Supplementary Information

Photo-deposition of Cu_2O on Pre-Annealed ZnO Nanorods Yields pn-Type Heterostructures with Enhanced Photocatalytic Activity

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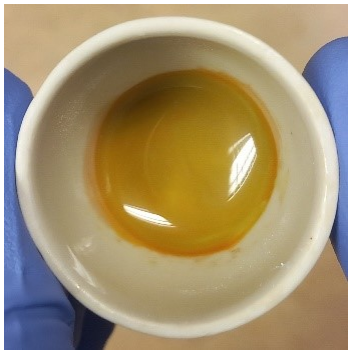

Fig. S1 The reaction mixture after the photo-deposition reaction.

Fig. S2 Digital photograph of the washed and dried Cu_2O@ZnO powder.

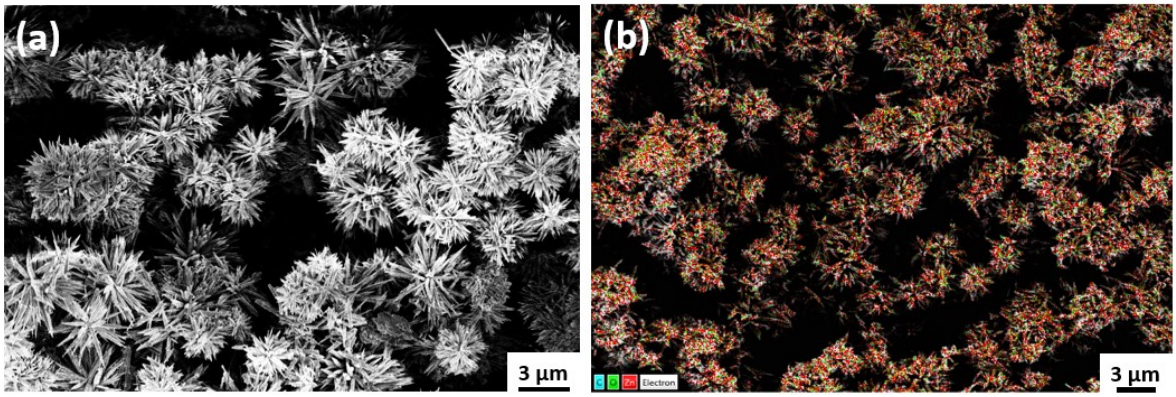

Fig. S3 (a) Representative SEM micrograph of as-prepared ZnO sea urchin-like structures. (b) Composite EDS elemental map of as-prepared ZnO, indicating only presence of zinc, oxygen, and carbon (from the carbon tape).

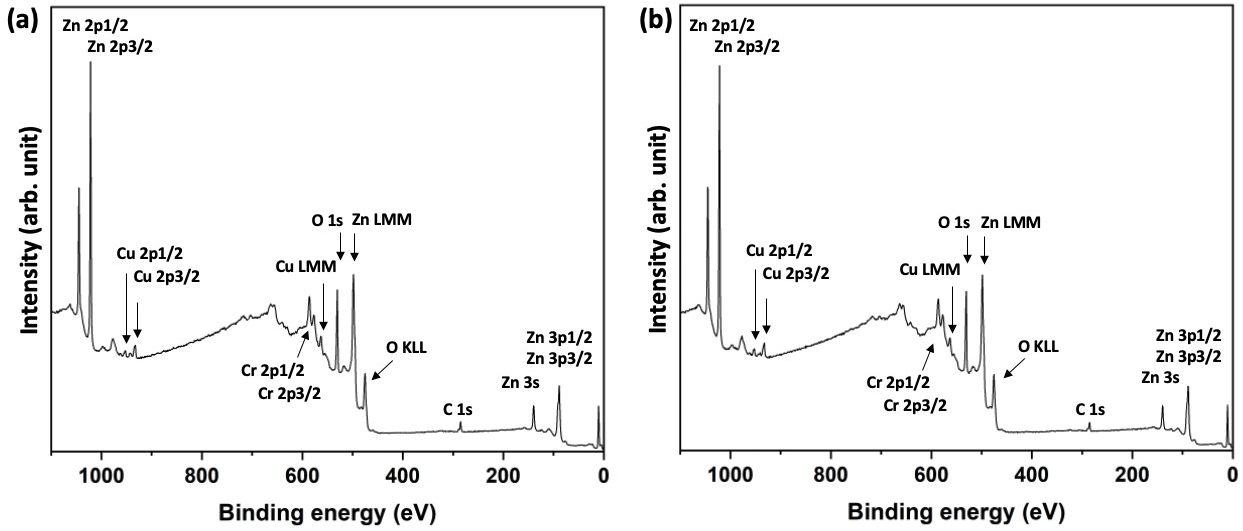

Fig. S4 XPS survey spectra of (a) Cu_2O@ZnO (as-prepared) and (b) Cu_2O@ZnO (post-heated).

