Supporting Information

Cobalt Porphyrazine Supported on SnO_2 with Oxygen Vacancies for Boosting Photocatalytic Aerobic Oxidation of Glucose to Organic Acids in an Aqueous Medium

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Preparation of SnO_2-OVs/H_2O_2

According to the literature,[1] a typical fabrication procedure for SnO_2-OVs/H_2O_2 composite was as follow: 200 mg of SnO_2-OVs was dispersed into 20 mL of deionized water under magnetic stirring, and then 5 mL of hydrogen peroxide (H_2O_2, 30% aqueous) was added dropwise into the above suspension solution. After that, the mixture was continuously stirred for 10 h in the dark in ambient temperature. The resultant precipitate was collected by filtration and washed with deionized water, and then dried at 80℃ overnight. This sample was denoted as SnO_2-OVs/H_2O_2.

Preparation of SnO_2-OVs/H_2O_2/CoPz

In a typical fabrication procedure for SnO_2-OVs/H_2O_2/CoPz composite, a solution of CoPz in dichloromethane was firstly prepared by dissolving 40 mg of CoPz into 50 mL of dichloromethane. Subsequently, 100 mg of SnO_2-OVs/H_2O_2 was dispersed into the 10 mL of dichloromethane under magnetic stirring, and then 0.625 mL of the as-prepared solution of CoPz in dichloromethane was added dropwise into the above suspension solution. After that, the mixture was continuously stirred for 12 h in ambient temperature. The resulting composite was obtained through removing the solvent by reduced pressure distillation. The CoPz content in the composite was about 0.5%, this sample was denoted as SnO_2-OVs/H_2O_2/CoPz (0.5%).

Absorption Measurements

The photocatalyst (20 mg) was immersed into 30 mL of the mixed solution containing glucose (0.06 mmol), glucaric acid (0.06 mmol), gluconic acid (0.06 mmol) and formic acid (0.06 mmol). The suspension system was stirred for 24 h in the dark in ambient temperature, then the filtered solution was used to analyze.

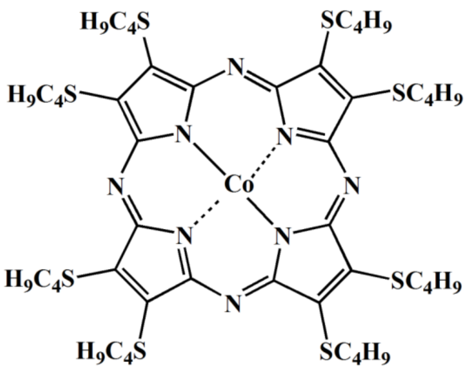

Figure S1. Molecular structure of CoPz.

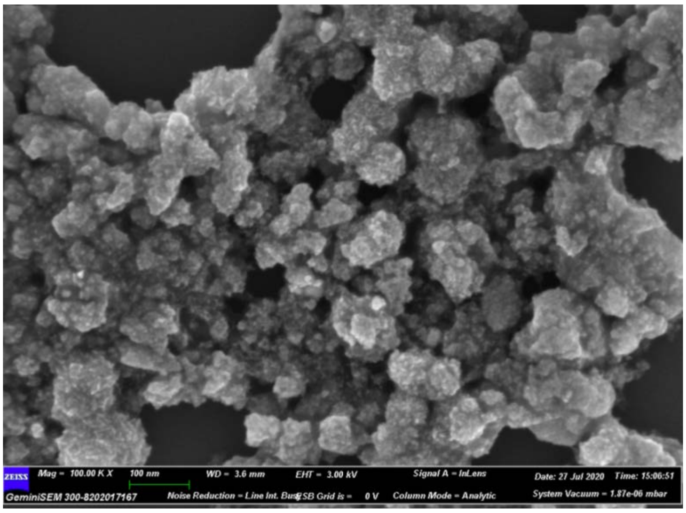

Figure S2. SEM of SnO_2-OVs.

