Supporting Information

Photocatalytic oxidation of glucose in water to value-added chemicals by zinc oxide-supported cobalt thioporphyrazine

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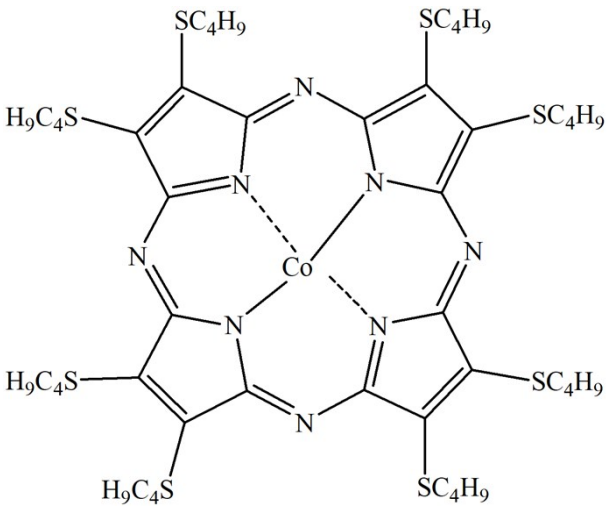


Fig. S1. Molecular structure of cobalt tetra(2,3-bis(butylthio)maleonitrile) porphyrazine ($CoPzS_8$)

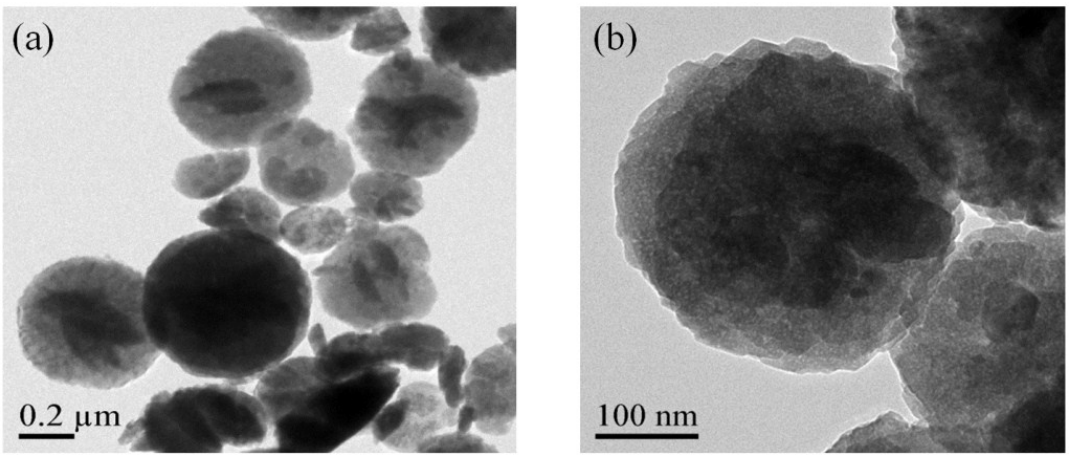


Fig. S2. TEM images of prepared ZnO.

