Supporting Information

Copper Nanocluster-Mediated Degradation of Toxic Organic Dyes: A Sustainable Approach to Water Remediation

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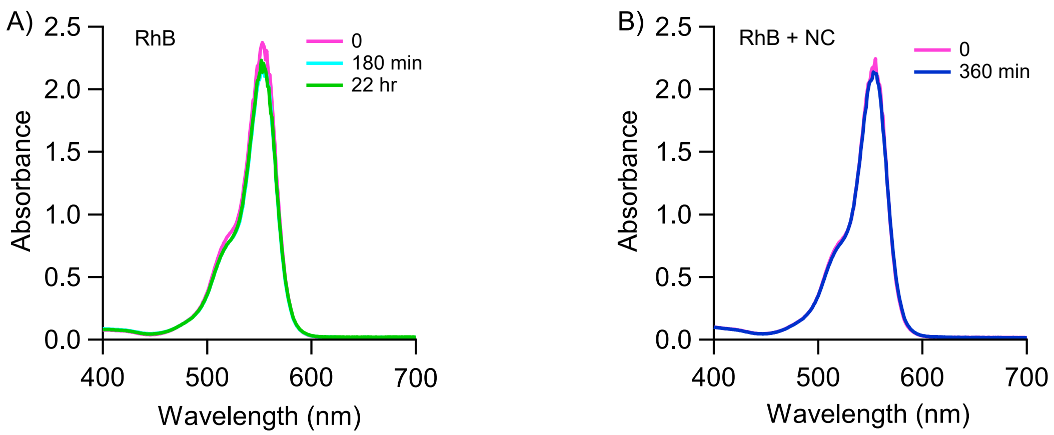

Figure S1: Time dependent UV-visible absorption spectra of RhB recorded in the (A) absence (B) presence of Cys-Cu NC.

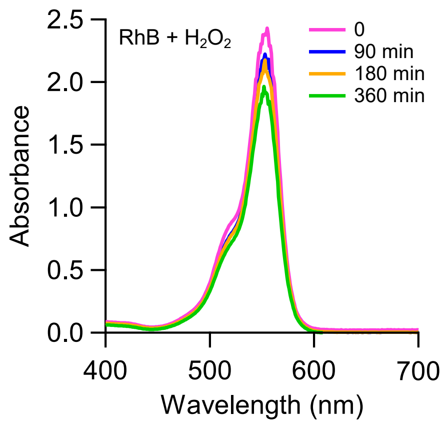

Figure S2: Time dependent UV-visible absorption spectra of RhB recorded in the presence of H_2O_2.

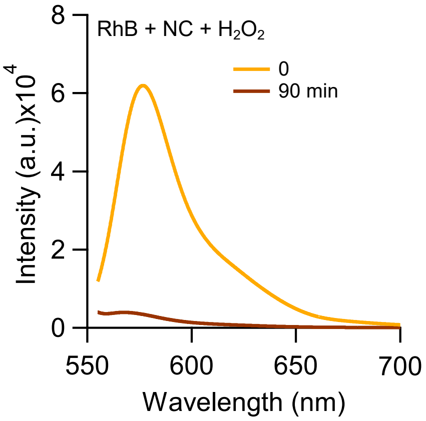

Figure S3: Emission spectra (λ_{ex} = 553 nm) of RhB in the presence of Cys-Cu NC and H_2O_2 before (orange) and after 90 minutes (brown) of degradation.

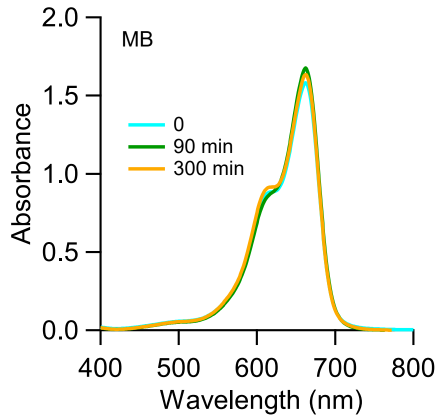

Figure S4: Time dependent UV-visible absorption spectra of MB showing negligible change in absorbance with time.