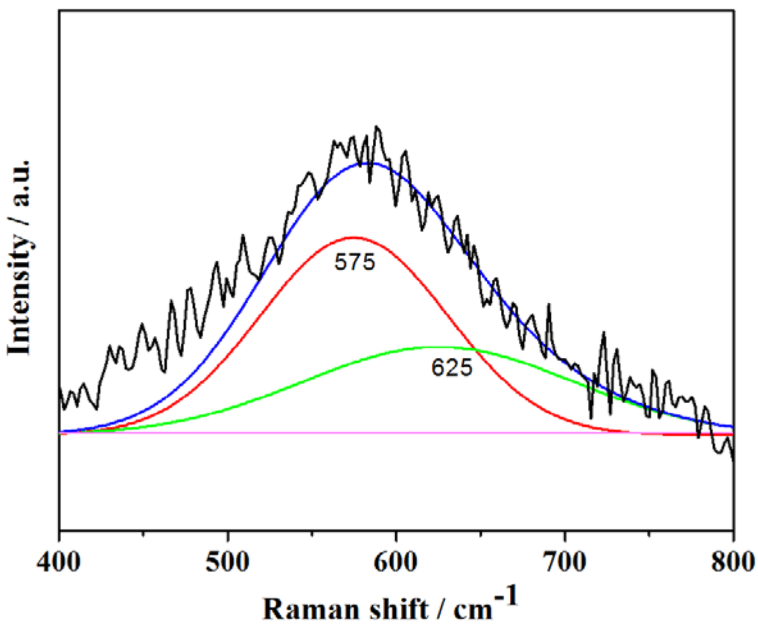

Figure S3. Raman spectra of SnO_2-OVs in the 400-800 cm^{-1} region.

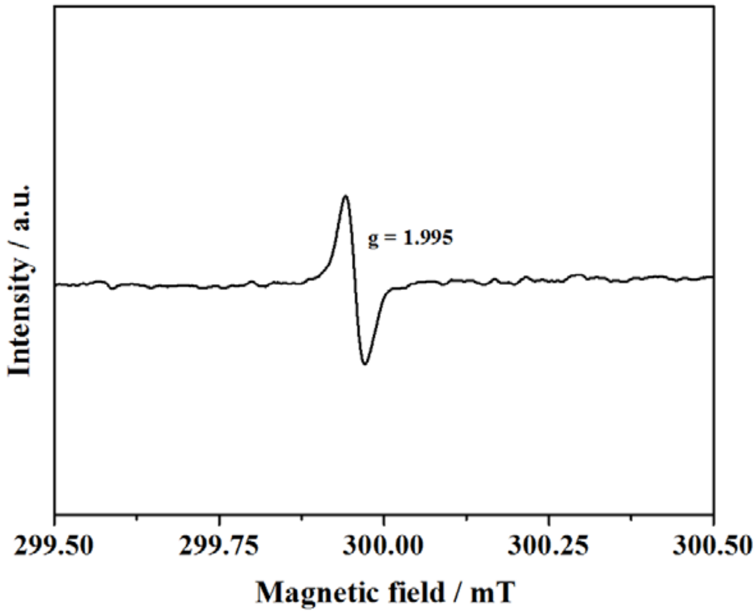

Figure S4. ESR spectrum of SnO_2-OVs.

