Electronic Supplementary Material (ESI) for Inorganic Chemistry Frontiers.
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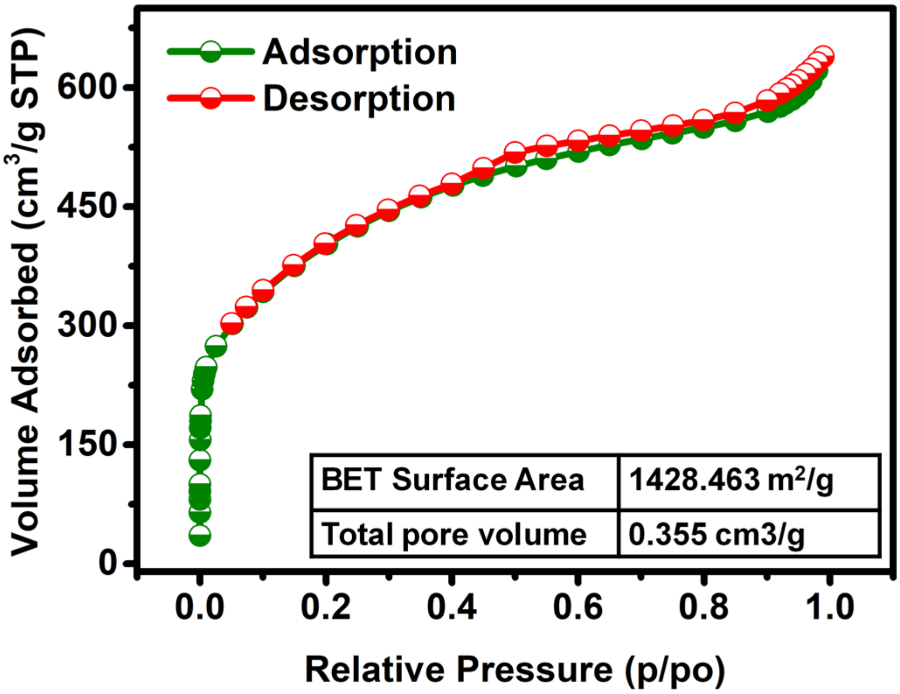
Electronic Supplementary Information



BET Surface Area	1428.463 m^2/g
Total pore volume	0.355 cm3/g

Figure S1. Nitrogen adsorption−desorption isotherm curves of Ru/NC-0.1.

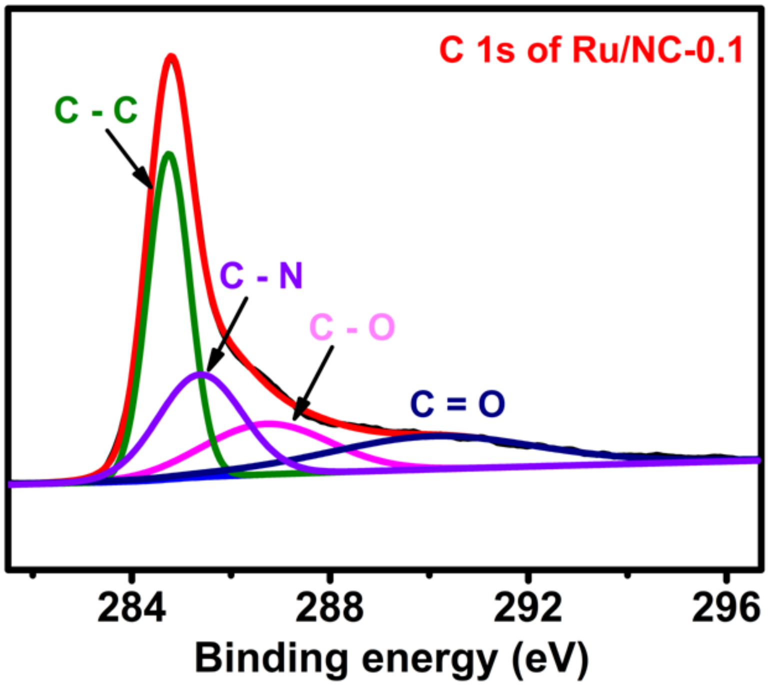


Figure S2. High-resolution XPS spectrum of C 1s.

