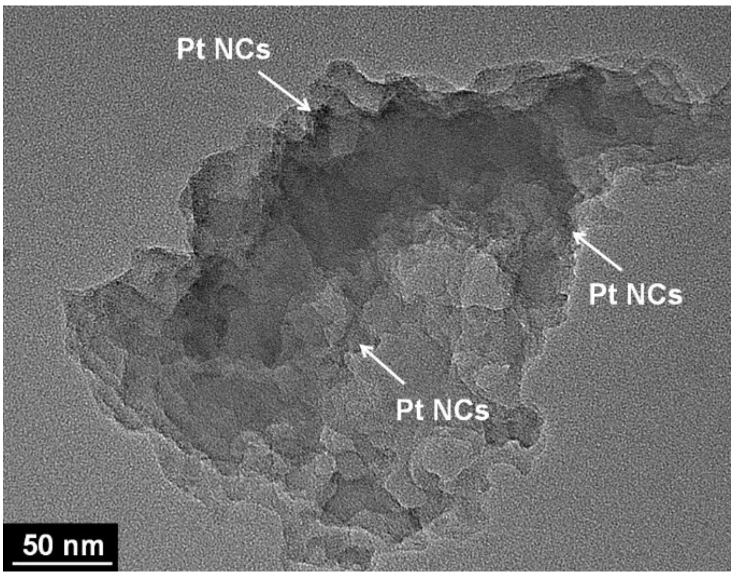

Figure S13. TEM image of the Pt@β-CD/C_3N_4-M after photocatalytic test.

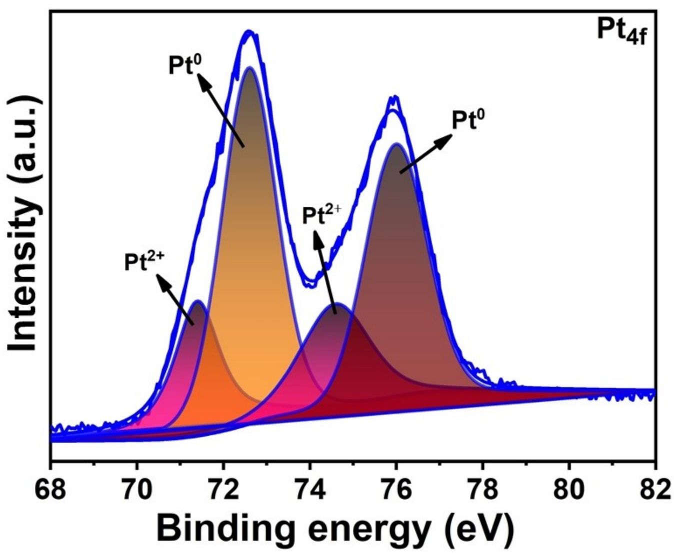

Figure S14. XPS survey of Pt 4f species in the Pt@β-CD/C_3N_4-M after photocatalytic test.

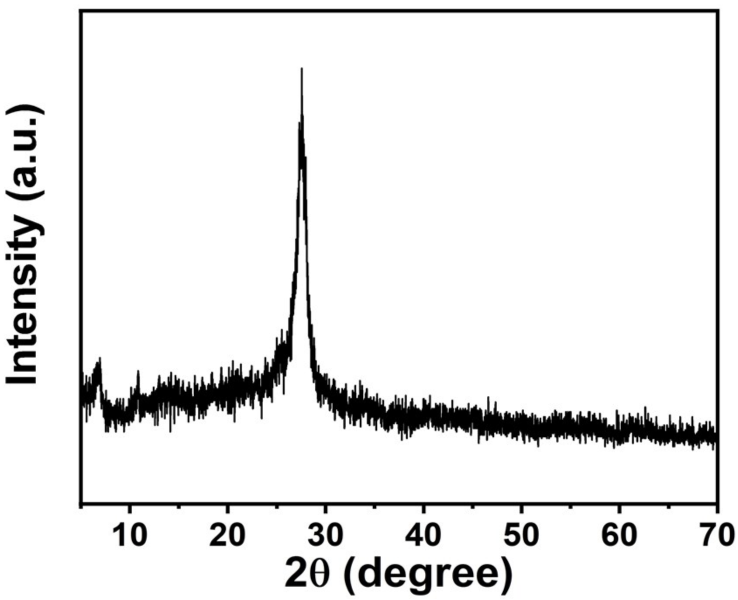

Figure S15. XRD pattern of the Pt@β-CD/C_3N_4-M after photocatalytic test.