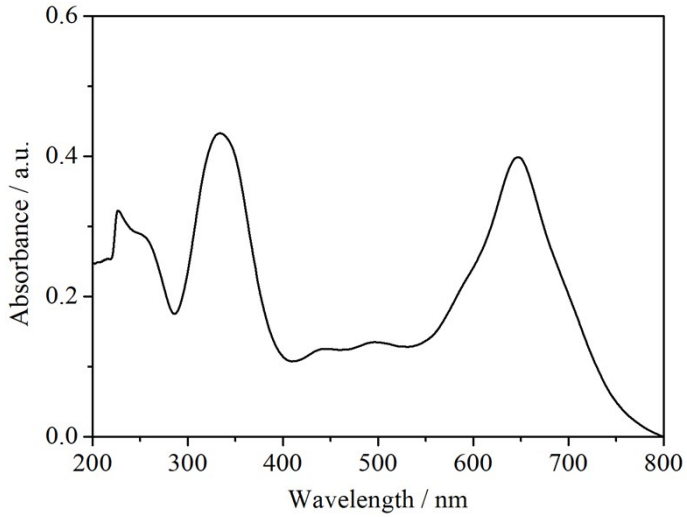
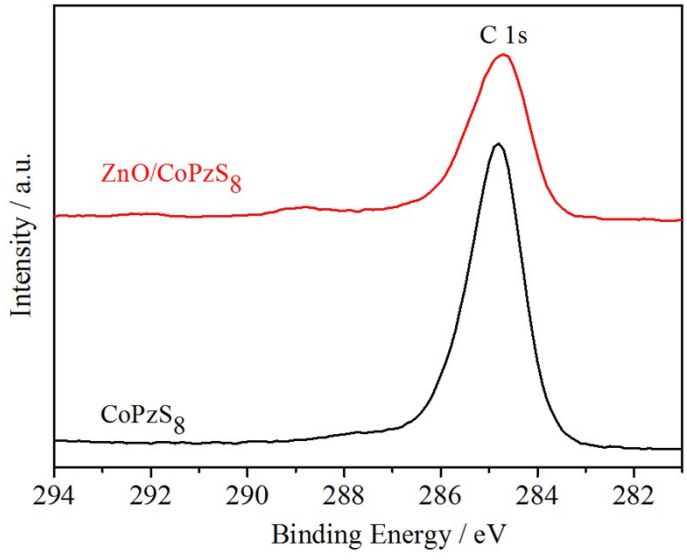
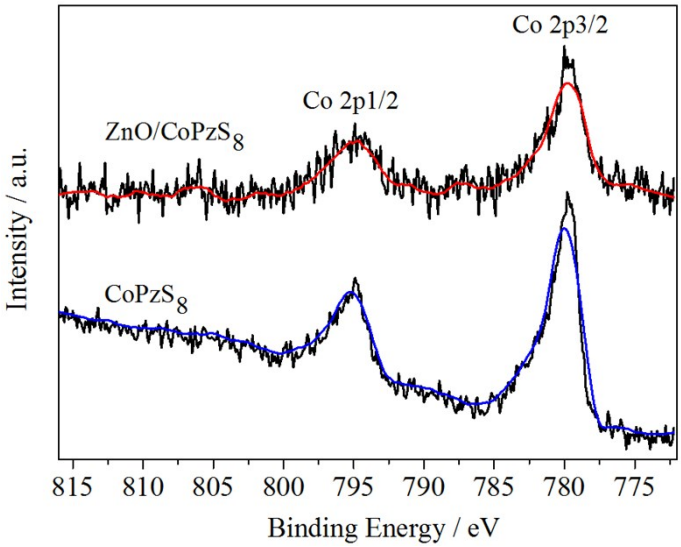
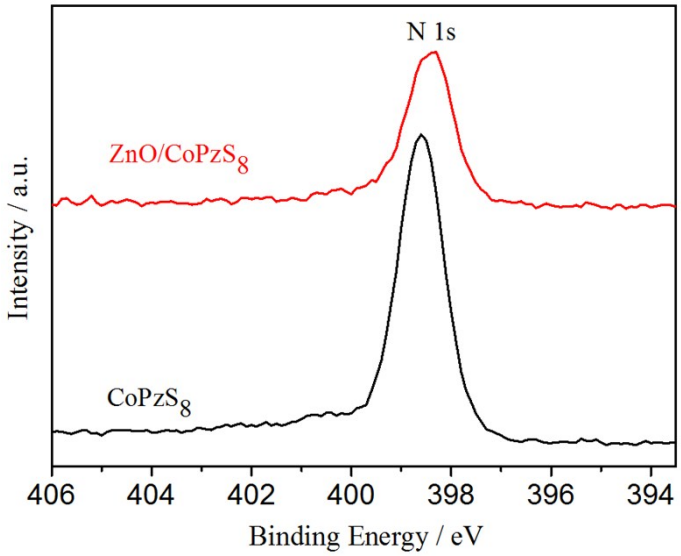


Fig. S3. UV-vis spectrum of $CoPzS_8$ in dichloromethane.




Co 2p3/2
Co 2p1/2
ZnO/CoPzS8
CoPzS8
Intensity / a.u.
815 810 805 800 795 790 785 780 775
Binding Energy / eV


N 1s
ZnO/CoPzS8
CoPzS8
Intensity / a.u.
406 404 402 400 398 396 394
Binding Energy / eV