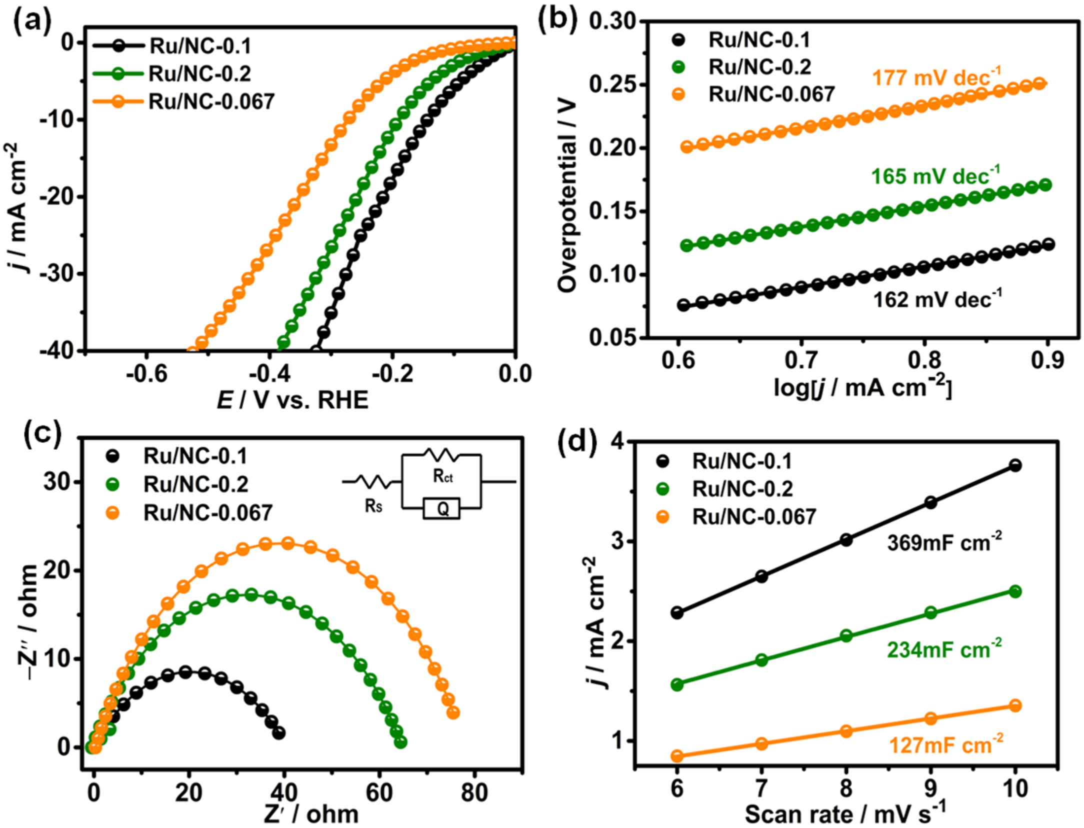


Figure S3. (a) Polarization curves of electrocatalytic H_2 evolution of Ru/NC-0.1, Ru/NC-0.2 and Ru/NC-0.067 in aqueous lactic acid (10% v/v) containing 0.5 M Na_2SO_4 at a scan rate of 5 mV s^{-1}. (b) Corresponding Tafel plots. (c) Measured (dot) and fitted (line) Nyquist plots an applied overpotential of 200 mV vs. RHE. (d) Linear plots of the capacitive current vs. the scan rates of the catalysts. Cdl was obtained from the half of the slopes.