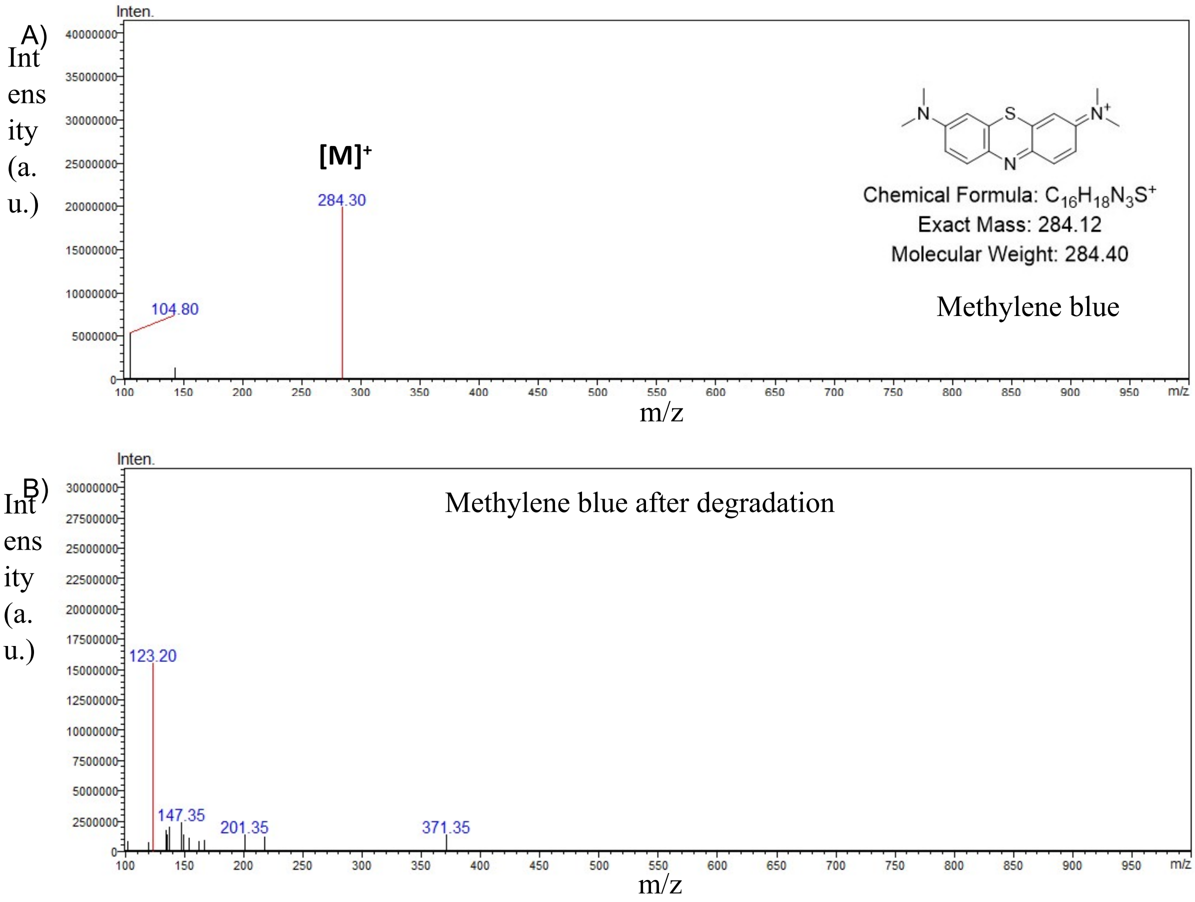

Figure S5: LC-MS of (A) pure MB and (B) MB after degradation in the presence of Cys-Cu NC and H_2O_2.