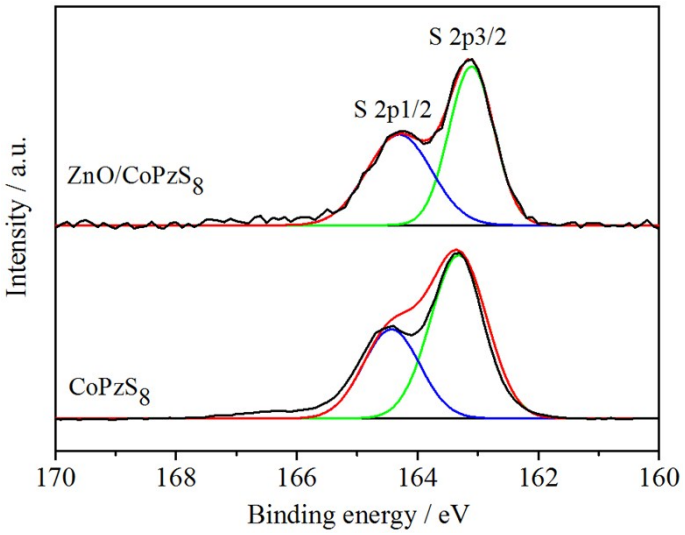

S 2p3/2
S 2p1/2
ZnO/CoPzS8
CoPzS8
Intensity / a.u.
170 168 166 164 162 160
Binding energy / eV

Fig. S4. The high resolution XPS spectra in C 1s, Co 2P, N 1s and S 2p for pure $CoPzS_8$ and $ZnO/CoPzS_8$(0.5%).

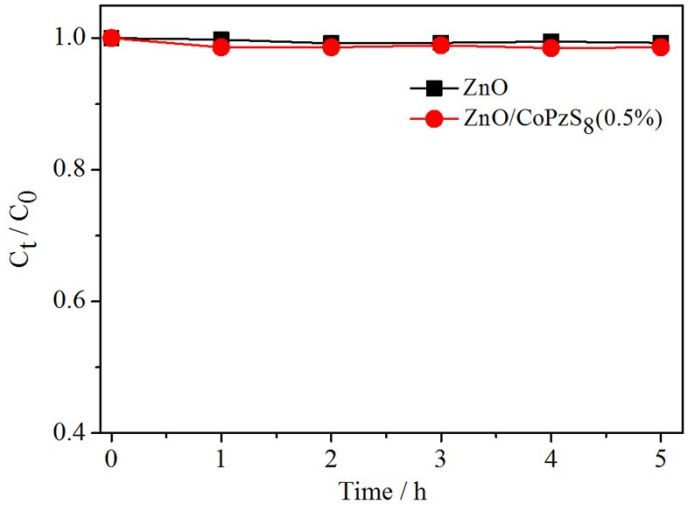
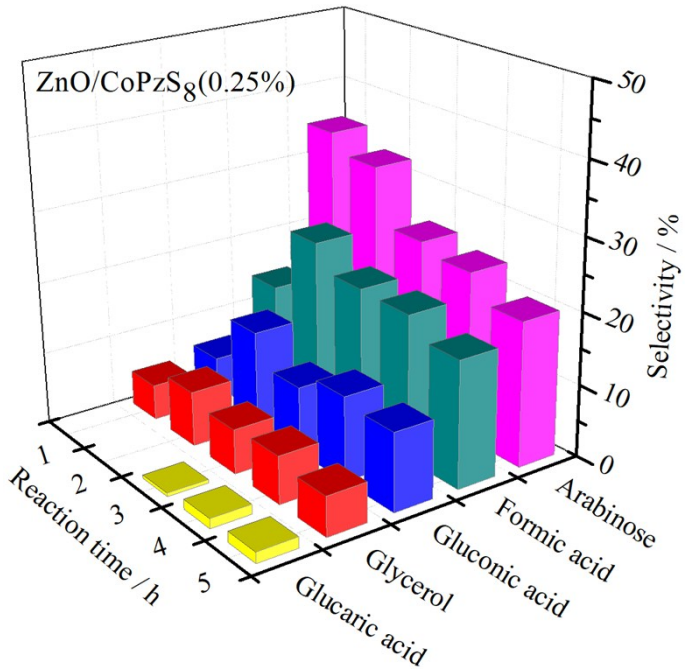


Fig. S5. The adsorption of aqueous glucose on the ZnO and $ZnO/CoPzS_8$(0.5%). Conditions: photocatalyst (20 mg), glucose (8 $mmol \cdot L^{-1}$).



