Electronic Supplementary Material (ESI) for New Journal of Chemistry.

Electronic Supplementary Information

Effect of calcination temperature on the morphology and catalytic properties of ZnO nanostructures fabricated from a chiral precursor for photodegradation of both cationic and anionic dyes

Shradha Gandhi,‡ Rupinder Kaur,‡ Vandana Sharma and Sanjay K. Mandal*

Department of Chemical Sciences, Indian Institute of Science Education and Research Mohali, Sector 81, Manauli PO, S.A.S. Nagar, Mohali, Punjab 140306, INDIA

‡ These authors contributed equally.

Corresponding Author

*E-mail: sanjaymandal@iisermohali.ac.in

Table of Contents

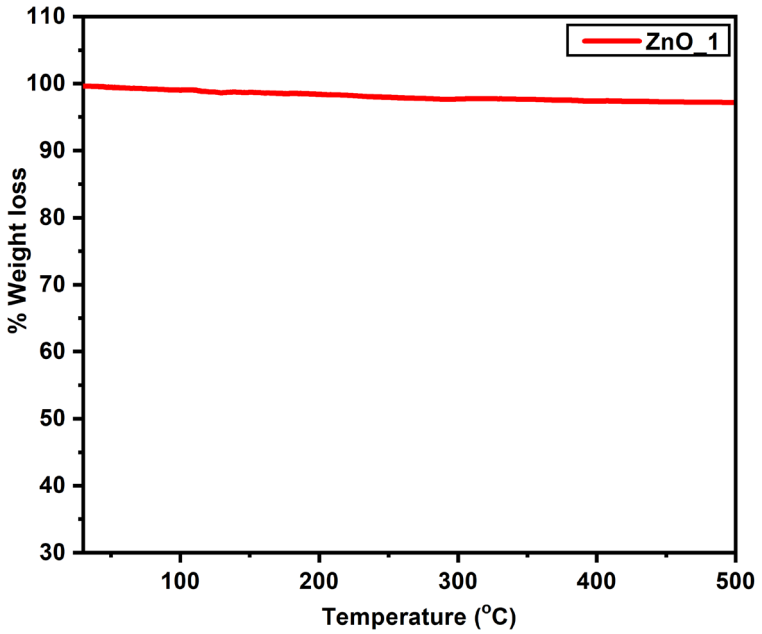


Fig. S1 TGA pattern of **ZnO_1**.

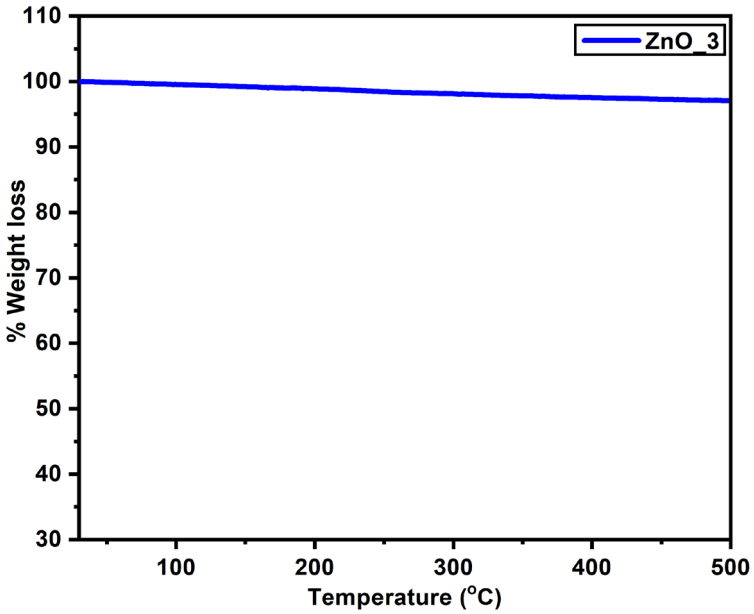


Fig. S2 TGA pattern of **ZnO_3**.

