Electronic Supplementary Material (ESI) for Green Chemistry.

Supplementary information

Endowing cells with unnatural photocatalytic ability for sustainable chemicals production by bionic minerals-triggered

Peng Liu,‡[a] Yi Chang,‡[a] Xueqing Ren,[a] Tingting Liu,[a] Hongmin Meng,[b] Xiangli Ru,[a] Zhengyu Bai,*[a] Lin Yang*[a] and Xiaoming Ma*[a]

[a] *Collaborative Innovation Center of Henan Province for Green Manufacturing of Fine Chemicals, Key Laboratory of Green Chemical Media and Reactions, Ministry of Education, School of Chemistry and Chemical Engineering, Henan Normal University, Xinxiang, Henan 453007, P. R. China. E-mail: mxm@htu.edu.cn, yanglin@htu.edu.cn*

[b] *College of Chemistry, Zhengzhou University, Zhengzhou, Henan 450001, P. R. China*

Results and Discussion

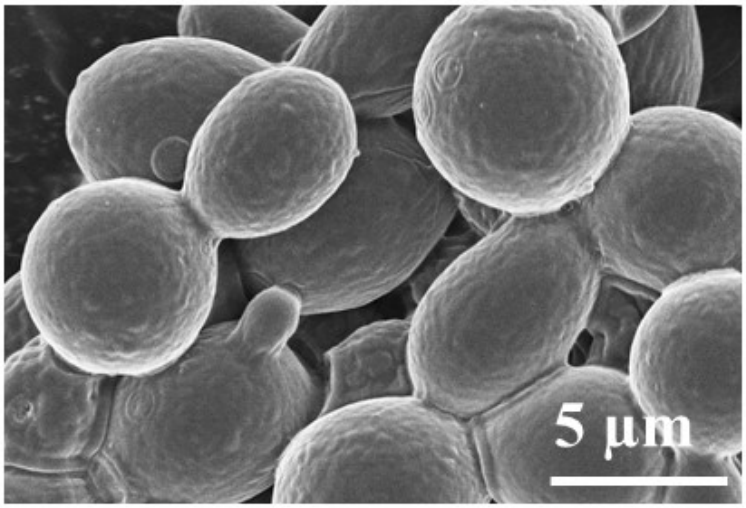

Figure S1. Scanning electron micrograph of native yeast cells.

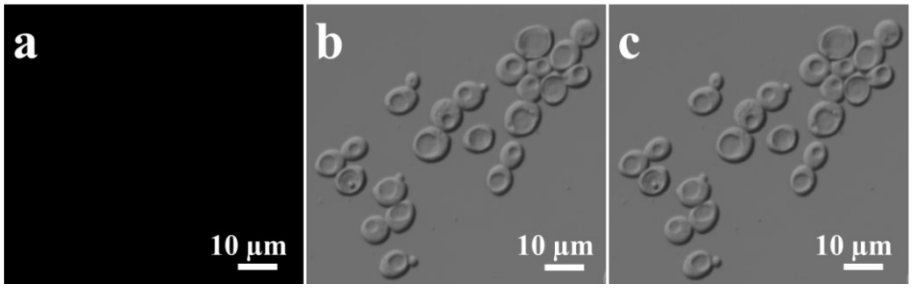

Figure S2. Confocal images of the native yeast cells cultivated at 30 °C for 24 h. The fluorescence images were excited by 405 nm laser beam (a), bright field (b) and merged field (c).

