Electronic Supplementary Material (ESI) for RSC Advances.

Supporting information

Low-temperature solution synthesis of CuO/Cu_2O nanostructures for enhanced photocatalytic activity with added H_2O_2: Synergistic effect and mechanism insight

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1. Color changes of HMTA and $Cu(NO_3)_2 \cdot 3H_2O$ aqueous solutions before and after mixing together followed by the addition of NaOH solution

The color evolution of aqueous solutions was as follows: HMTA aqueous solution was transparent and $Cu(NO_3)_2 \cdot 3H_2O$ aqueous solution was light blue as shown in Fig. SI-1(a). Once the two solutions were mixed together for a short moment the color of solution changed into a little lightly blue turbid as depicted in Fig. SI-1(b). After the addition of 9 ml (2M) NaOH the solution color became blue immediately as shown in Fig. SI-1(c).

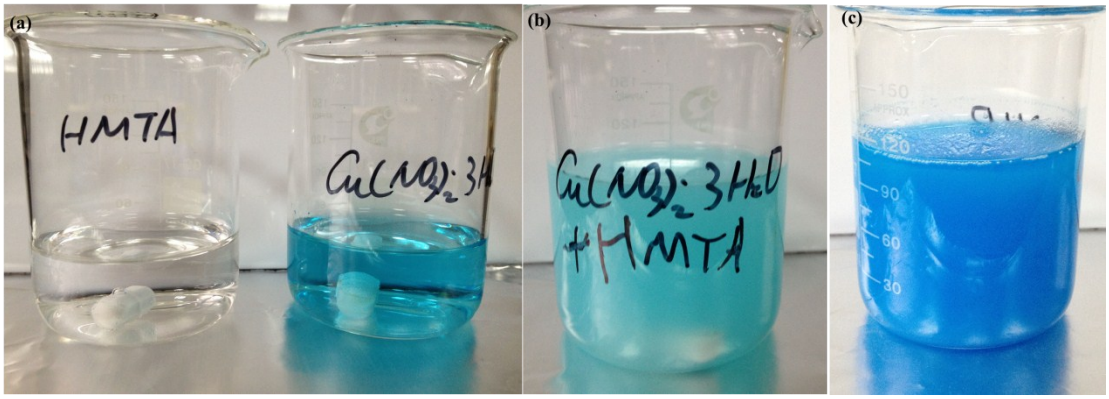

Fig. SI-1 Color changes of HMTA and $Cu(NO_3)_2 \cdot 3H_2O$ aqueous solutions before and after mixing together followed by the addition of NaOH solution: (a) the sole aqueous solution of HMTA (left) and $Cu(NO_3)_2 \cdot 3H_2O$ (right), (b) the two solutions mixed together, and (c) after the addition of NaOH aqueous solution.

2. **The effect of SDS on the shape of as-prepared CuO nanostructures under the same conditions except for the replacement of HMTA during the growth process**

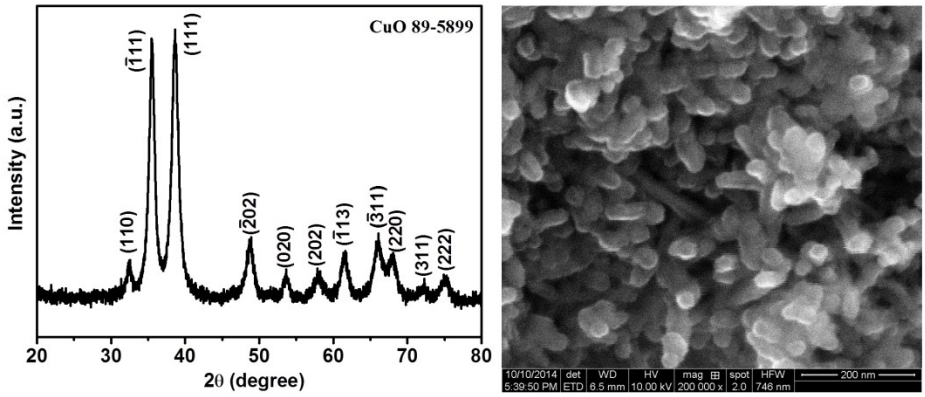

Fig. SI-2 XRD pattern (left panel) and SEM image (right panel) of CuO prepared under the same conditions except for using SDS instead of HMTA in the synthetic procedure.

