

SUPPORTING INFORMATION

**Nature-Based Catalyst for Visible-Light-Driven Photocatalytic
CO₂ Reduction**

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Table S1 The photocatalytic CO₂ reduction efficiency of various catalysts.

Photocatalyst	Light source	CO evolution rate ($\mu\text{mol h}^{-1} \text{g}^{-1}$)	CH ₄ evolution rate ($\mu\text{mol h}^{-1} \text{g}^{-1}$)	Reference
Bi ₄ O ₅ I ₂ /g-C ₃ N ₄	300 W Xenon lamp (with $\lambda > 400$ nm filter)	45.6	6	1
LaPO ₄ /g-C ₃ N ₄	300W Xenon lamp	14.4	N/A	2
SnO ₂ /g-C ₃ N ₄	500W Xenon lamp	18	2	3
Pt/B ₄ C/g-C ₃ N ₄	Visible light (405– 723 nm)	N/A	0.84	4
ZnO/g-C ₃ N ₄	500 W Xenon lamp (with a 420 nm cut filter)	29	4	5

NA= not available

Table S2 The photocatalytic CO₂ reduction efficiency and the corresponding QE of g-C₃N₄ based photocatalysts

Photocatalyst	Light source	CO evolution rate ($\mu\text{mol g}^{-1} \text{h}^{-1}$)	QE (%)	Reference
KOH/g-C ₃ N ₄	300 W Xeon lamp (PLS-SXE300UV)	2.0	N/A	6
Co-porphyrin/g-C ₃ N ₄	300W Xenon lamp (with a UV-cut filter)	17.0	0.8 (420 nm)	7
N-TiO ₂ /g-C ₃ N ₄	300 W Xenon lamp (Perfect Light)	12.2	N/A	8
LaPO ₄ /g-C ₃ N ₄	300W Xenon lamp (Aulight CEL-HX)	14.4	N/A	9
BiOI/g-C ₃ N ₄	300 W Xenon lamp (with a UV cutoff filter $\lambda > 400$ nm)	3.45	N/A	10
rGO/g-C ₃ N ₄	15 W energy-saving daylight lamp (Philips)	N/A	0.56 (420 nm)	11
Co-ZIF-9/g-C ₃ N ₄	Xenon lamp (with a 420 nm cutoff filter)	10.4	0.9 (420 nm)	12
Bi ₂ WO ₆ /g-C ₃ N ₄	300 W Xenon lamp (Aulight CEL-HX)	5.19	N/A	13
N-TiO ₂ /g-C ₃ N ₄	400 W Xenon lamp	12.28	N/A	14

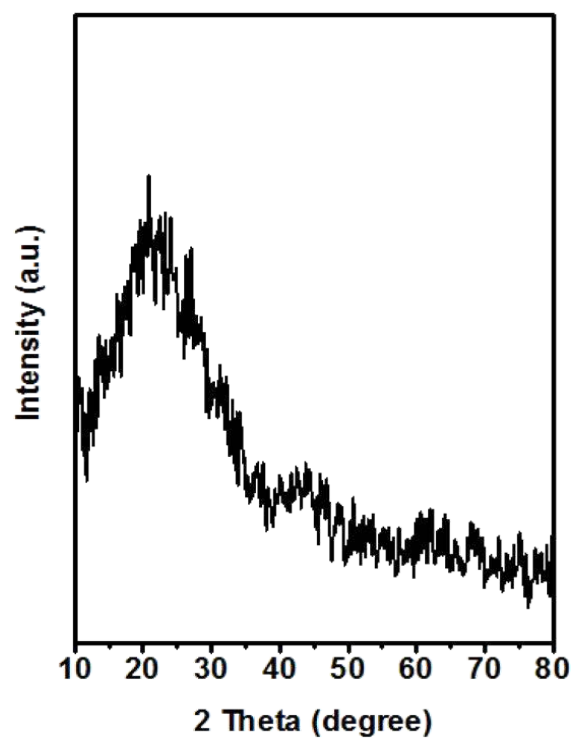


Figure S1. XRD pattern of TRP catalyst.