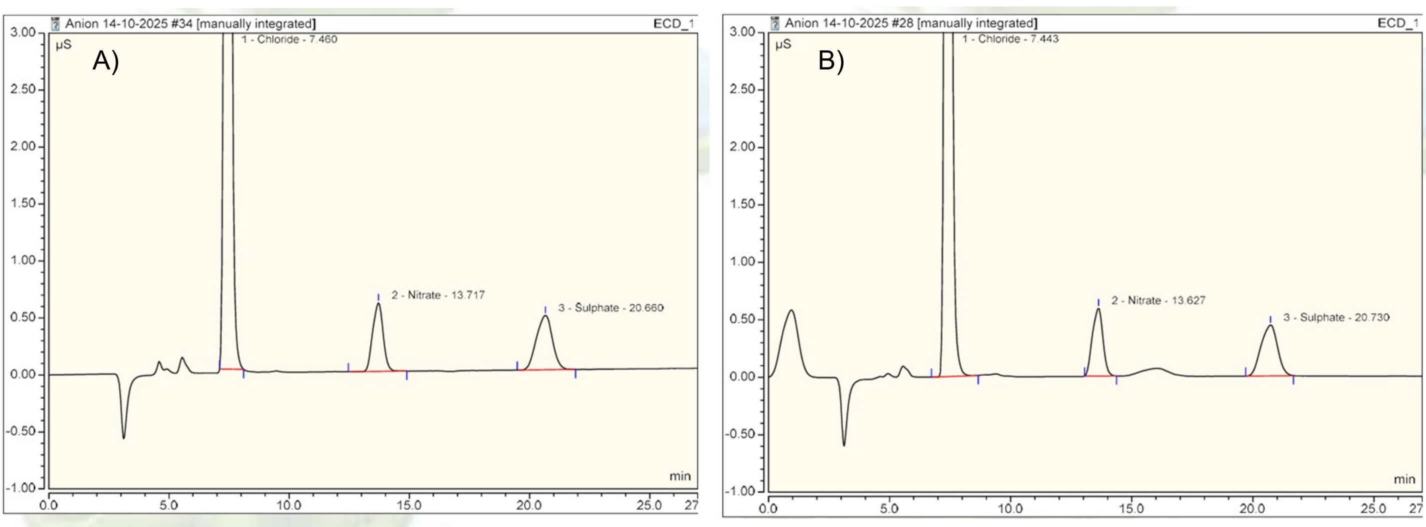

Figure S6: Ion chromatography spectra of (A) RhB and (B) MB after complete degradation in the presence of Cys-Cu NC and H_2O_2.

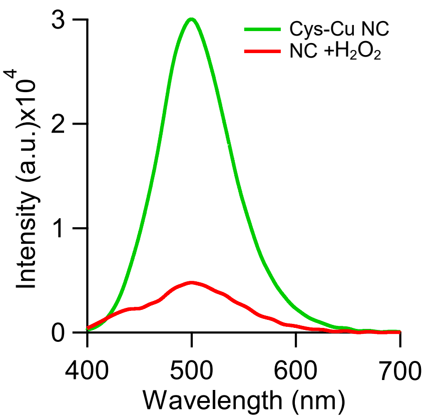

Figure S7: Photoluminescence emission spectra (λ_{ex} = 370 nm) of Cys-Cu NC in the absence (green) and presence (red) of 50 mM H_2O_2 at pH 7.

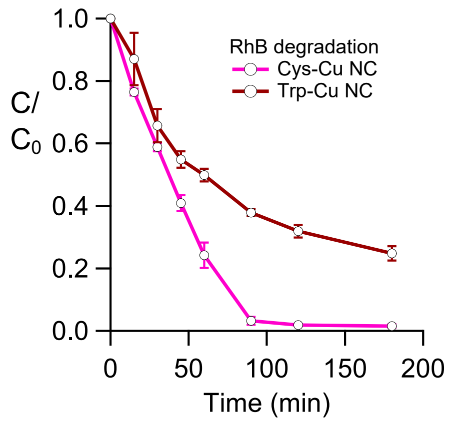

Figure S8: Degradation profiles (C/C_0 vs time) of RhB in the presence of H_2O_2 and Cys-Cu NC (pink) or, Trp-Cu NC (brown).