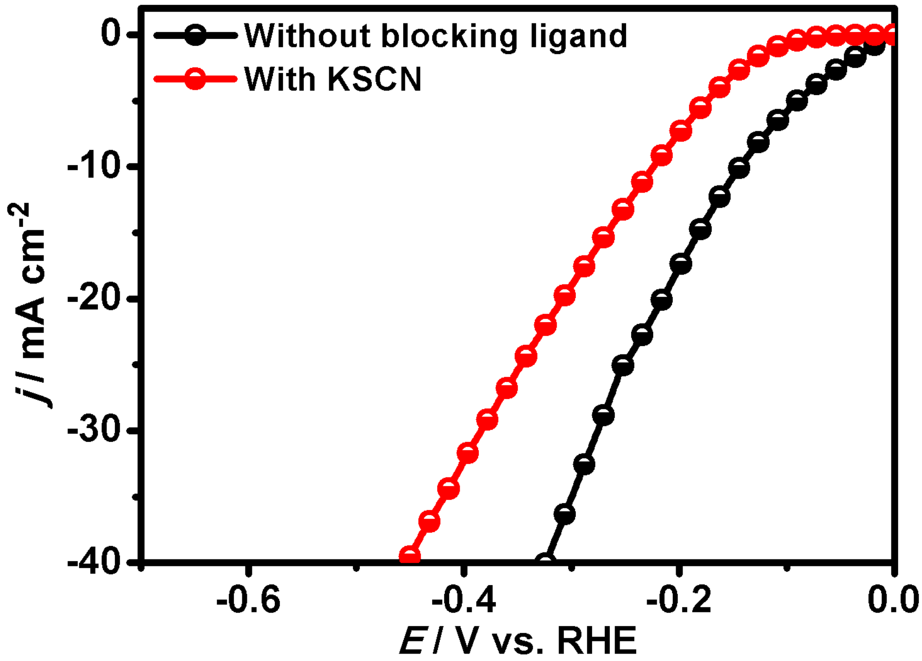


Figure S4. Polarization curves of electrocatalytic H_2 evolution of Ru/NC-0.1 with and without KSCN in aqueous lactic acid (10% v/v) containing 0.5 M Na_2SO_4 at a scan rate of 5 mV s^{-1}.