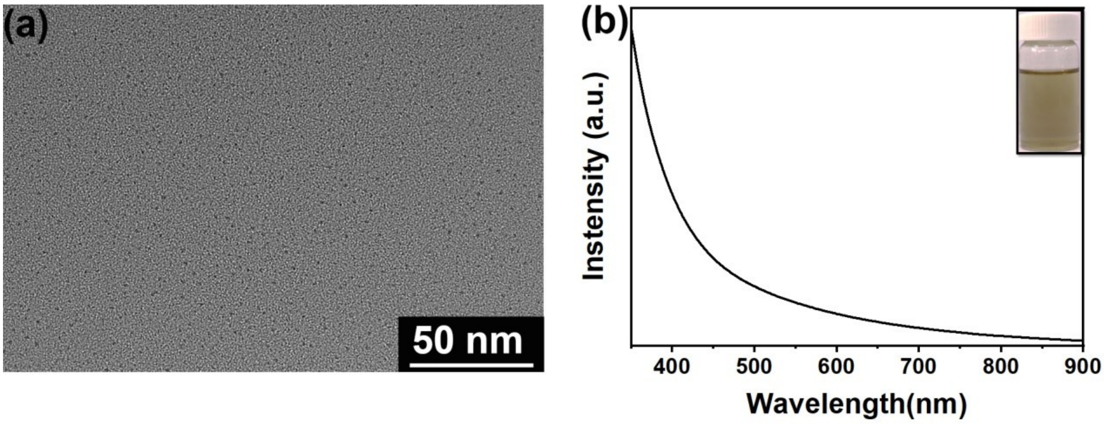

Figure S16. TEM image (a) and UV-Vis absorption spectrum of Pt@GSH NCs and the photo of corresponding NC solution taken under visible light

Table S1. Comparison of the photocatalytic performance of the Pt@β-CD/C_3N_4-M with other C_3N_4-based photocatalysts reported in the literature.

Photocatalyst	Dosage ($g{\cdot}L^{-1}$)	Light wavelength	Reaction solution	Yield ($\mu M{\cdot}g^{-1}{\cdot}h^{-1}$)	Ref.
g-C_3N_4/BDI	1.67	λ > 420 nm,	Water	17.05	1
g-C_3N_4/PDI	1.67	λ > 420 nm	Water	21.04	2
g-C_3N_4/PDI/rGO	1.67	λ > 420 nm,	Water	24.17	3
3DOM-g-C_3N_4-PW_{11}	1	λ > 320 nm	Water	35.00	4
MMO@C_3N_4	1	Solar light	Water, pH =3	40.00	5
Ag@U-g-C_3N_4-NS	1	λ > 420 nm,	Water, pH =3	≈69.00	6
Cv-g-C_3N_4	1	λ > 420 nm	Water	≈90.00	7
PI-NCN	1	λ > 420 nm	Water	≈92.00	8
DCN	0.83	λ > 420 nm	20 vol % IPA/water	96.80	9
$Bi_4O_5Br_2$/g-C_3N_4	1	λ > 420 nm	Water	124.00	10
TC/pCN	1	λ > 420 nm	10 vol% IPA/water	131.71	11
R_{370}-C_3N_4	1	λ > 420 nm	Water	170.00	12
Mesoporous g-C_3N_4	4	λ > 420 nm	90 vol% EA/water	≈183.50	13
PEI/C_3N_4	1	Solar light	water	208.10	14
g-C_3N_4-CNTs	1	λ≥400 nm	10 vol % FA/water	487.00	15
Pt@β-CD/C_3N_4-M	1	λ≥400 nm	Water	147.10	**This work**

BDI: biphenyl diimide; PDI: pyromellitic diimide; rGO: reduced graphene oxide; 3DOM g-C_3N_4: three dimensionally ordered macroporous graphitic carbon nitride; PW_{11}: polyoxometalate (POMs) cluster of $[PW_{11}O_{39}]^{7-}$; MMO: Mixed-Metal Oxide; Ag@U-g-C3N4-NS: PI-NCN: Ag NPs decorated on ultrathin g-C_3N_4 nanosheets; Cv-g-C_3N_4: Carbon vacancy contained g-C_3N_4; PI-NCN: perylene imides deposited on g-C_3N_4 nanosheets; DCN, nitrogen defective g-C_3N_4; R_{370}-C_3N_4: Reduced g-C_3N_4 prepared at reduction temperature of 370 ^oC; TC/pCN: Ti_3C_2/porous g-C_3N_4; PEI: polyethylenimine; IPA: isopropanol; EA: ethanol; FA: formic acid.

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