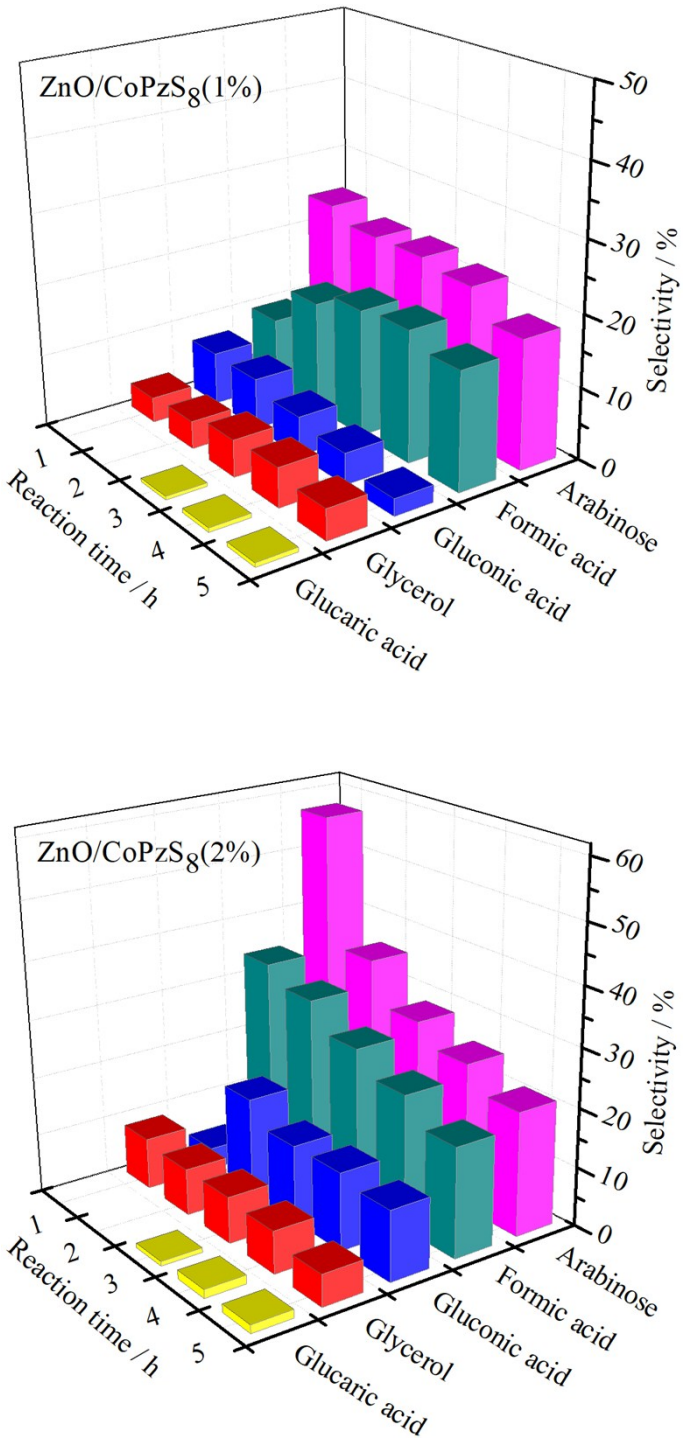
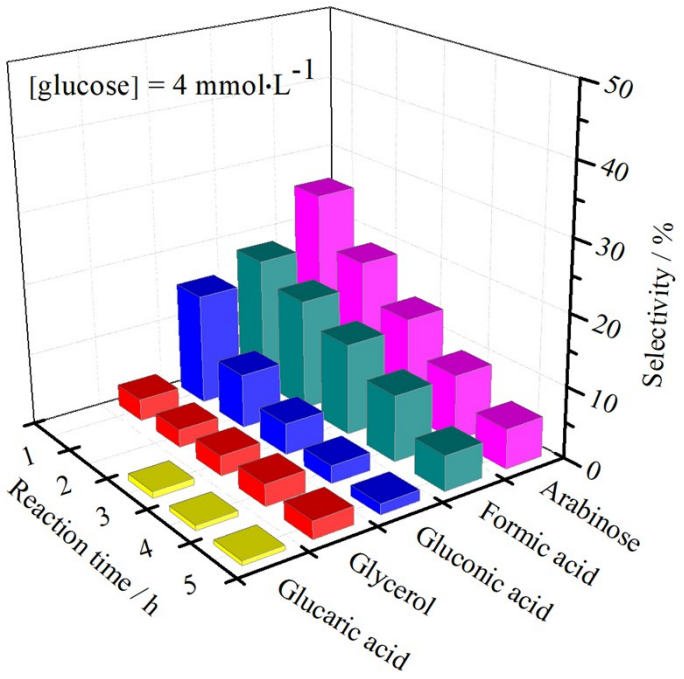
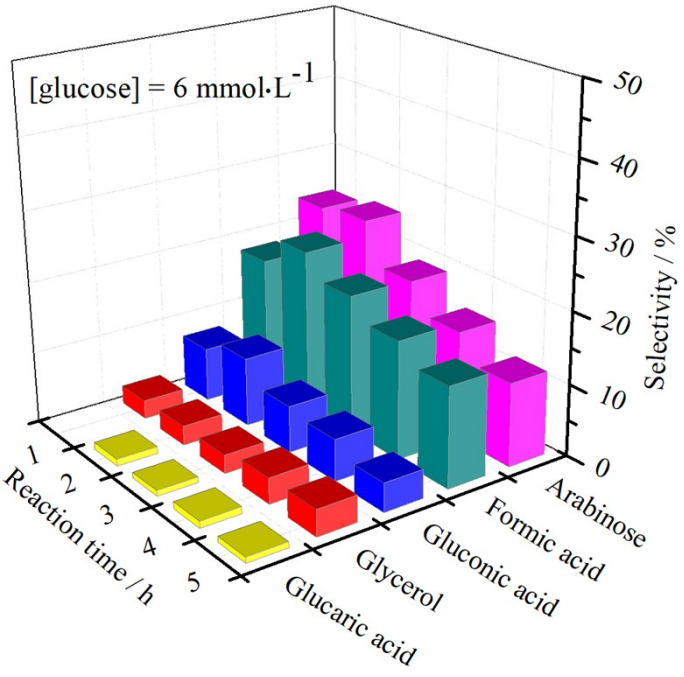