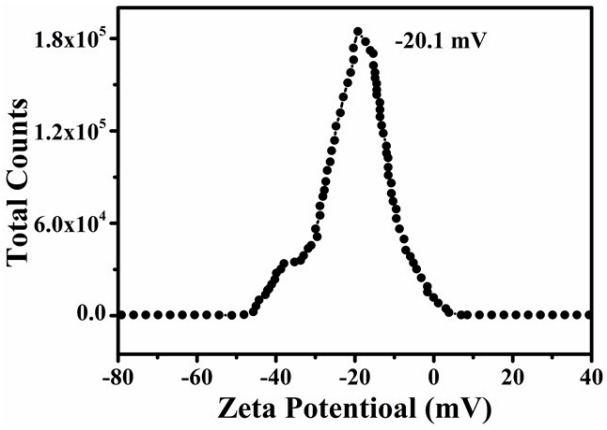

Figure S3. Zeta potentials of isolated nCdS from nCdS@Yeasts dispersed in aqueous solution.

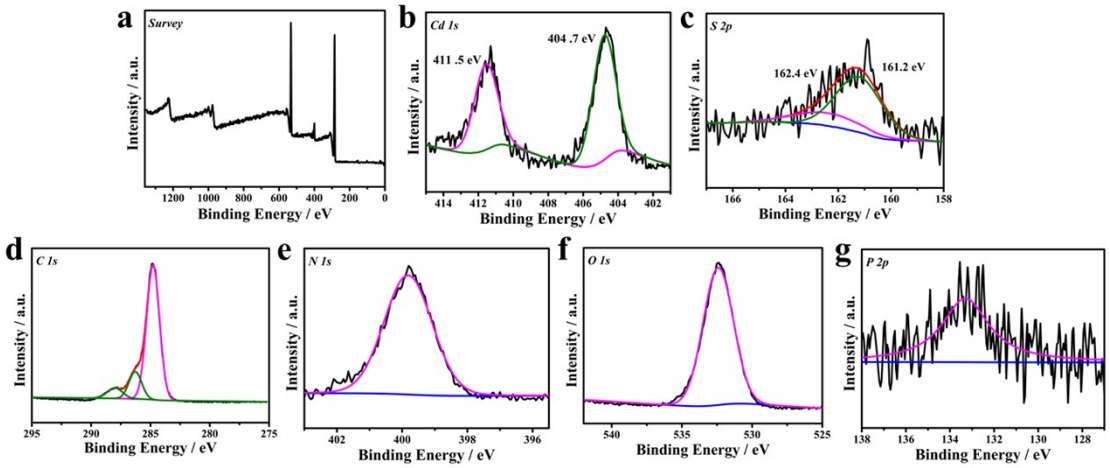

Figure S4. XPS of isolated nCdS from nCdS@Yeasts. (a) The survey graph of nCdS, (b-g) the graphs of Cd 3d, S 2p, C 1s, N 1s, O 1s and P 2p, respectively.

The XPS analysis of the nCdS shows the binding energies of Cd $3d_{5/2}$ peak and Cd $3d_{3/2}$ peaks locate in 404.7 and 411.5 eV, and the S 2p exhibits doublet peaks at 161.2 ($2p_{3/2}$) and 162.4 eV ($2p_{1/2}$), respectively, which are all typical values for nCdS. In addition, the regions of nanodots are also rich in carbon, oxygen and nitrogen, attributing to the presence of intracellular proteins combined with the nCdS.

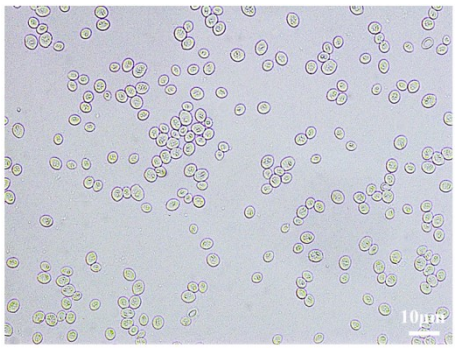

Figure S5. Light micrograph of the nCdS@Yeasts stained by trypan blue.