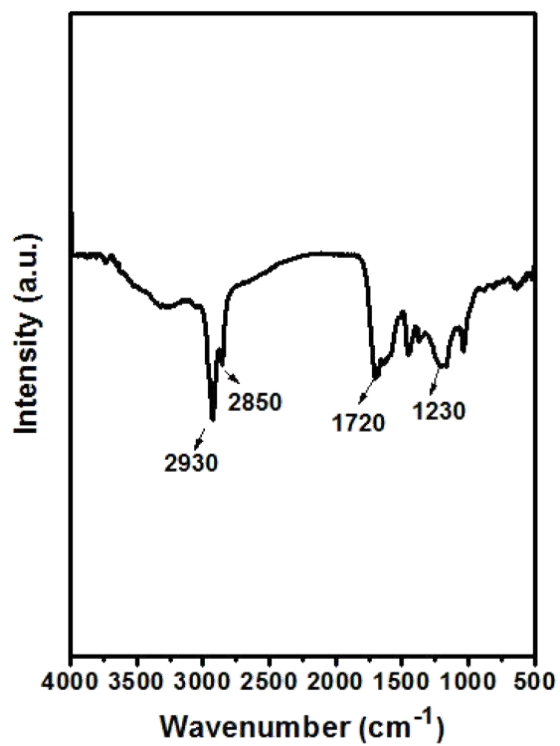


Figure S2. FT-IR spectrum of TRP catalyst.

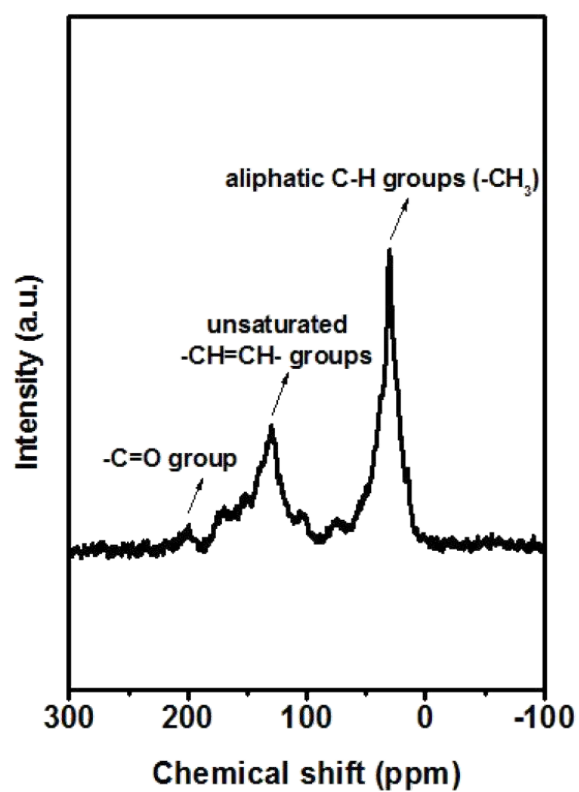


Figure S3. ^{13}C Solid-state NMR spectrum of TRP catalyst.

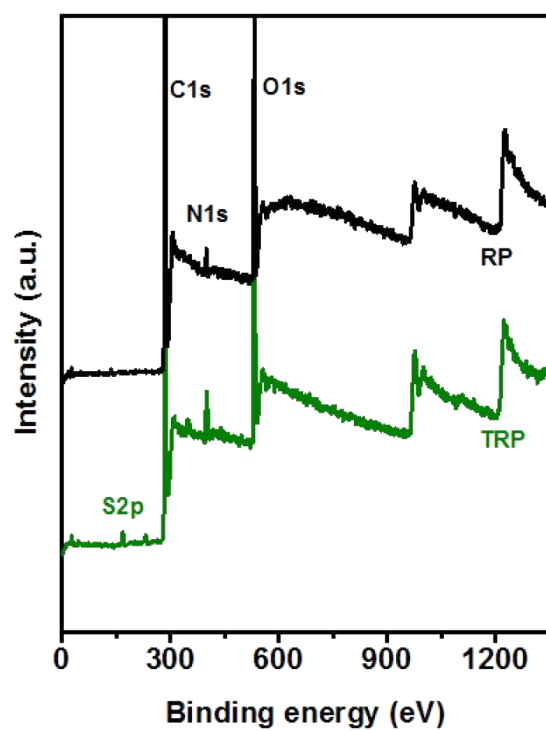


Figure S4. XPS spectra of RP and TRP catalyst.