3. Time-dependent of UV-vis absorption spectral changes of an aqueous solution of RhB in the presence of Cu_xO products without H_2O_2 under visible light irradiation

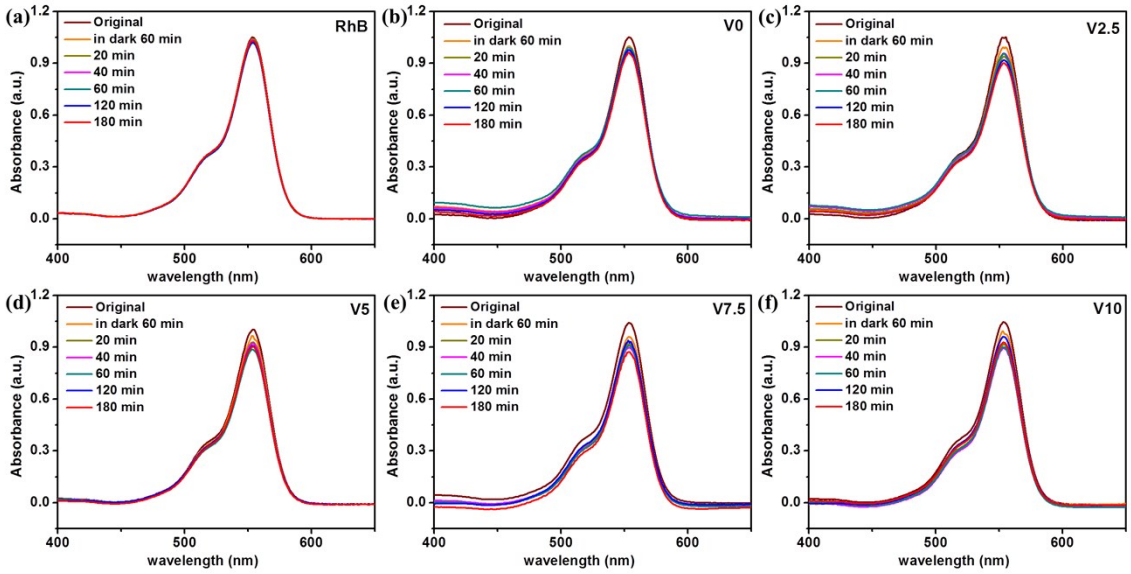

Fig. SI-3 Time-dependent of UV-vis absorption spectral changes of an aqueous solution of RhB. Time-dependent of UV-vis absorption spectral changes of an aqueous solution of RhB in the presence of Cu_xO products without H_2O_2 under visible light irradiation for the samples prepared with different amount of hydroxylamine hydrochloride (HAHC): (a) RhB, (b) V0, (c) V2.5, (d) V5, (e) V7.5, and (f) V10.

4. Time-dependent of UV-vis absorption spectral changes of an aqueous solution of MO in the presence of Cu_xO products without H_2O_2 under visible light irradiation