Fig. S6. The selectivity of glucose oxidation products under different loading amounts of $CoPzS_8$. Reaction conditions: photocatalyst (20 mg), glucose (8 $mmol \cdot L^{-1}$), air (20 $mL \cdot min^{-1}$), light intensity (1.5 $w \cdot cm^{-2}$).


[glucose] = 4 mmol·L-1
Selectivity / %
0
10
20
30
40
50
Reaction time / h
1
2
3
4
5
Glucaric acid
Glycerol
Gluconic acid
Formic acid
Arabinose


[glucose] = 6 mmol·L-1
Selectivity / %
0
10
20
30
40
50
Reaction time / h
1
2
3
4
5
Glucaric acid
Glycerol
Gluconic acid
Formic acid
Arabinose

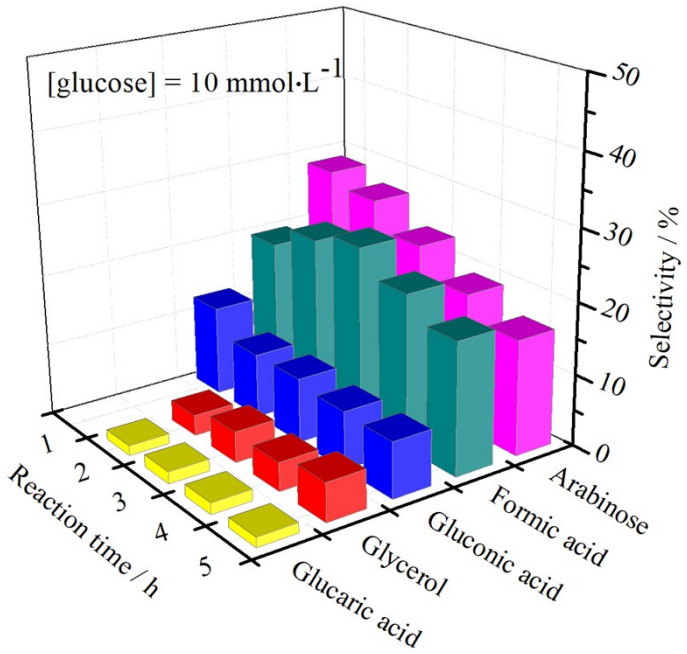


Fig. S7. The selectivity of glucose oxidation products under different glucose concentrations in presence of ZnO/CoPzS$_8$(0.5%). Reaction conditions: ZnO/CoPzS$_8$(0.5%) (20 mg), air (20 mL·min^{-1}), Light intensity (1.5 w·cm^{-2}).

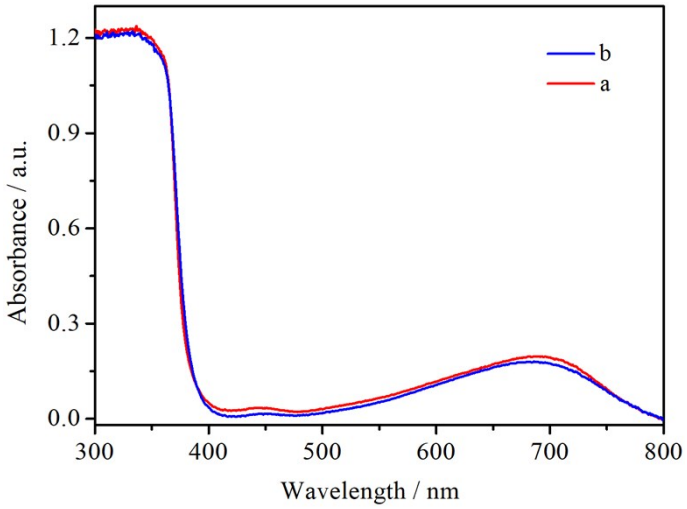


Fig. S8. UV-Vis diffuse reflectance spectra (DRS) of ZnO/CoPzS$_8$(0.5%) before and after light reaction for 5 h. (a) before light reaction; (b) light reaction for 5 h in presence of glucose.