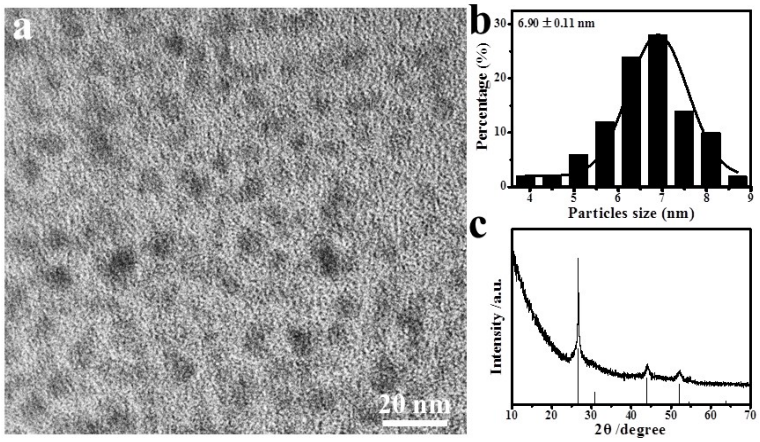

Figure S6. The characterizations of CdS nanoparticles (CdS NPs) synthesized in vitro under the mediation of the morphology regulator (bovine serum albumin BSA). (a) TEM of CdS NPs, (b) the size distribution of CdS NPs, (c) XRD spectra of CdS NPs.

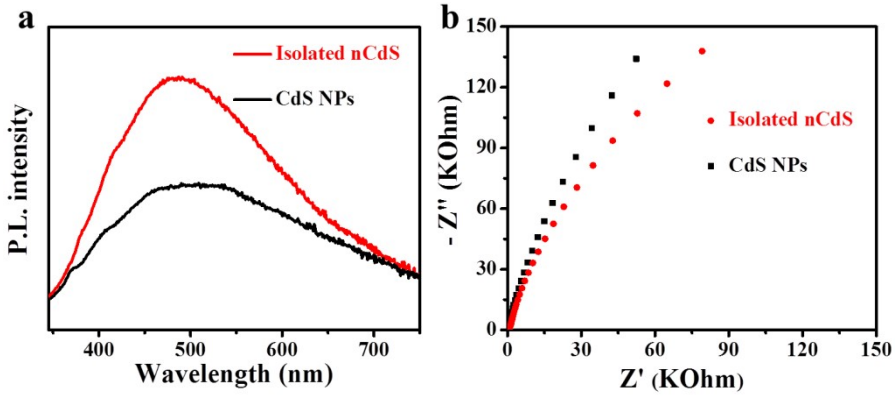

Figure S7. (a) Steady-state PL spectra of nCdS isolated from nCdS@Yeasts and CdS NPs at excitation wavelength of 360 nm. (b) EIS Nyquist plots of nCdS isolated from nCdS@Yeasts and CdS NPs in 0.5 M Na_2SO_4 solution under visible light.

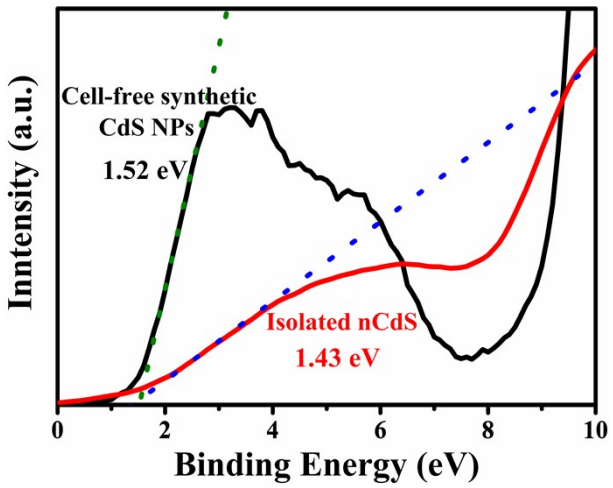

Figure S8. XPS valence spectra of isolated nCdS from nCdS@Yeasts and CdS NPs synthesized in vitro, respectively.