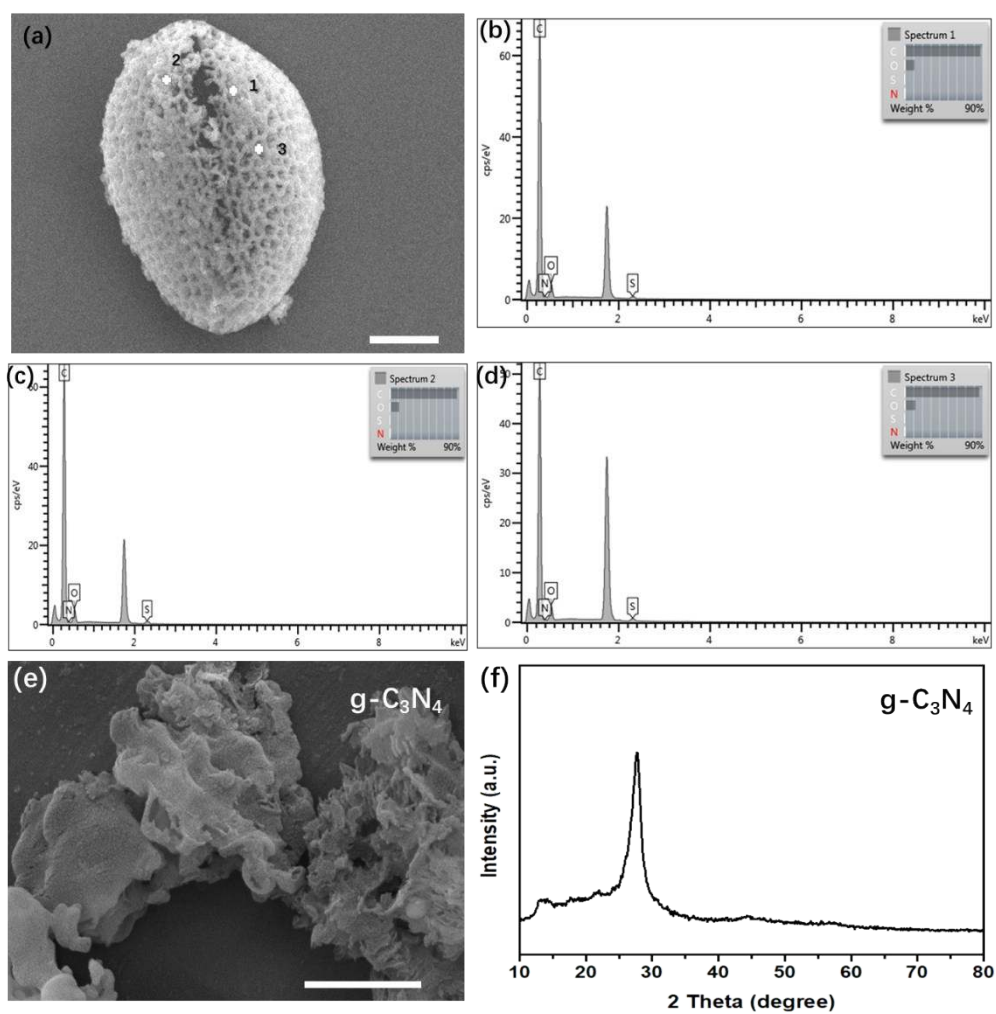


Figure S5. SEM image (a) and corresponding EDX spectra (b-d) of TRP catalyst, SEM image (e) and XRD pattern (f) of g-C₃N₄. Scale bar: 5 μm (a), 1 μm (e)