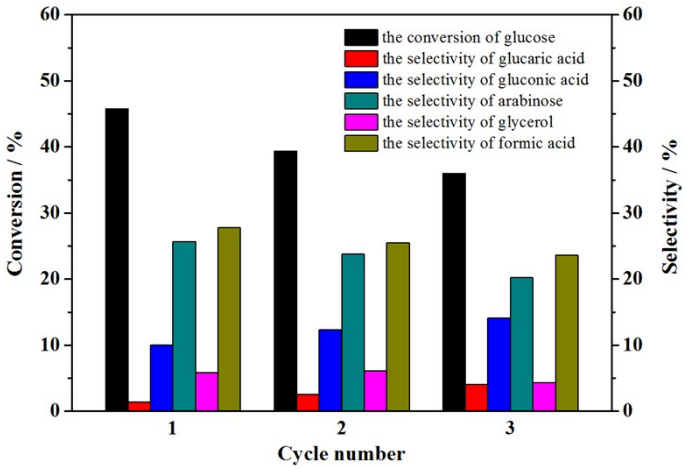


Fig. S9. Reusability of ZnO/$CoPzS_8$(0.5%) for photocatalytic oxidation of glucose in water under simulated sunlight irradiation. Reaction conditions: ZnO/$CoPzS_8$(0.5%) (20 mg), glucose (8 mmol·L^{-1}), air (20 mL·min^{-1}), light intensity (1.5 w·cm^{-2}), reaction of 3 h.

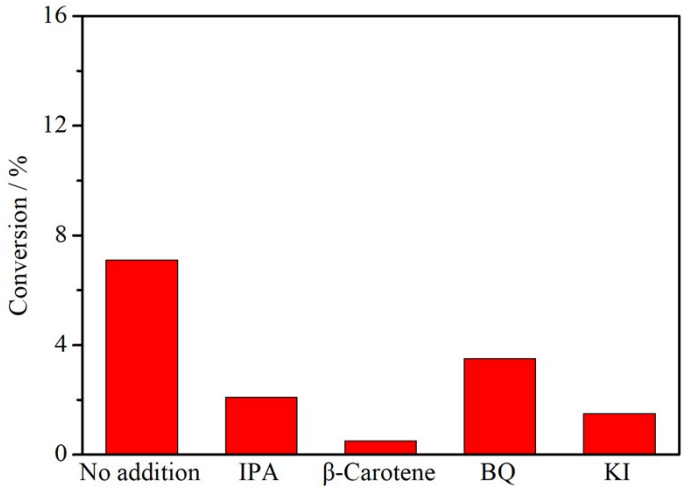


Fig. S10. Effect of scavenger agents on the photocatalytic conversion of glucose in presence of ZnO under simulated sunlight irradiation. Reaction conditions: ZnO (20 mg), air (20 mL·min^{-1}), light intensity (1.5 w·cm^{-2}), reaction of 2 h, isopropanol (IPA, 800 mmol·L^{-1}), *β*-carotene (16 mmol·L^{-1}), potassium iodide (KI, 800 mmol·L^{-1}), BQ (400 mmol·L^{-1})**.**