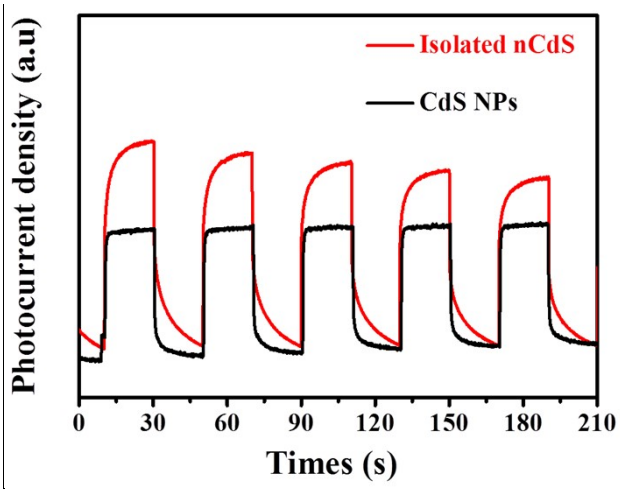

Figure S9. Transient photocurrent response for nCdS isolated from nCdS@Yeasts and CdS NPs.

Table S1 Performance comparisons of different whole-cell catalysts or enzyme catalysts.

Hybrid systems	Products	Yield	References
CdS/*D. desulfuricans*	H_2	36 μmol g–1 dcw h^{-1}	1
Cu_2O/RGO/SW	H_2	77 μmol g–1 Cu_2O h^{-1}	2
CdS/*E. coli* cells	H_2	0.56 to 1.15 μmol/10^8 cells /hour	3
CdS/rGO/cystathionine γ-lyase (CSE)	H_2	550 μmol g^{-1} h^{-1}	4
PDA/laccase/tannic acid/C. pyrenoidosa	H_2	0.32 μmol h^{-1} (mg chlorophyll)$^{-1}$	5
nCdS@Yeasts	H_2	1063.51 μmol g–1 CdS h^{-1}	This work

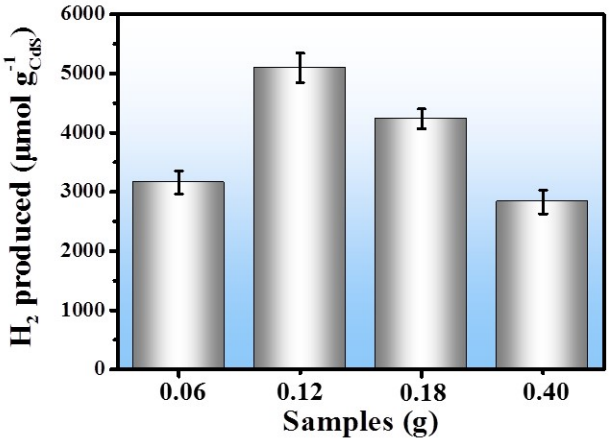

Figure S10. Photocatalytic hydrogen production versus the amount of nCdS@Yeasts.

Hydrogen generation rate of nCdS@Yeasts shows optimum H_2 production when the amount of nCdS@Yeasts in the photoreactor was 0.12 g.

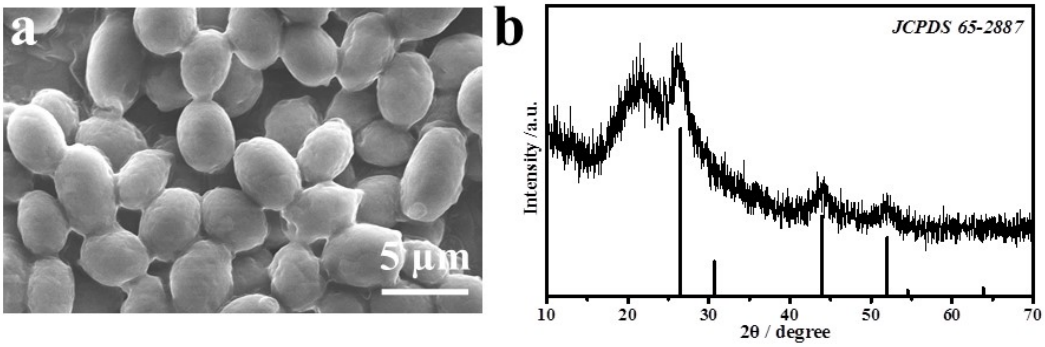

Figure S11. SEM of nCdS@Yeasts (a) and XRD patterns of isolated nCdS (b) after the recycles of the photocatalytic H_2 production.

