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Supplementary data

Optimization of Facile Synthesized ZnO/CuO Nanophotocatalyst for Organic Dye Degradation by Visible Light Irradiation using Response Surface Methodology

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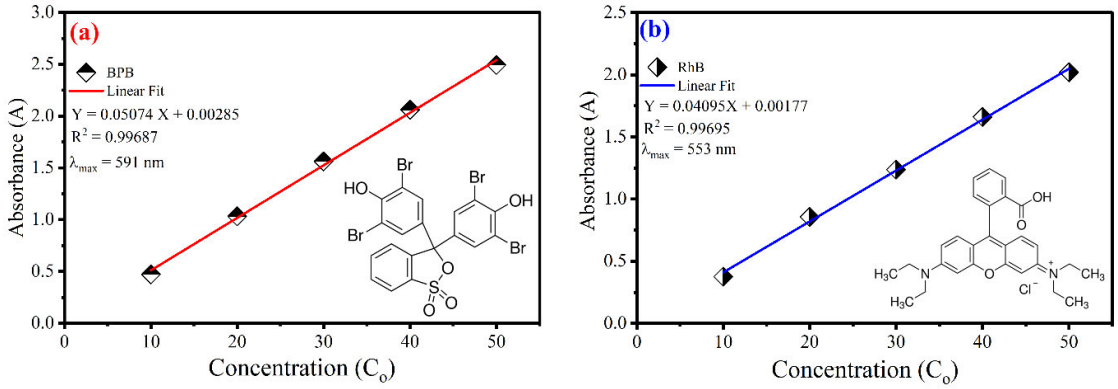


Figure S1. Structure of dye molecules and calibration curve of (**a**) BPB (**b**) RhB.