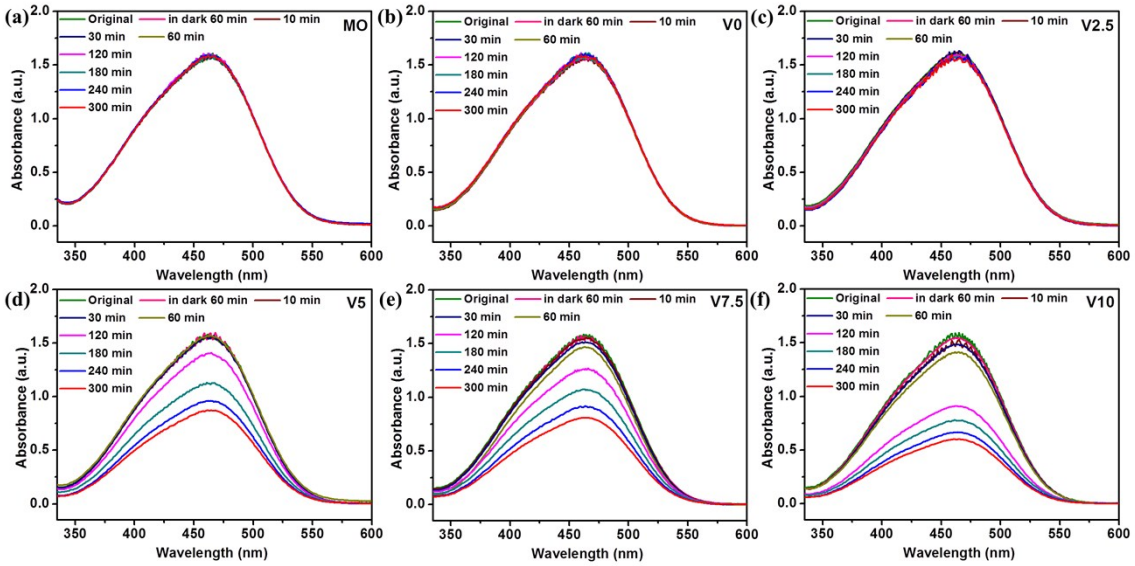

Fig. SI-4 Time-dependent of UV-vis absorption spectral changes of an aqueous solution of MO. Time-dependent of UV-vis absorption spectral changes of an aqueous solution of MO in the presence of Cu_xO products without H_2O_2 under visible light irradiation for the samples prepared with different amount of HAHC: (a) MO, (b) V0, (c) V2.5, (d) V5, (e) V7.5, and (f) V10.

5. Time-dependent of UV-vis absorption spectral changes of an aqueous solution of MO in the presence of Cu_xO products and H_2O_2 under visible light irradiation

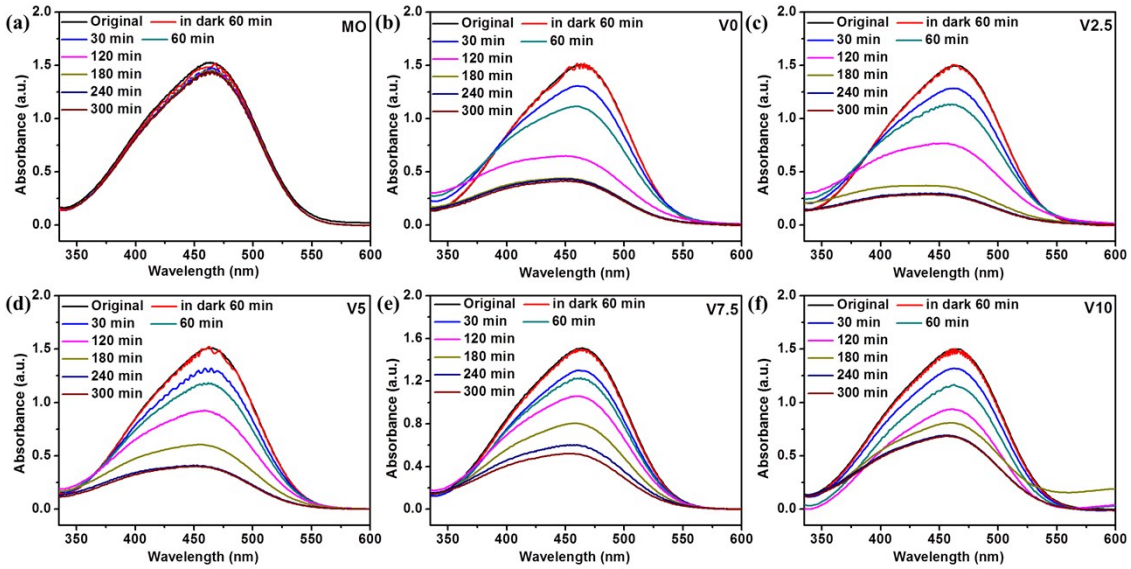

Fig. SI-5 Time-dependent of UV-vis absorption spectral changes of an aqueous solution of MO. Time-dependent of UV-vis absorption spectral changes of an aqueous solution of MO in the presence of Cu_xO products and H_2O_2 under visible light irradiation for the samples prepared with different amount of HAHC: (a) MO, (b) V0, (c) V2.5, (d) V5, (e) V7.5, and (f) V10.

6. Plots of ln(C/C$_0$) versus time of MO in an aqueous solution against given irradiation intervals in the presence of Cu$_x$O products and in the absence of H$_2$O$_2$ under visible light irradiation

The photocatalytic rate constant (k) was estimated by the pseudo first-order model which was usually applied to analyze the photodegradation kinetics of organic dyes in the aqueous solution as expressed in the manuscript.[1-3] The rate constants was evaluated by the slopes of linear fit to be 4.7×10^{-5}, 0.0001, 0.0021, 0.0023, and 0.0035 min^{-1} for sample V0, V2.5, V5, V7.5, and V10, respectively. Therefore, the as-grown samples photodegraded MO in the aqueous solutions without the addition of H_2O_2 were subjected to the following order: V10>V7.5>V5>V2.5>V0.