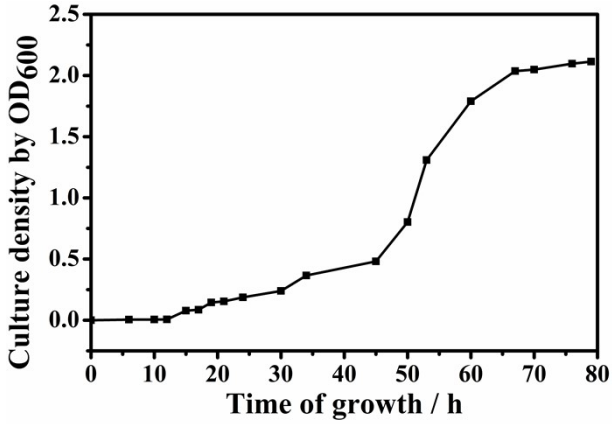

Figure S12. The growth curve of the nCdS@Yeasts after the recycles of photocatalytic H_2 production.

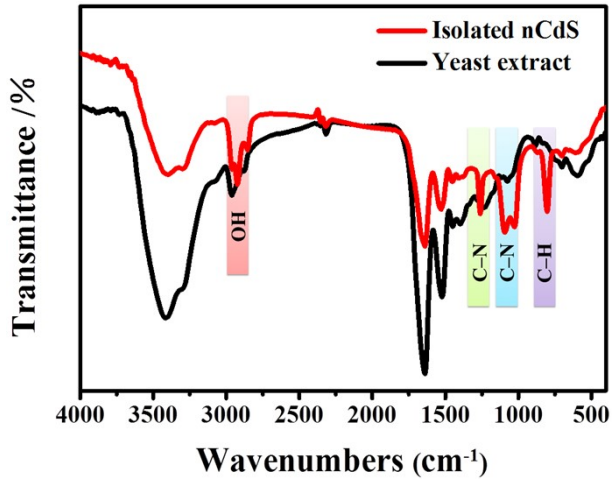

Figure S13. The FT-IR spectra of isolated nCdS from nCdS@Yeasts.

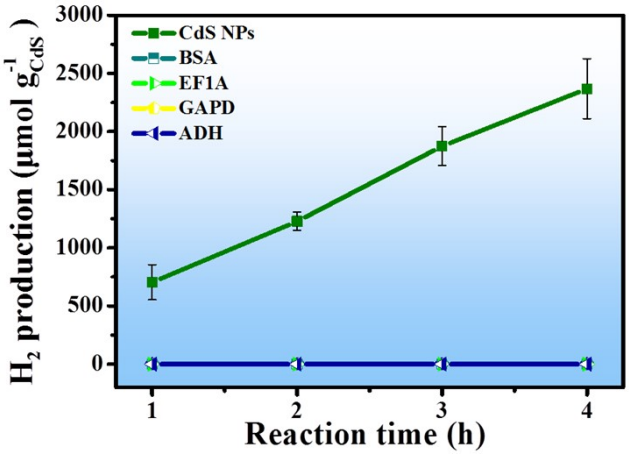

Figure S14. Hydrogen production of CdS NPs, BSA, ADH, GAPD and EF1A, respectively. The lines of BSA, ADH, GAPD and EF1A are overlapping.

References

1. M. Martins, C. Toste and I. A. C. Pereira, *Angew. Chem. Int. Ed.*, 2021, **60**, 9055–9062.
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