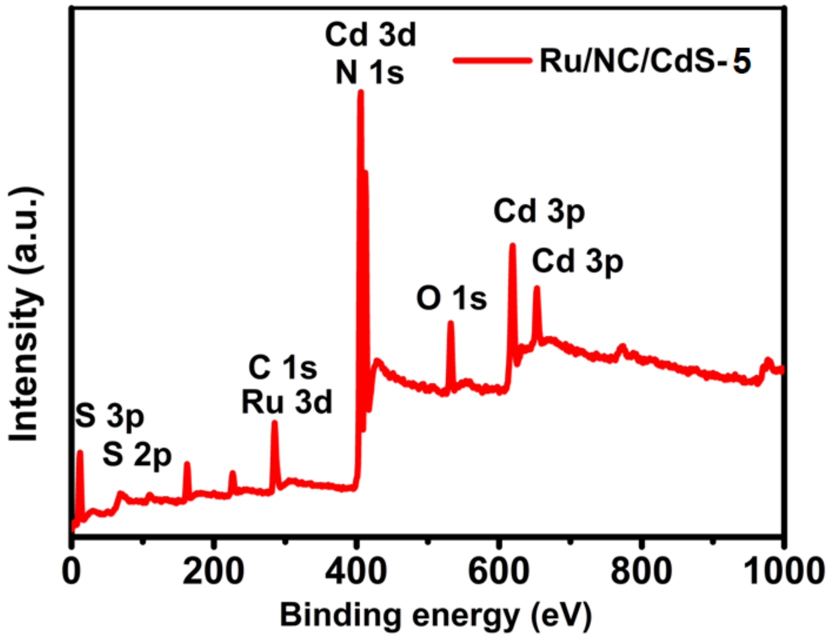


Figure S5. XPS spectrum of Ru/NC/CdS-5

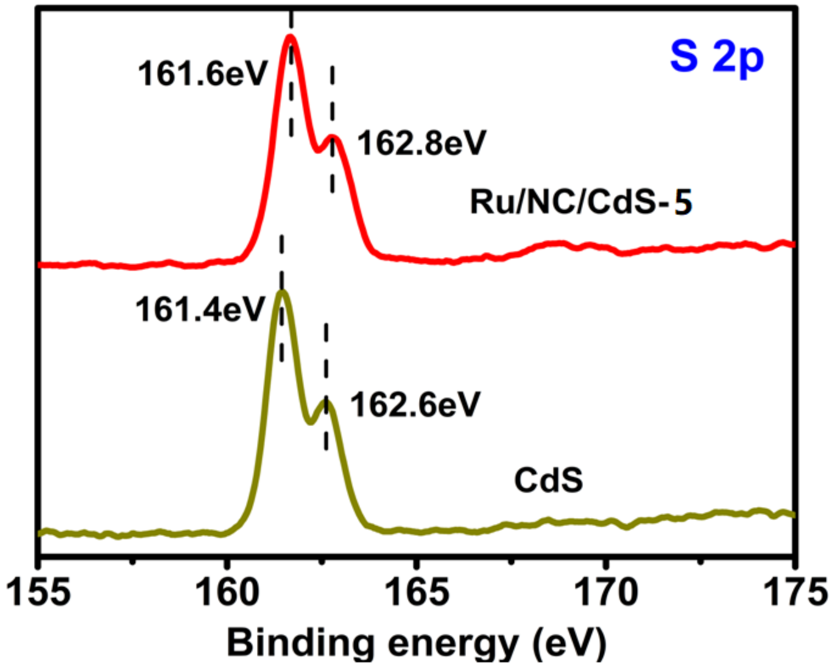


Figure S6. High-resolution XPS spectra of S 2p for Ru/NC/CdS-5 and CdS.

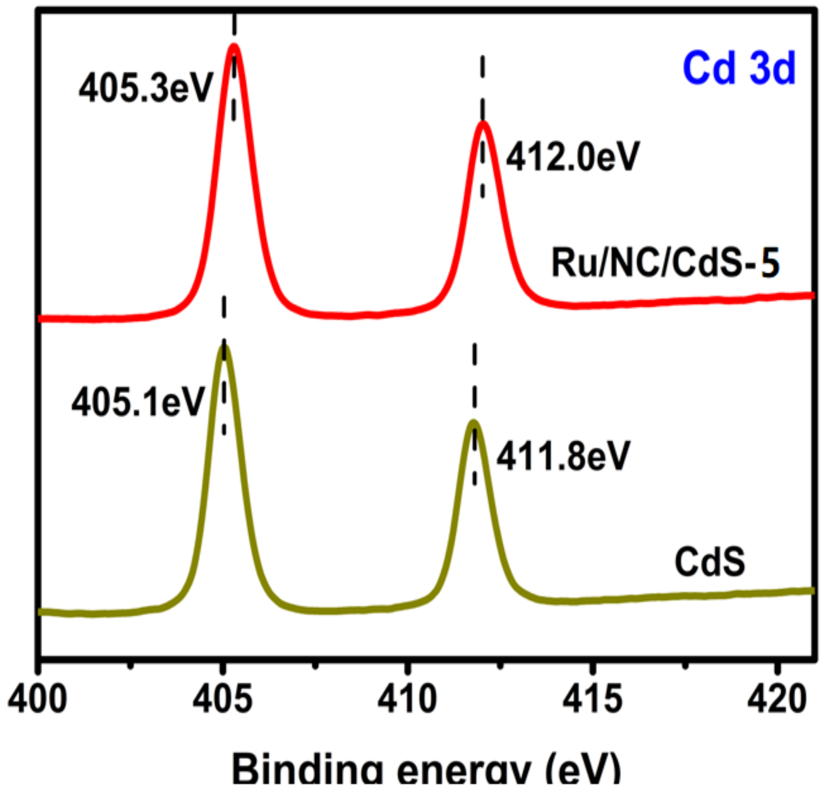


Figure S7. High-resolution XPS spectra of Cd 3d or Ru/NC/CdS-5 and CdS.

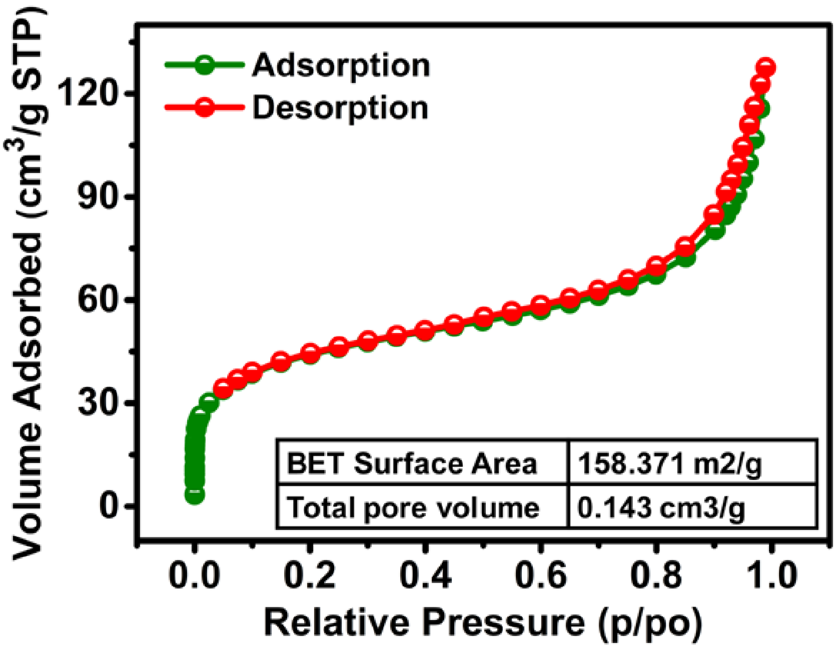


Figure S8. Nitrogen adsorption−desorption isotherms curves of Ru/NC/CdS-5.