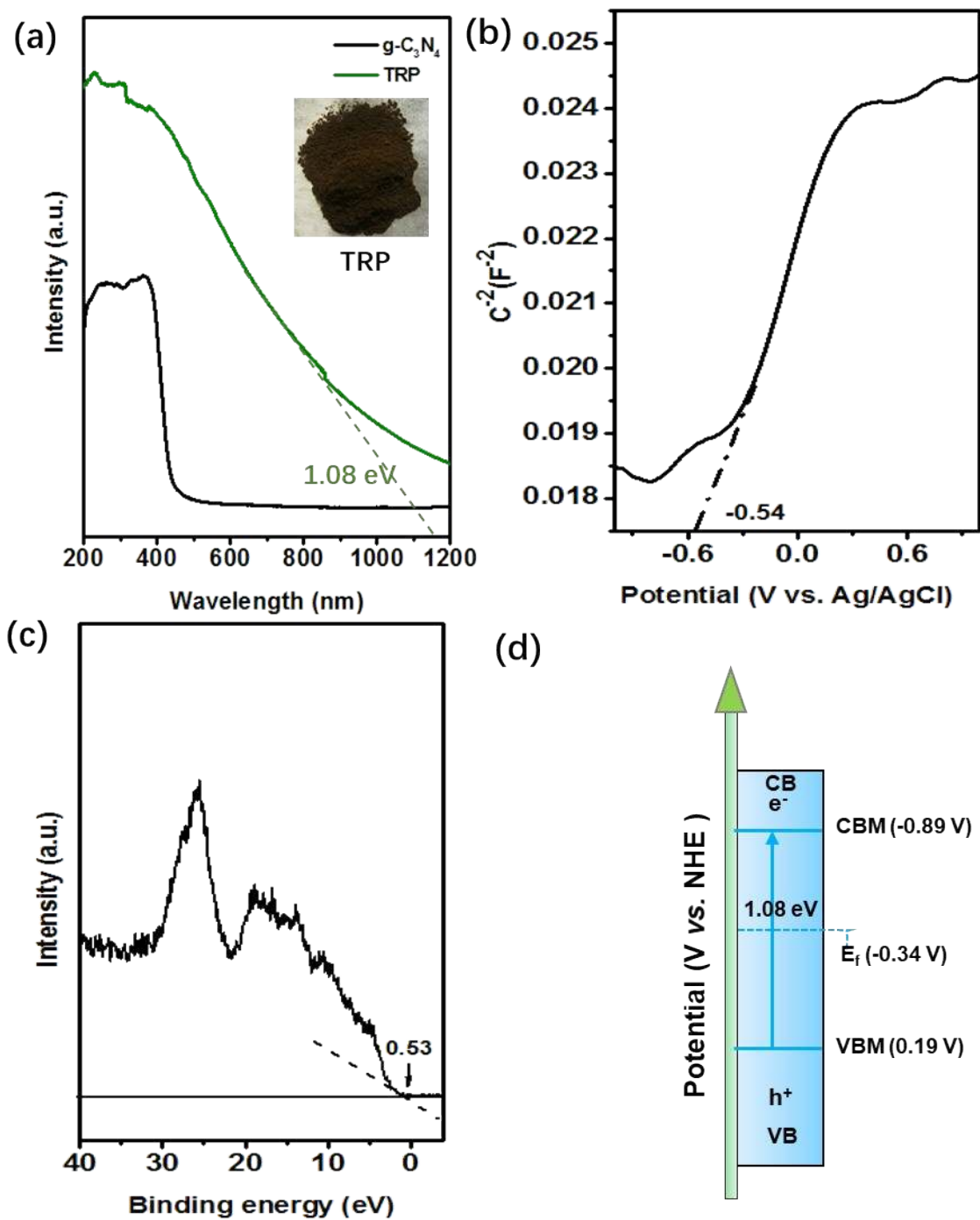


Figure S6. UV-vis diffuse reflectance spectra of $g\text{-C}_3\text{N}_4$ and TRP (inset: Photograph of TRP sample) (a), Mott-Schottky plot (b), valence band XPS spectrum (c) and energy band diagram (d) of TRP catalyst.