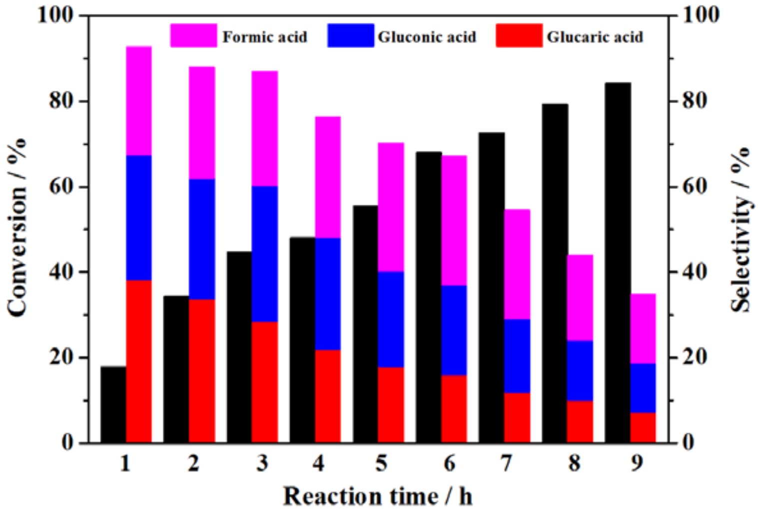

Figure S5. Conversion and selectivity results for oxidizing glucose to organic acids versus reaction time in presence of SnO_2-OVs/CoPz(0.5%). Reaction conditions: 30 mL of aqueous glucose (2 mmol·L^{-1}), 20 mg of SnO_2-OVs/CoPz(0.5%) composite, light intensity of 1.5 W·cm^{-2}. (Note: black bar and color bar represent the glucose conversion and the selectivity of organic acid, respectively.)

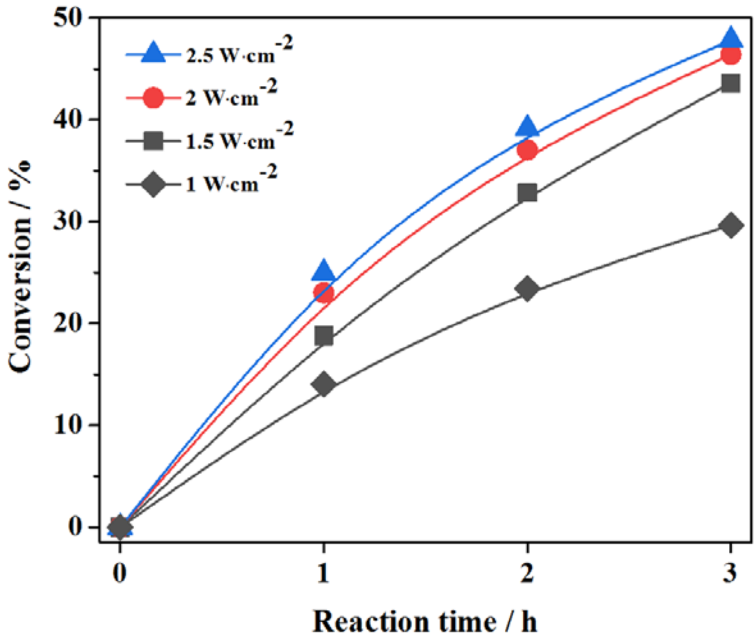

Figure S6. The effect of light intensity on the glucose conversion. Reaction conditions: 30 mL of aqueous glucose (2 mmol·L^{-1}), 20 mg of SnO_2-OVs/CoPz(0.5%) composite.

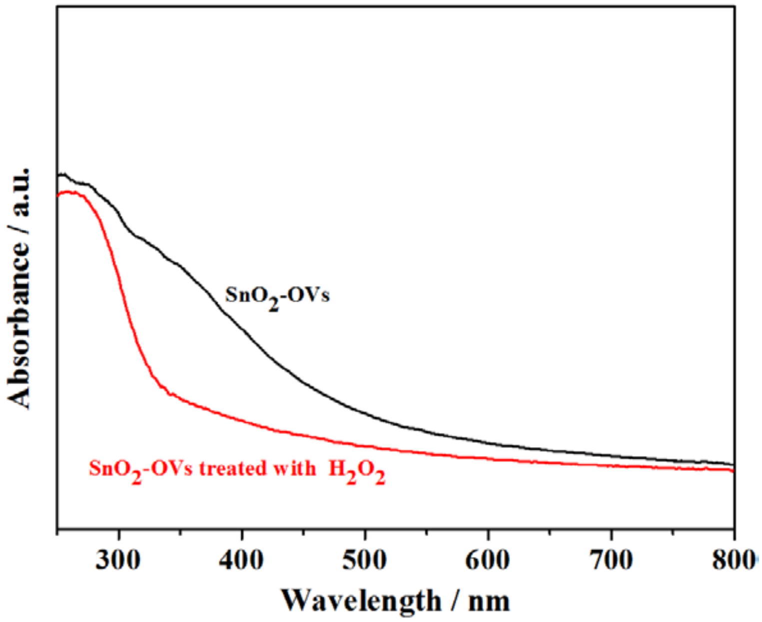

Figure S7. The UV-vis DRS of SnO_2-OVs treated by H_2O_2.