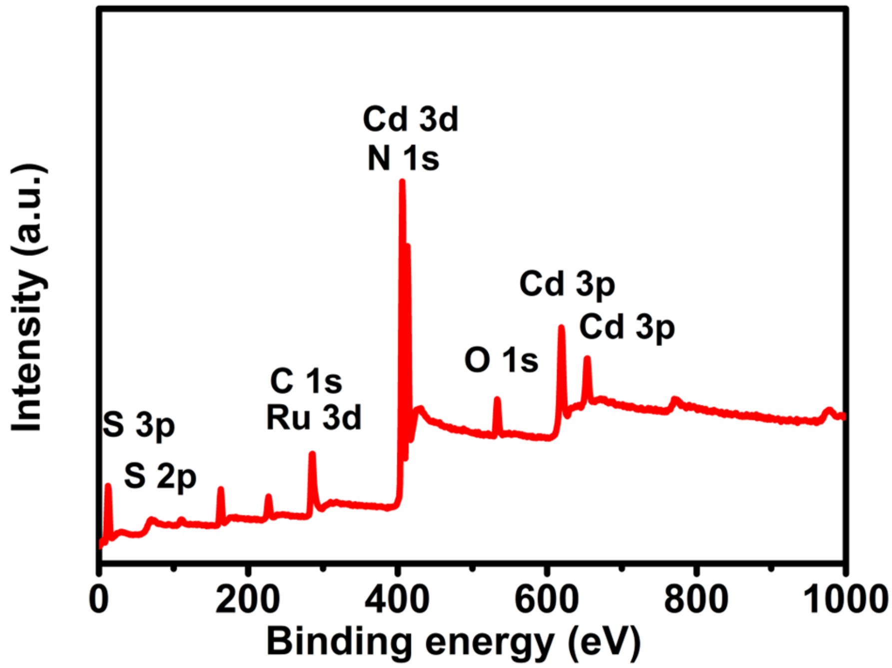


Figure S9. XPS spectrum of Ru/NC/CdS-5 after photo catalysis.

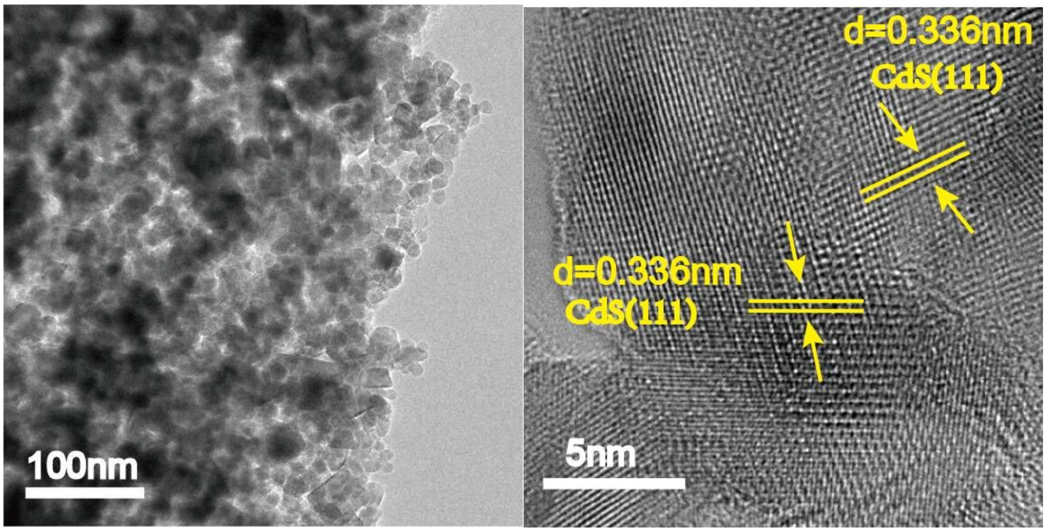


Figure S10. TEM of Ru/NC/CdS-5 after photo catalysis.