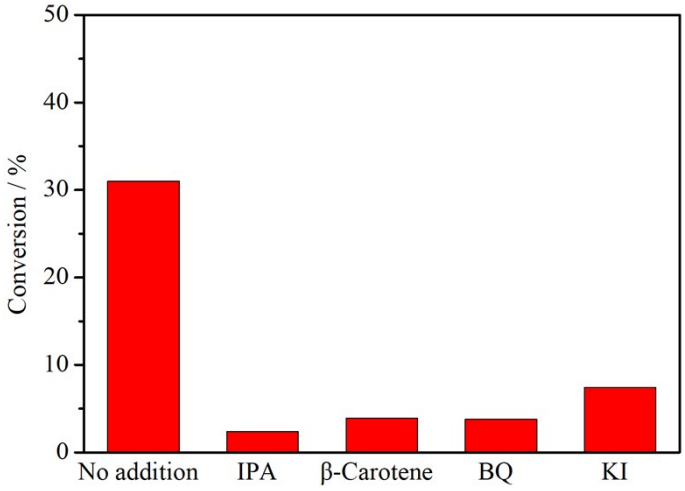


Fig. S11. Effect of scavenger agents on the photocatalytic conversion of glucose in presence of ZnO/CoPzS$_8$(0.5%) under simulated sunlight irradiation. Reaction conditions: ZnO/CoPzS$_8$(0.5%) (20 mg), air (20 mL·min^{-1}), light intensity (1.5 w·cm^{-2}), reaction of 2 h, isopropanol (IPA, 800 mmol·L^{-1}), *β*-carotene (16 mmol·L^{-1}), potassium iodide (KI, 800 mmol·L^{-1}), BQ (400 mmol·L^{-1})**.**

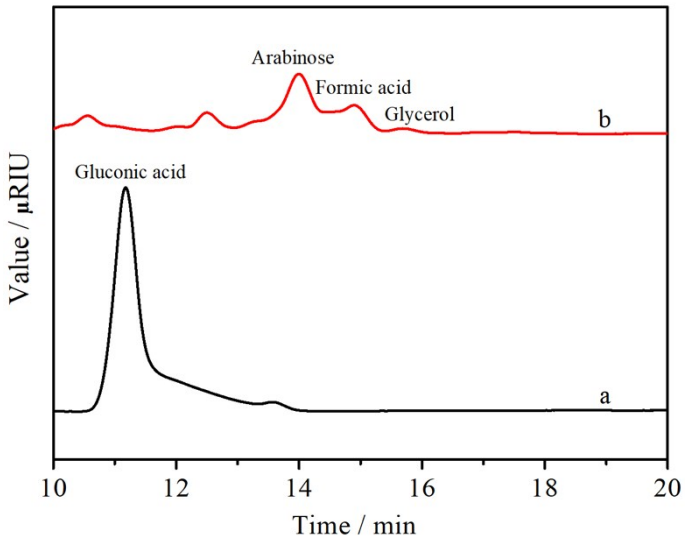


Fig. S12. The photocatalytic conversion of aqueous gluconic acid in presence of ZnO under simulated sunlight irradiation. Reaction conditions: ZnO (20 mg), gluconic acid (1 mmol·L^{-1}), air (20 mL·min^{-1}), light intensity (1.5 w·cm^{-2}). (a) before reaction; (b) reaction of 3 h.

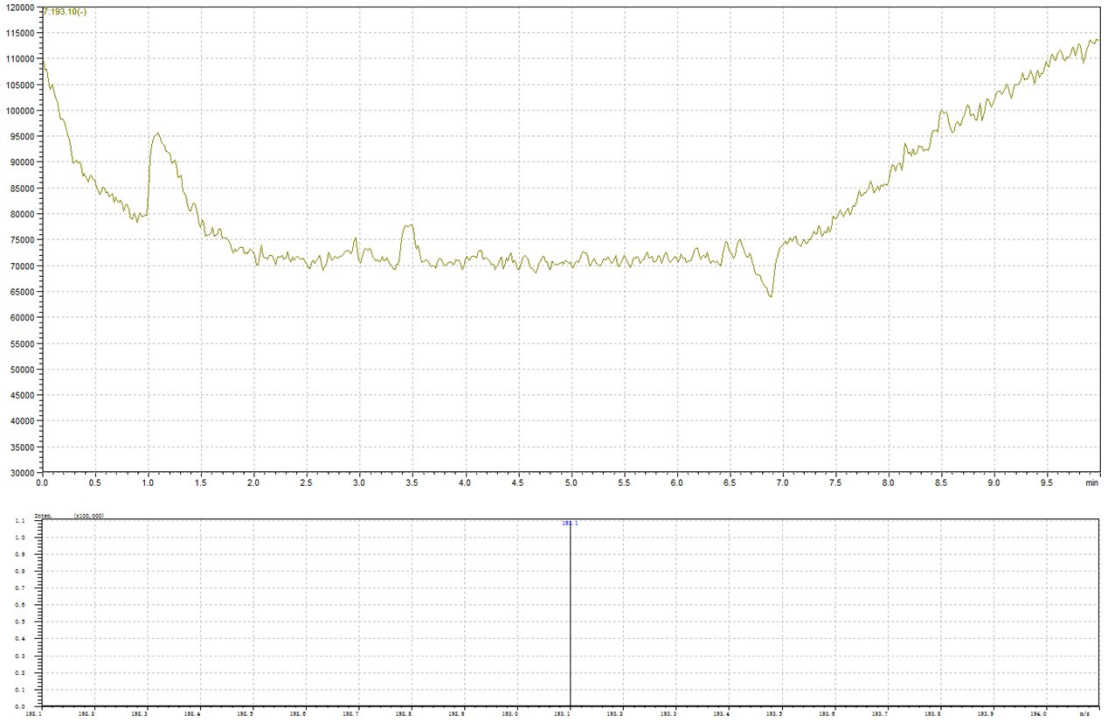


Fig. S13. HPLC-MS spectrum of glucuronic acid generated from the oxidation of glucose in presence of ZnO/CoPzS$_8$(0.5%).