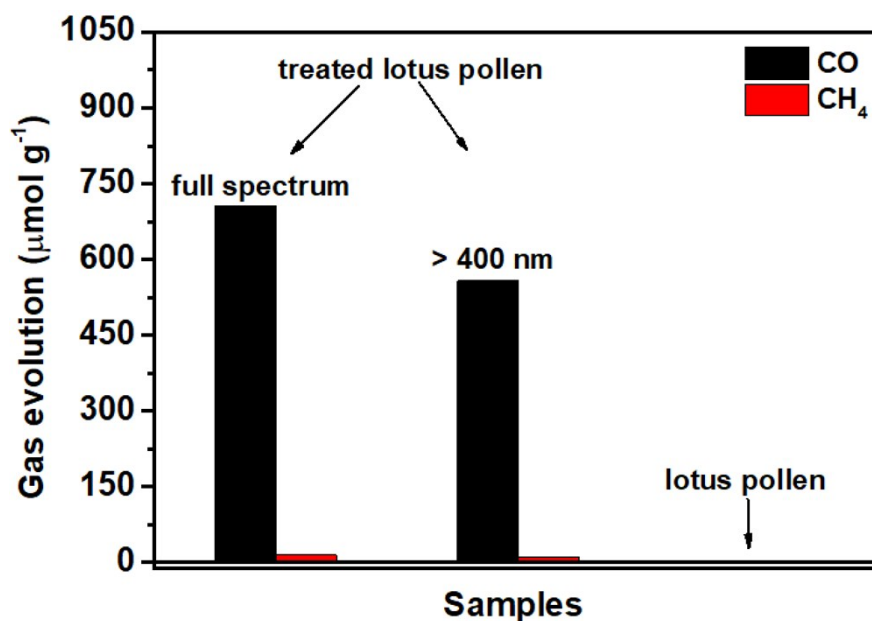


Figure S7. Photocatalytic CO₂ reduction activity of the treated lotus pollen and lotus pollen.

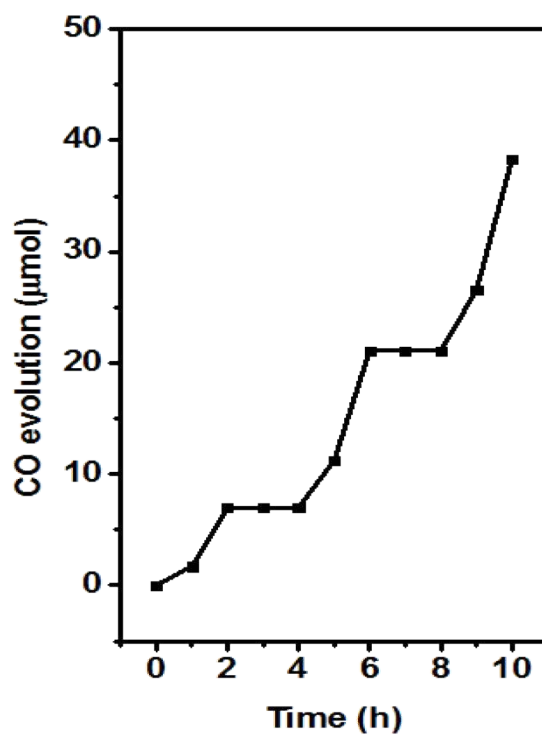


Figure S8. The possibility of recycling ability of TRP catalyst.
(Reaction condition: 15 mg TRP, 20 mL water)