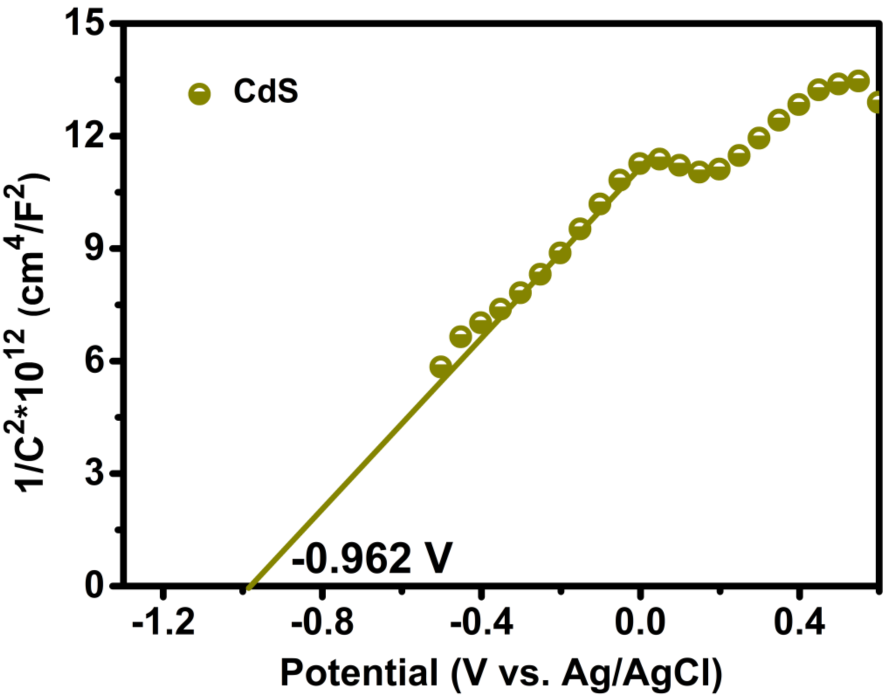


Figure S11. Mott−Schottky plot of the $1/C_{SC}^2$ as a function of voltage (E) relative to the redox potential of Ag/AgCl for CdS.

Table S1. Summary of the recent reported CdS-based photocatalysts and other photocatalysts for H_2 generation.

Photocatalyst	Co-Catalysts	Sacrificial reagent	Light source	Activity (mmol h^{-1} g^{-1})	**Reference**
CdS	**Ru/NC**	**Lactic acid**	**300W Xe lamp ($\lambda \geq 420$)**	**73.6**	**this work**
CdS QDs	CeO_2	Na_2SO_3 and $NaSO_4$	300W Xe lamp ($\lambda \geq 420$)	0.101	1
CQDs@CdS	Ni_4P_2	H_2O	LED ($\lambda \geq 420$)	0.145	2
0.05CIGCS-R	Pt-G_{cys}	Lactic acid	300W Xe lamp ($\lambda \geq 420$)	29.8	3
CdS QDs	g-C3N4	Methanol	300W Xe lamp ($\lambda \geq 420$)	0.172	4
CQDs-CaTiO3		Methanol	PLS-SXE-300C(320-750nm)	6.5	5
ZIS-100CN		TEOA	300W Xe lamp ($\lambda \geq 400$nm)	11.914	6
ZnTCPP/THPP		Ascorbic acid	300W Xe lamp ($\lambda \geq 420$nm)	41.4	7
Ti-MOF/COF		Ascorbic acid	300W Xe lamp ($\lambda \geq 400$nm)	13.98	8

$Cd_{0.4}Zn_{0.6}S$	Lactic acid	300W Xe lamp (λ≥420nm)	4.45	9
D/A NPs	Ascorbic acid	Asahi Max 303	18.5	10
0.05CIGCS-R	Lactic acid	5 W white light multi-channel	16.16	11
Cu/TiO_2	Methanol	300 W UV lamp	~5	12
CQDs/CdS	Na_2S and Na_2SO_3	5 W LED (λ ≥420 nm)	17.5	13
$Ta_3N_5@ReS_2$	Na_2S and Na_2SO_3	300 W Xenon lamp	0.739	14

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