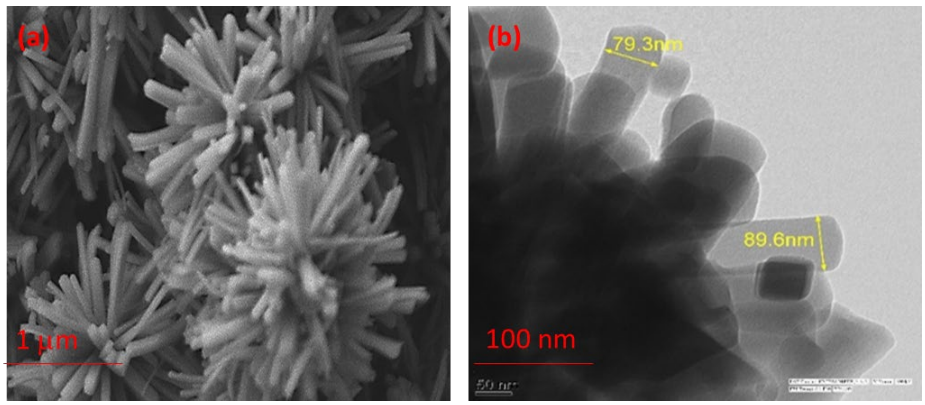
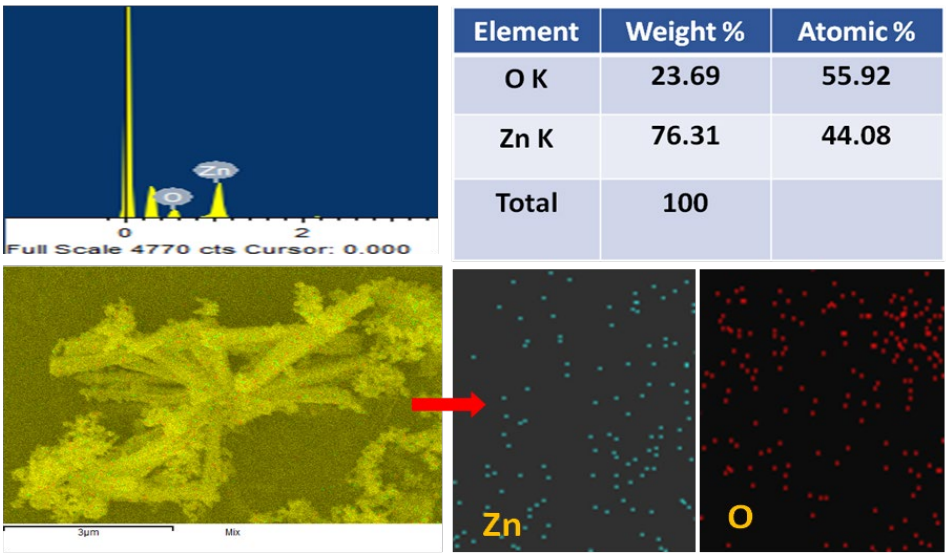
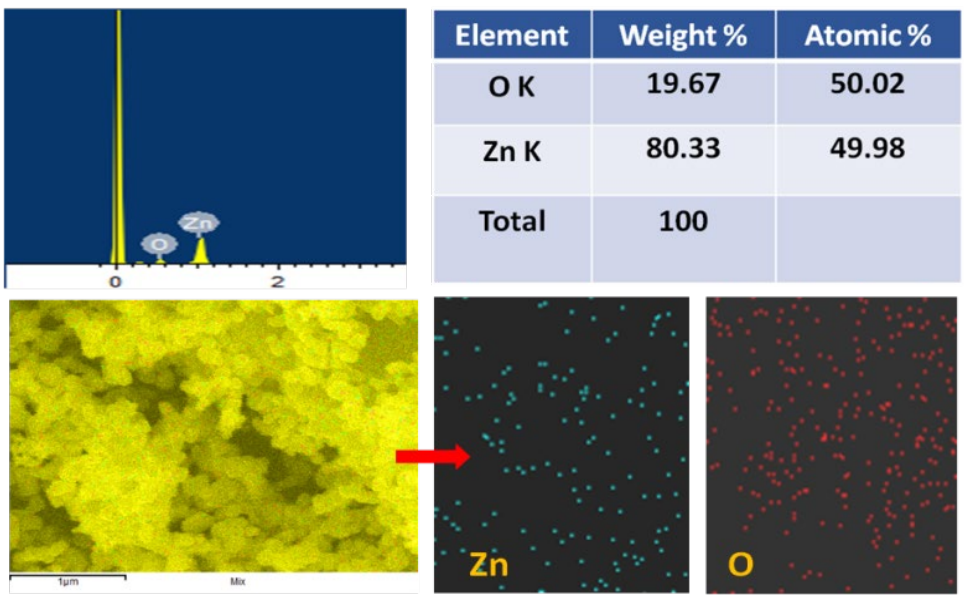


Fig. S3 (a) FESEM image and (b) TEM image of **Zn-CBS**.