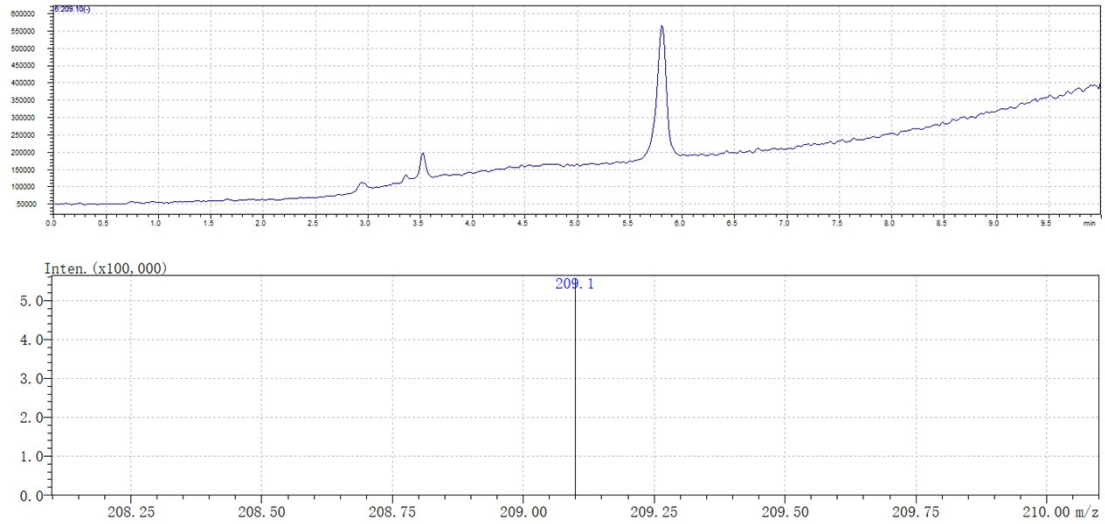


Fig. S14. HPLC-MS spectrum of glucaric acid generated from the photocatalytic conversion of aqueous glucuronic acid in presence of ZnO/CoPzS$_8$(0.5%) under simulated sunlight irradiation. Reaction conditions: ZnO/CoPzS$_8$(0.5%) (20 mg), glucuronic acid (1 mmol·L^{-1}), air (20 mL·min^{-1}), light intensity (1.5 w·cm^{-2}).

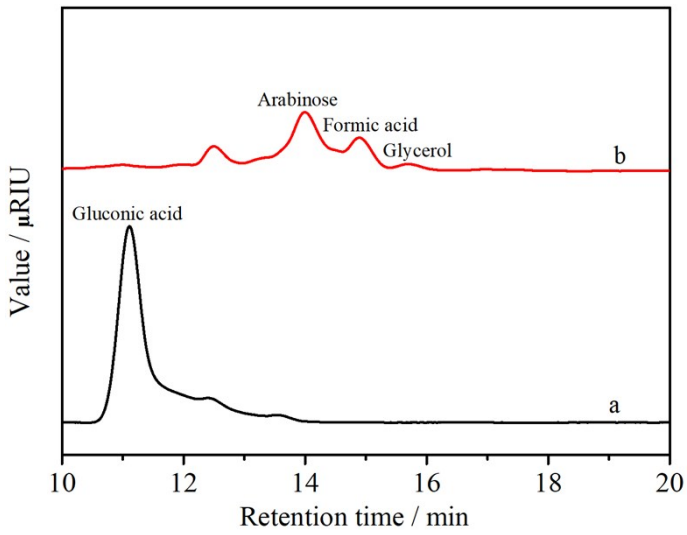


Fig. S15. The photocatalytic conversion of aqueous gluconic acid in presence of ZnO/CoPzS$_8$(0.5%) under simulated sunlight irradiation. Reaction conditions: ZnO/CoPzS$_8$(0.5%) (20 mg), gluconic acid (8 mmol·L^{-1}), air (20 mL·min^{-1}), light intensity (1.5 w·cm^{-2}). (a) before reaction; (b) reaction of 1 h.