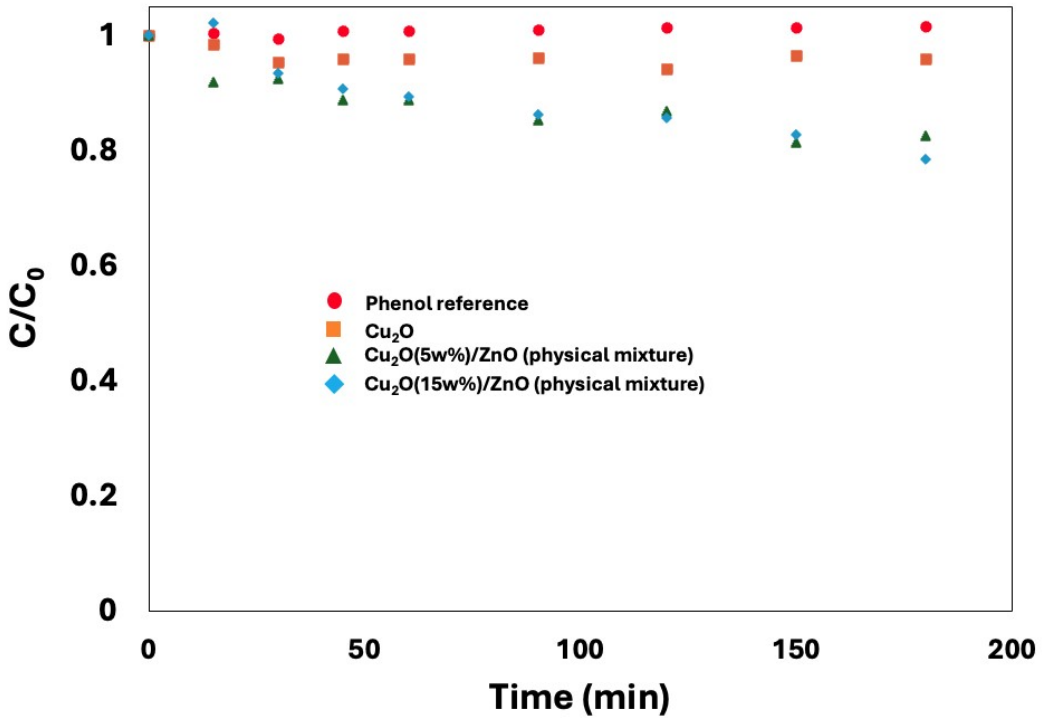

Fig. S5 Degradation of phenol in absence of catalyst, with only Cu_2O, physical mixture of 5 w% Cu_2O with ZnO (as-prepared), and 15 w% Cu_2O with ZnO (as-prepared).

Table S1. Concentration and binding energy the different components of the deconvoluted Cu $2p_{3/2}$ and O 1s high-resolution XPS spectra.

Sample	**Concentration (at.%)/ Binding energy (eV)**				
	Cu(I) $2p_{3/2}$	**Cu(II) $2p_{3/2}$**	**O 1s (O_{latt})[a]**	**O 1s (O_{def}/$O_{OH,strong}$)[b]**	**O 1s (O_{ads})[c]**
ZnO (as-prepared)	-	-	55 % / 529.9 eV	39 % / 530.8 eV	6 % / 531.7 eV
ZnO post-heated (30 min at 500°C)	-	-	61 % / 530.1 eV	34 % / 531.1 eV	5 % / 531.9 eV
Cu_2O@ZnO (post-heated before photocatalysis)	67 % / 931.6 eV)	33 % / 933.6 eV	66 % / 529.8 eV	30 % / 530.8 eV	3 % / 531.8 eV
Cu_2O@ZnO (post-heated after photocatalysis)	67 % / 931.7 eV	33 % / 933.1 eV	62 % / 530.0 eV	33 % / 530.6 eV	5 % / 531.8 eV

[a] Lattice oxygen (O^{2-} in metal oxide)

[b] Defect-associated oxygen and/or strongly bound surface hydroxyls

[c)] Adsorbed oxygen species (e.g., weakly bound OH, H_2O, carbonates, organics)