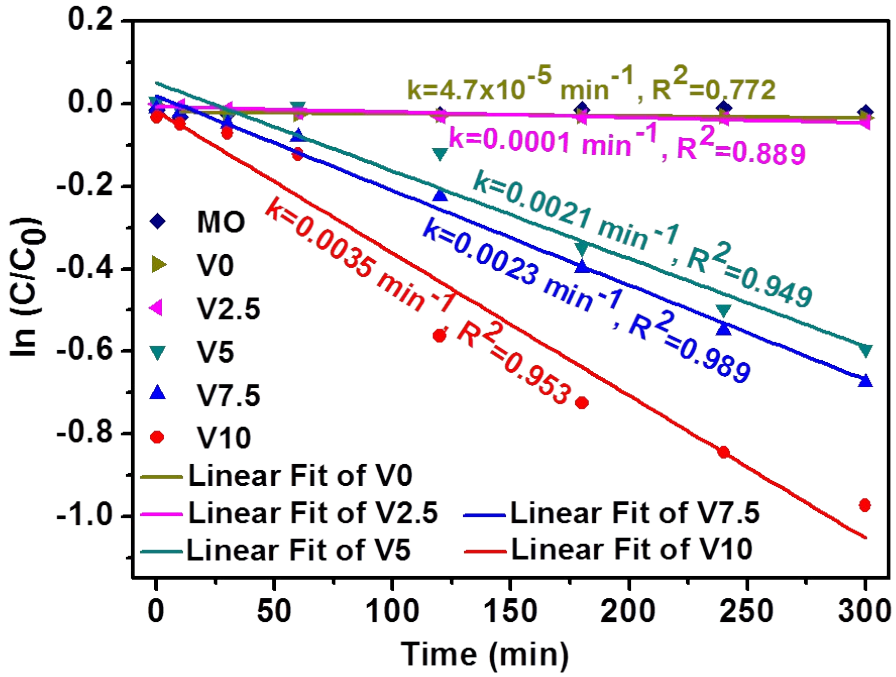

Fig. SI-6 Photodegradation of MO under visible light irradiation with different catalysts. The plots of ln(C/C_0) versus time of MO degradation in the presence of Cu$_x$O products and the absence of H$_2$O$_2$ under visible light illumination.

7. N_2 adsorption-desorption isotherms of as-synthesized samples at 77K

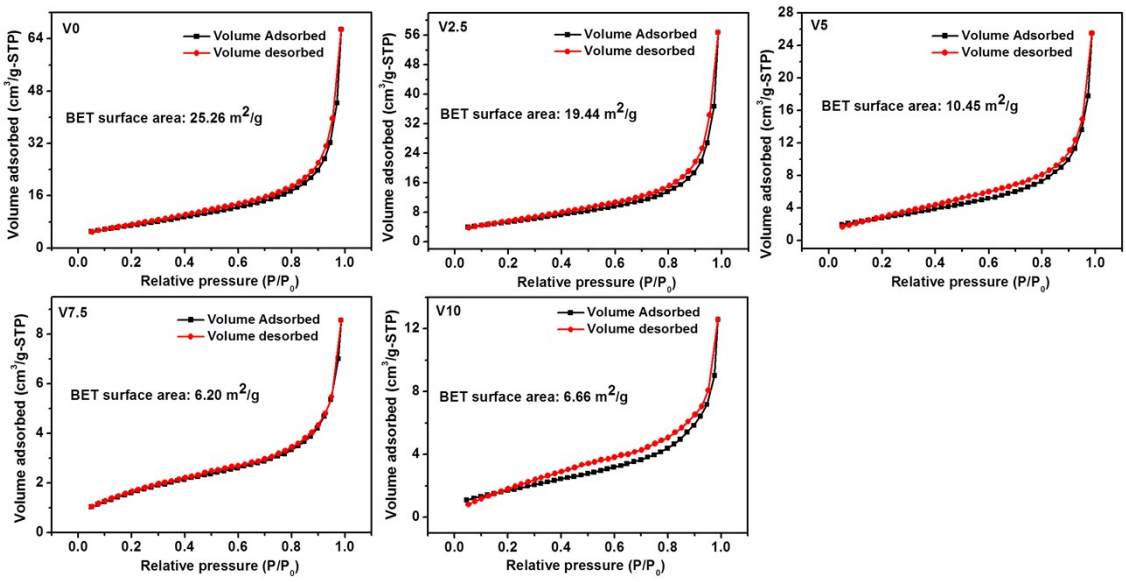

Fig. SI-7 N_2 adsorption-desorption isotherms of as-synthesized samples at 77K.

References

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