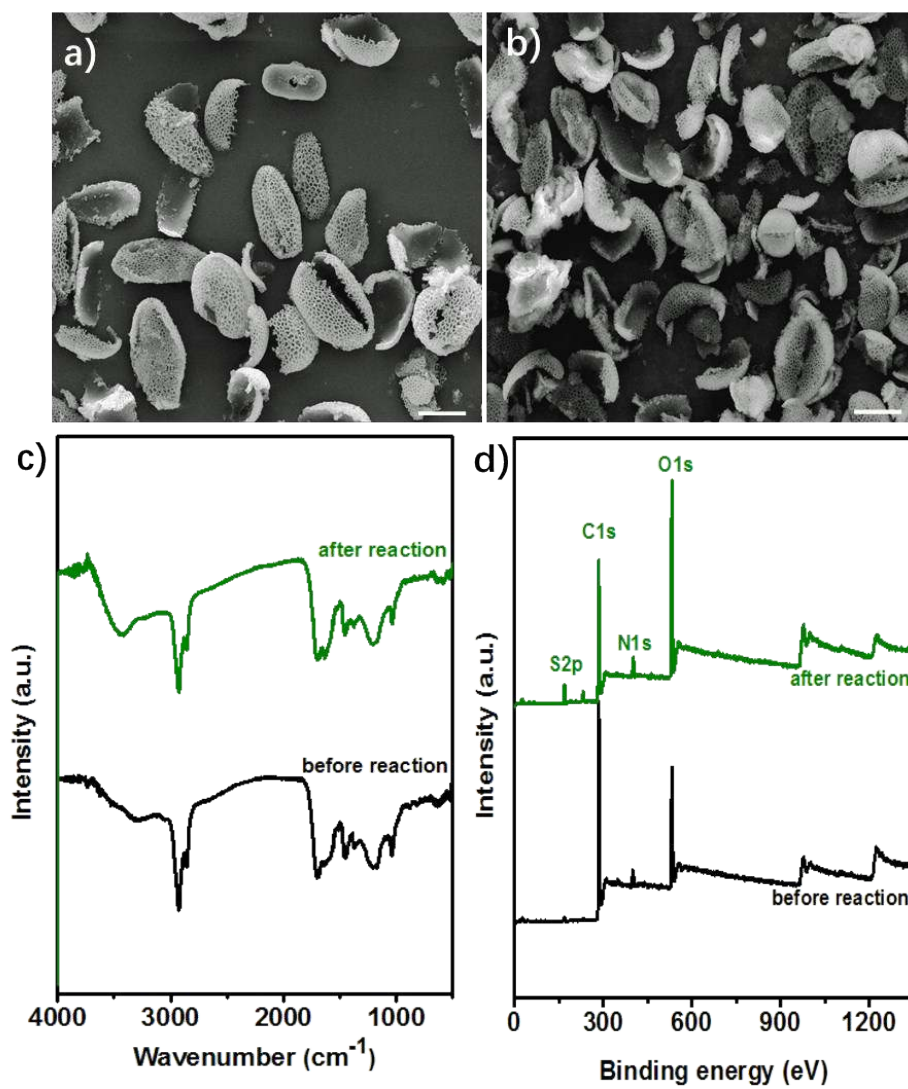


Figure S9. SEM images of TRP before (a) and after (b) reaction, FT-IR (c) and XPS (d) spectra of TRP catalyst before and after reaction. Scale bar (a and b: 10 μm)

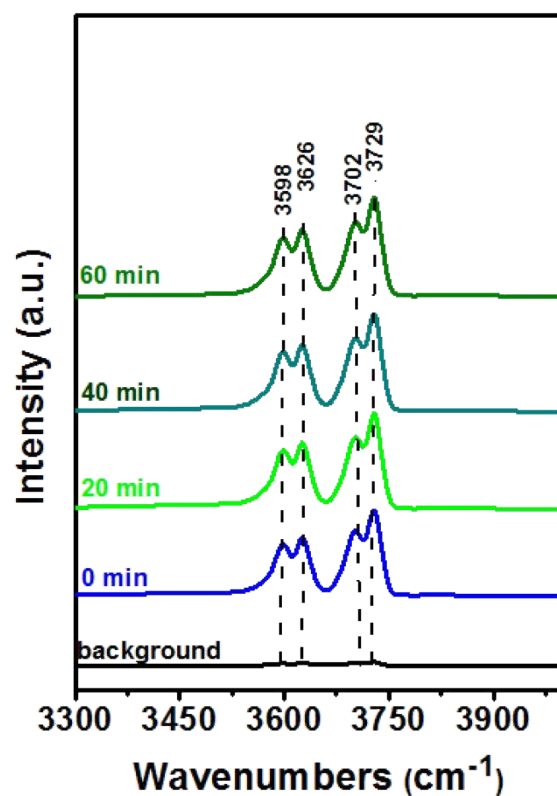


Figure S10. *In situ* FT-IR spectra for co-adsorption of a mixture of CO₂ and H₂O vapor on the TRP catalyst in the dark and under visible light (LED lamp, $\lambda = 420$ nm) irradiation for 20, 40, 60 min, respectively.

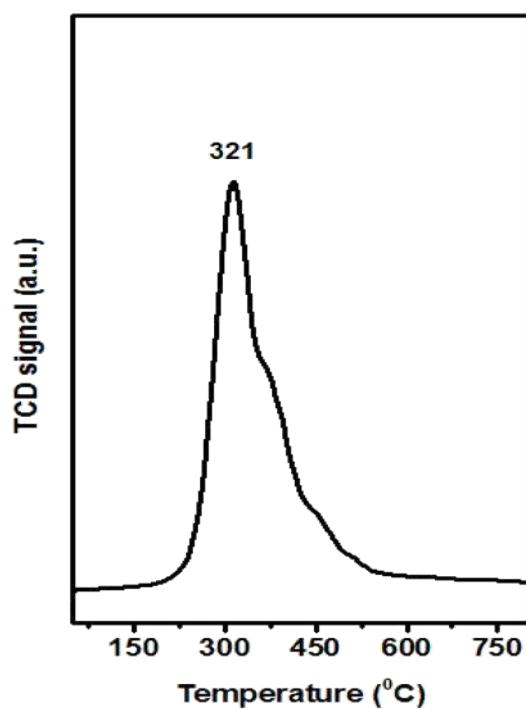


Figure S11. CO₂-TPD spectrum of TRP catalyst.

References

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