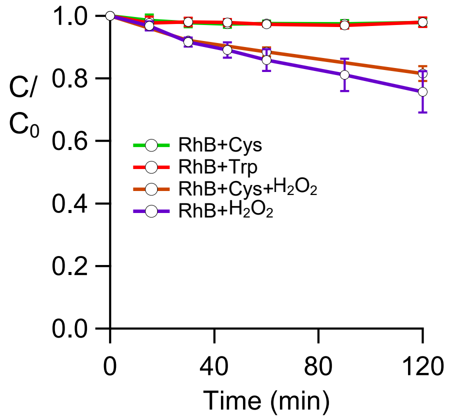

Figure S9: Degradation profile (C/C_0 vs time) of RhB in the presence of ligands Cys (green), Trp (red), Cys + H_2O_2 (brown) and H_2O_2 alone (violet).

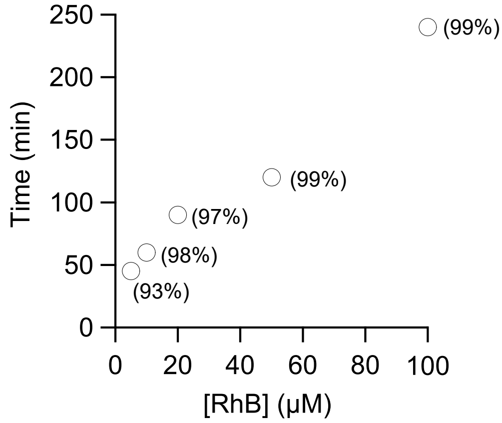

Figure S10: Time required for RhB degradation as a function of its initial concentration (5, 10, 20, 50, and 100 μM) in the presence of fixed concentrations of Cys–Cu NC and H_2O_2. The corresponding degradation efficiencies at each concentration are shown in brackets.

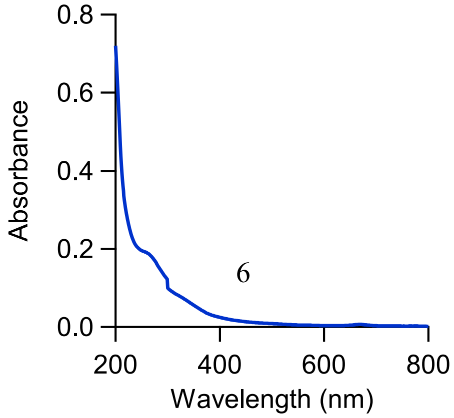

Figure S11: UV-Vis absorption spectra of pond water.

Table S1: Comparative analysis of various methods employed for the degradation of RhB and MB.

Sl. No.	System	Dye	Concentration of dye (mg L^{-1})	Degradation Time (minutes)	Degradation efficiency	Reference
1	$g\text{-}C_3N_4$ in presence of 300W Xenon Lamp	RhB	10	20	100 %	1
2	GSH-Ag NC in presence of solar light		20	30	85.1 %	2
3	ZnO-Ag NC in presence of W-30 LED light		23.9	60	86 %	3
4	WO_3 nanoparticles under visible light		5	240	96 %	4
5	co-doped CdNiZnO nanoparticles with UV irradiation		30	50	98 %	5
6	Fe^0/H_2O_2 Fenton system		47.9	60	98 %	6
7	HOOC-fMWCNTs in presence of $NaBH_4$		4.8	130	81.3 %	7
8	MoS_2/COF irradiated with 300W Xenon lamp		20	30	98 %	8
9	**Cys-Cu NC in presence of H_2O_2**		**9.6**	**90**	**97 %**	**This work**
10	Co_3O_4-ZnO nanocomposite in presence of UV light	MB	10	90	86 %	9
11	Zinc-Tin oxide nanostructures (ZTO) with UV irradiation		1.5	90	96 %	10
12	$K_2Ti_6O_{13}$ nanotubes under UV irradiation		10	90	82.06 %	11
13	$Ag:Al_2O_3:TiO_2$ irradiated with tungsten-halogen lamp		3.2	30	99 %	12
14	Magnetic MOF in presence of H_2O_2		20	30	100 %	13
15	Ag NP-CNS nanocomposite		17.5	60	95.2 %	14
16	$Mo_{72}Fe_{30}$ NC under sun light		2	60	100 %	15
17	Por-PD-COF in presence of 300W		5	180	98 %	16

	Xenon lamp					
18	**Cys-Cu NC in presence of H_2O_2**		**6.4**	**90**	**97 %**	**This work**

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