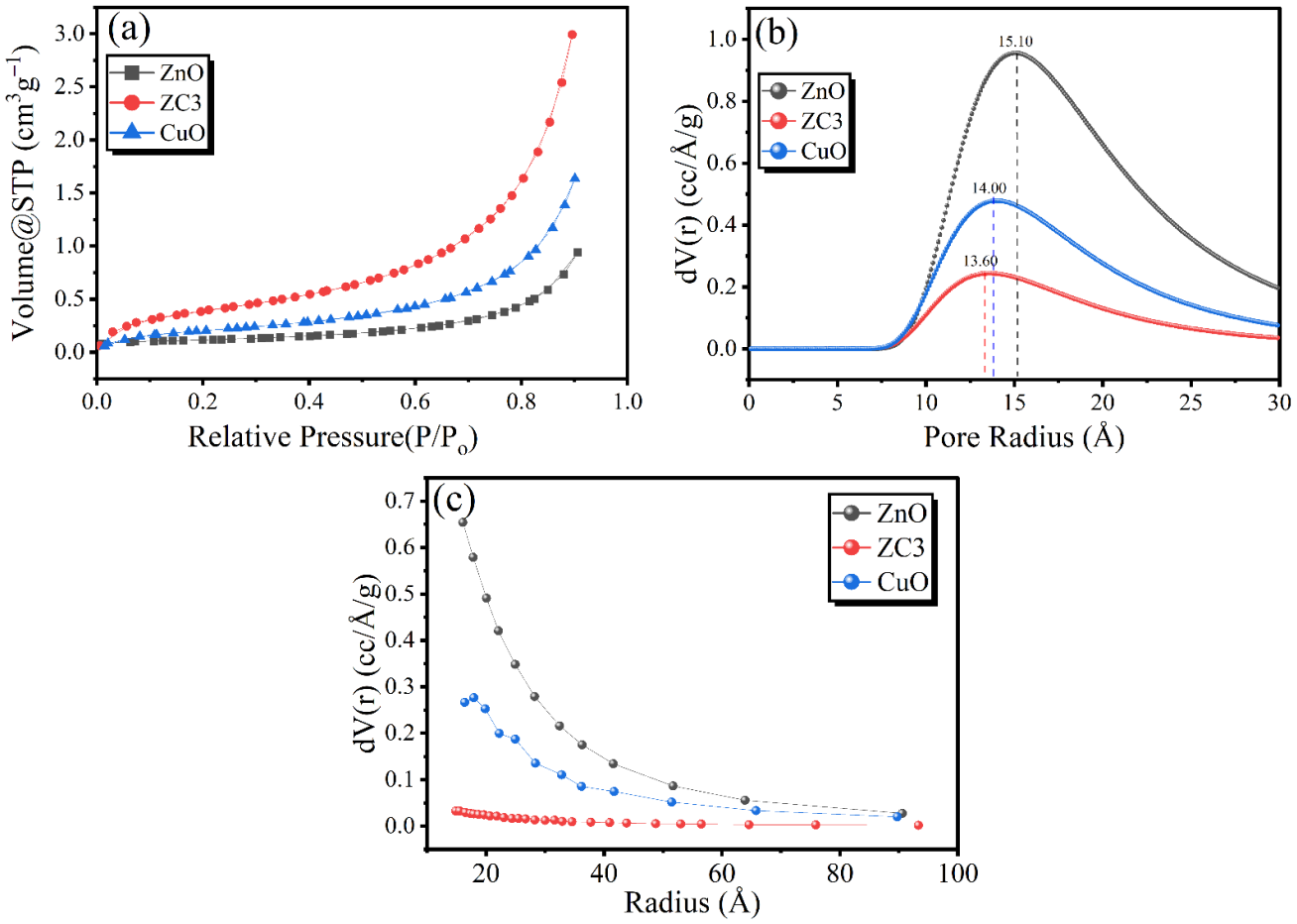


Figure S2. (**a**) N_2 adsorption–desorption isotherm, (**b**) DA pore radius, and (**c**) BJH pore size distribution plots of the as-synthesized ZnO, CuO and ZnO/CuO.

Table S1. Central composite design (uncoded) for RhB and BPB degradation (%).

Run	Factor 1	Factor 2	Factor 3	Response 1	Response 2
	A:Photocatalyst dose (mg)	B:Dye concentration (mgL^{-1})	C:Reaction time (min)	RhB-Degradation (%)	BPB-Degradation (%)
1	22.50	27.50	57.50	93.79	88.79
2	10.00	15.00	85.00	73.15	68.15
3	22.50	27.50	57.50	91.93	86.93
4	22.50	27.50	11.25	5.12	1.04
5	35.00	40.00	85.00	93.20	88.20
6	1.47	27.50	57.50	15.88	10.88
7	22.50	6.47	57.50	79.36	74.36
8	10.00	15.00	30.00	16.96	11.96
9	10.00	40.00	30.00	10.27	4.07
10	35.00	40.00	30.00	40.89	34.89
11	22.50	27.50	57.50	92.79	87.79
12	35.00	15.00	85.00	90.39	85.39
13	35.00	15.00	30.00	30.54	28.54
14	43.52	27.50	57.50	55.36	51.36
15	10.00	40.00	85.00	60.25	56.25
16	22.50	48.52	57.50	76.49	71.49
17	22.50	27.50	103.74	93.81	87.81

Table S2. Optical bandgap of ZnO, CuO, and ZnO/CuO.

Samples	Optical Bandgap (E_g, eV)
ZnO	2.87
ZC1	2.60

ZC2	2.72
ZC3	1.52
ZC4	1.72
ZC5	1.73
CuO	1.59

FT-IR study

The vibrational frequency of the bond Cu-O and Zn-O can be assessed using the Eq. (S1):

$$\upsilon = \frac{1}{2\pi c}\left(\frac{k}{\mu}\right)^{1/2} \quad (S1)$$

Where υ is the wavenumber, c is the velocity of light (3×10^{10} cm s^{-1}), k is the average force constant of M-O (Where, M = Zn, Cu), and μ is the effective mass of M-O bond calculate by the relation: $\mu = \frac{M_M \times M_O}{M_M + M_O}$ where M_M and M_O are the atomic mass of metal (Zn and Cu) and O, respectively. The relation between force constant (k) and average bond length (r) was evaluated from Eq. (S2):

$$k = \left(\frac{17}{r^3}\right) \quad (S2)$$