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Electronic Supplementary Information (ESI):

Ultrasound-assisted Preparation, Characterization and Properties of Porous Cu_2O Microcubes

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The preparation of porous Cu_2O microcubes:

In a typical experiment, all compounds were analytically pure and used without further purification. 0.02 mol of glucose ($C_6H_{12}O_6 \cdot H_2O$) and 0.02 g of polyvinylpyrrolidone (PVP) were dissolved into distilled water of 20 mL to form solution A; 0.005 mol of $CuCl_2 \cdot 2H_2O$ and 0.005 mol of trisodium citrate were dissolved into distilled water of 10 mL to form solution B; Then, Solution B was dropped into 6 mL NaOH of 1 mol/L to form solution C; Finally, Solution C was added into solution A under the assistance of ultrasonic wave with 90%-output power at 60 °C. After 3 h, brick red precipitates were collected, washed with distilled water and absolute ethanol several times and dried in vacuum at 60 °C for 5 h. As a control, smooth Cu_2O microcubes were also prepared in the absence of PVP under the same conditions.

Characterizations:

Powder X-ray diffraction (XRD) of the product was carried out on a Shimadzu XRD-6000 X-ray diffractometer, employing a scanning rate of $10°min^{-1}$; SEM images and energy dispersive spectrum (EDS) of the product were obtained on a Hitachi S-4800 field emission scanning electron microscope, employing the accelerating voltage of 5 kV and 15 kV, respectively. TEM images were recorded on a JEOL JEM-200CX transmission electron microscope, employing an accelerating voltage of 200 kV.

The photocatalytic degradation property of the product for organic dyes was measured at room temperature under the irradiation of the 254 nm UV light for given time. 15 mg of products (porous or smooth cubes) were dispersed into 40 mL pyronine B aqueous solution of 0.01 g/L. The optical property changes of pyronine B dye were recorded on a Hitachi U-3010 UV-Vis absorption spectrophotometer, employing twice-distilled water as the reference.

The Brunauer-Emmett-Teller (BET) surface area and pore size distribution of the product was measured with an accelerated surface area and porosimetry system (ASAP 2020).

Electrochemical measurements:

Nafion-perfluorinated ion-exchange resin was obtained from Aldrich. All other chemicals used were analytical grade. Double-distilled water was used for preparation of buffer and standard solutions. To study the electrochemical property of the product, 10 mg Cu_2O was firstly dispersed in 2 mL of Nafion solution of 0.1% (wt%). Next, 20 μL of Cu_2O/Nafion solution (0.5 mg/mL) was cast on the surface of the GCE and dried in air. Electrochemical experiments were performed with CHI 660 electrochemical analyzer (CHI, USA) with conventional three-electrode cell. The working electrode was a Cu_2O/nafion modified GCE. An Ag/AgCl and a platinum electrode were used as the reference and the auxiliary electrode, respectively. All experiments were deoxygenated by N_2 and carried out at room temperature under the protection of N_2.

The preparation of LB liquid substrate:

10 g Peptone, 10 g NaCl and 10 g Ywast Extract were adequately dissolved into distilled water of 950 mL, then the solution was transferred into a reagent-bottle of 1 L. After the pH of the system was adjusted to ~7.2 by dropping NaOH aqueous solution of 5 mol/L, the distilled water was added into the solution up to the volume of 1 L. After high pressure killing bacilli, the system was cooled to ~40 °C. Finally, 1 mL of penicillin (40 μg/L) was introduced to kill other bacilli.

Antibacterial experiments:

(1) 15 curettes killed bacilli were employed and numbered in turn: 1, 2a, 2b, …, 7a, 7b. After 4 mL of LB liquid substrate and 1 mL of cultivated E. coli were added into every curette, 1 mL of Cu_2O solution (120 μg/L) was introduced into 2b, 3b, …, 7b and 1 mL of distilled water into 1, 2a, 3a, …, 7a, respectively. These curettes were placed into the shaking bed (KYC-100B, 150 rpm) at constant temperature of 37 °C for different time stages: 1 (0 h), 2a and 2b (2 h), …, 7a and 7b (14 h). The OD value of each curette was measured using UV-Vis spectrophotometer (WFZ-UV2000, Wavelength set at 600 nm).

(2) To investigate the influence of the amount of porous Cu_2O microcubes on the propagation of E. coli, under keeping the other conditions constant, Cu_2O solutions with the concentrations of 50, 80, 100, 150 and 200 μg/L were used in the above experiment 7b instead of 120 μg/L, respectively.

SI 1. Nitrogen adsorption/desorption isotherm of the as-prepared porous Cu_2O microcubes