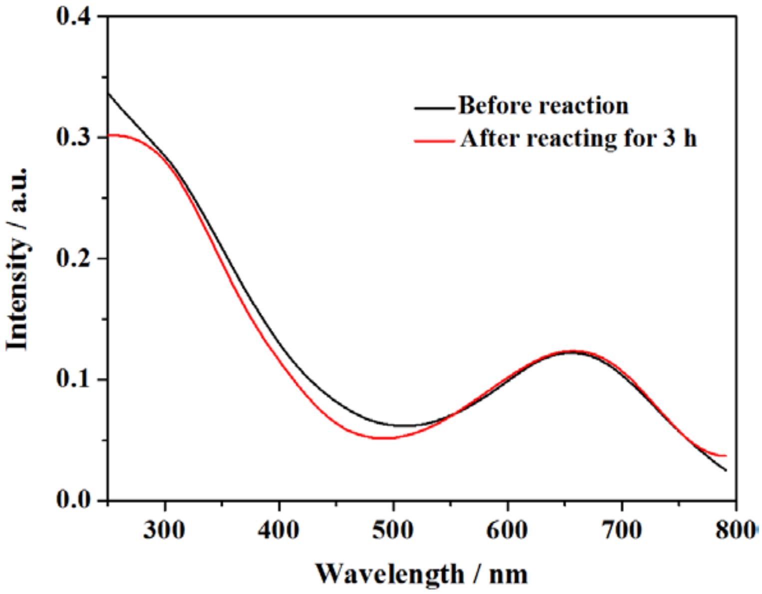

Figure S8. The UV-vis DRS of SnO_2-OVs/CoPz(0.5%) composite before the reaction and after reacting for 3 h.

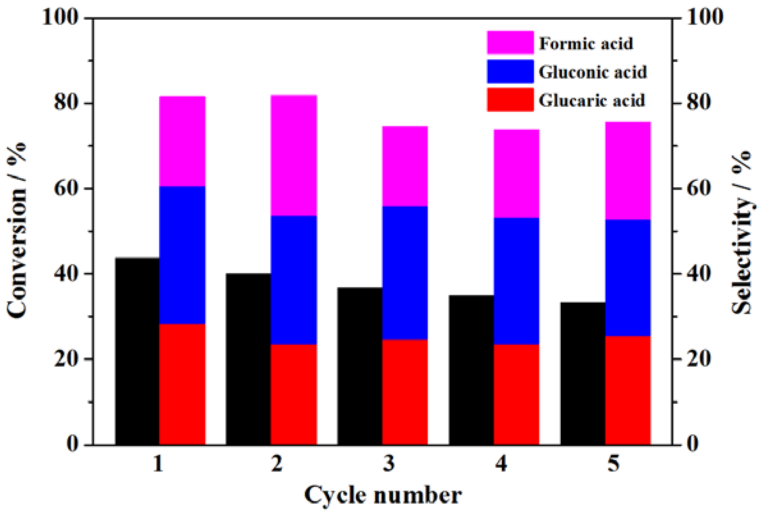

Figure S9. Reusability of SnO_2-OVs/CoPz(0.5%) composite for oxidizing glucose to organic acids. Reaction conditions: 30 mL of aqueous glucose (2 $mmol \cdot L^{-1}$), 20 mg of SnO_2-OVs/CoPz(0.5%) composite, reacting for 3 h, light intensity of 1.5 $W \cdot cm^{-2}$. (Note: black bar and color bar represent the glucose conversion and the selectivity of organic acid, respectively.)