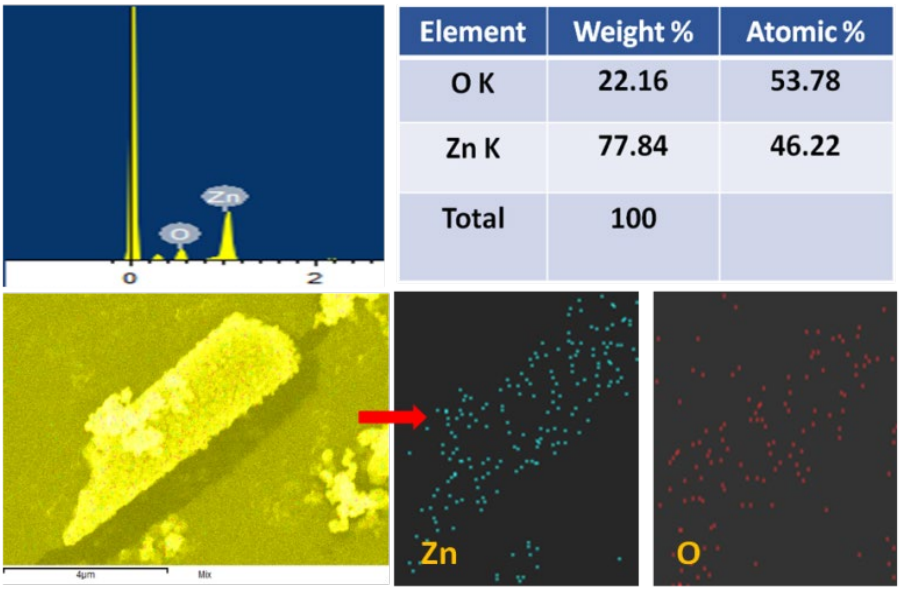
Element	Weight %	Atomic %
O K	23.69	55.92
Zn K	76.31	44.08
Total	100	

Fig. S4 EDX spectrum and elemental mapping of **ZnO_1**.



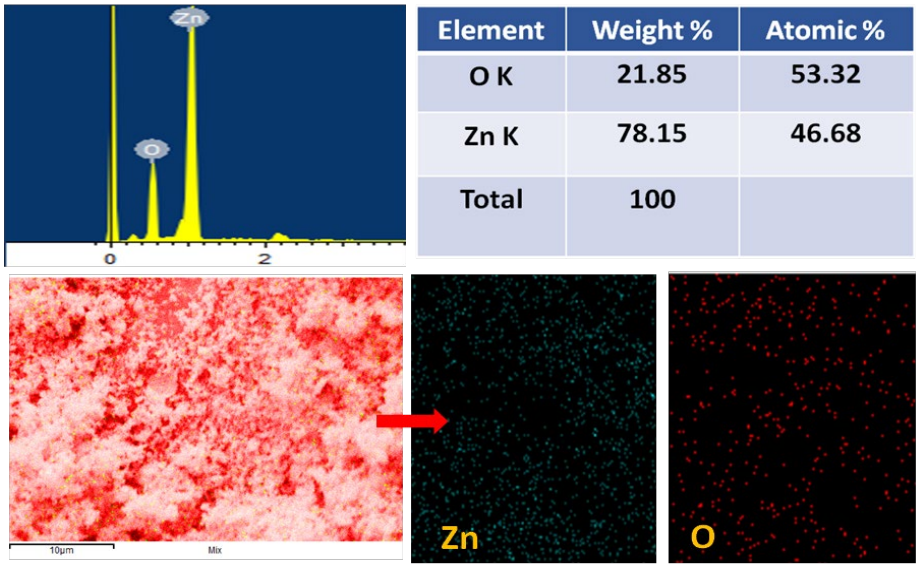
Element	Weight %	Atomic %
O K	19.67	50.02
Zn K	80.33	49.98
Total	100	

Fig. S5 EDX spectrum and elemental mapping of **ZnO_2**.