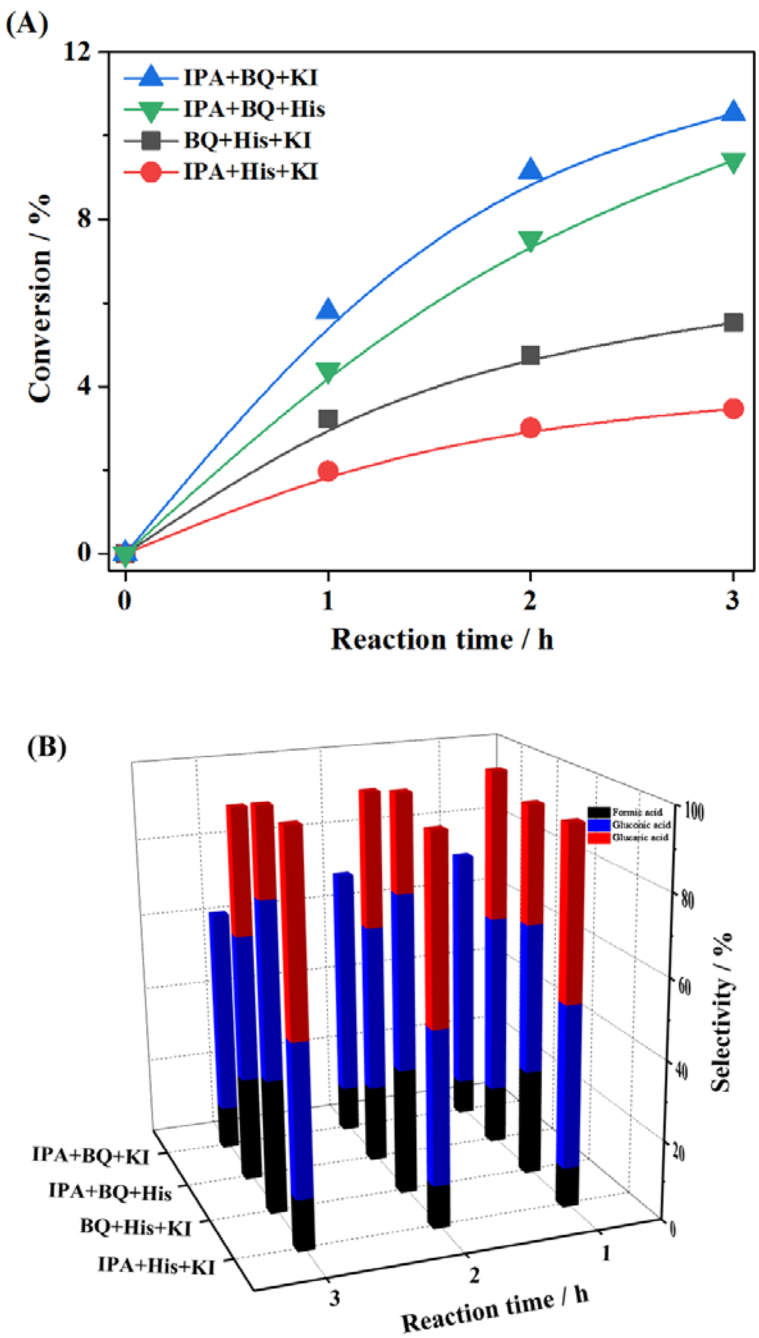

Figure S10. Conversion (A) and selectivity (B) results for oxidizing glucose to organic acids under the condition of adding three kinds of scavengers at the same time in the SnO_2-OVs/CoPz(0.5%) photocatalytic system. Reaction conditions: 30 mL of aqueous glucose (2 mmol·L^{-1}), 20 mg of SnO_2-OVs/CoPz(0.5%) composite, light intensity of 1.5 W·cm^{-2}. IPA (13.3 mmol·L^{-1}), KI (13.3 mmol·L^{-1}), BQ (13.3 mmol·L^{-1}), His (13.3 mmol·L^{-1}).

References

(1) Xiao, C.; Zhang, L.; Hao, H.; Wang, W. High Selective Oxidation of Benzyl Alcohol to Benzylaldehyde and Benzoic Acid with Surface Oxygen Vacancies on $W_{18}O_{49}$/Holey Ultrathin g-C_3N_4 Nanosheets. *ACS Sustainable Chem. Eng.* **2019**, *7*, 7268-7276.