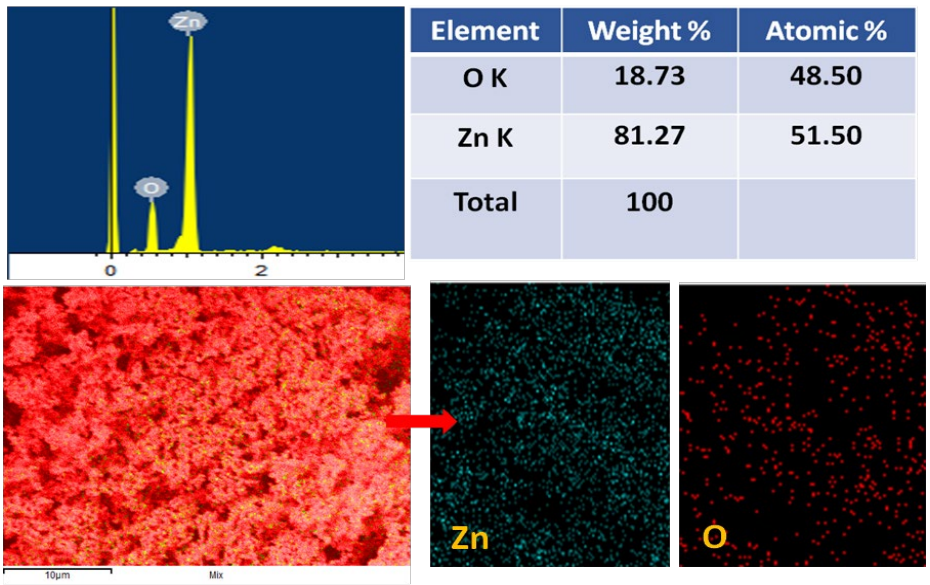
Element	Weight %	Atomic %
O K	22.16	53.78
Zn K	77.84	46.22
Total	100	

Fig. S6 EDX spectrum and elemental mapping of **ZnO_3**.



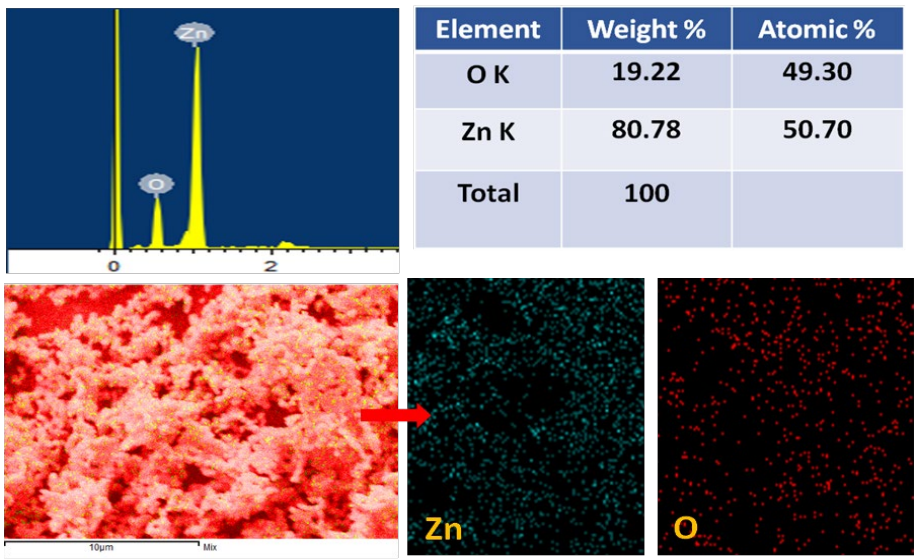
Element	Weight %	Atomic %
O K	21.85	53.32
Zn K	78.15	46.68
Total	100	

Fig. S7 EDX spectrum and elemental mapping of **ZnO_1a**.



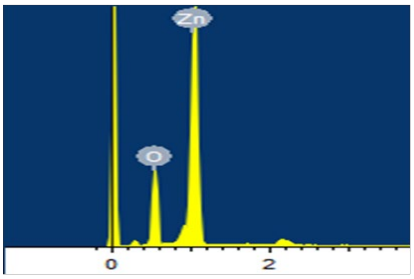
Element	Weight %	Atomic %
O K	18.73	48.50
Zn K	81.27	51.50
Total	100	

Fig. S8 EDX spectrum and elemental mapping of **ZnO_2a**.



Element	Weight %	Atomic %
O K	19.22	49.30
Zn K	80.78	50.70
Total	100	

Fig. S9 EDX spectrum and elemental mapping of **ZnO_3a**.



Element	Weight %	Atomic %
O K	21.84	53.31
Zn K	78.16	46.69
Total	100	

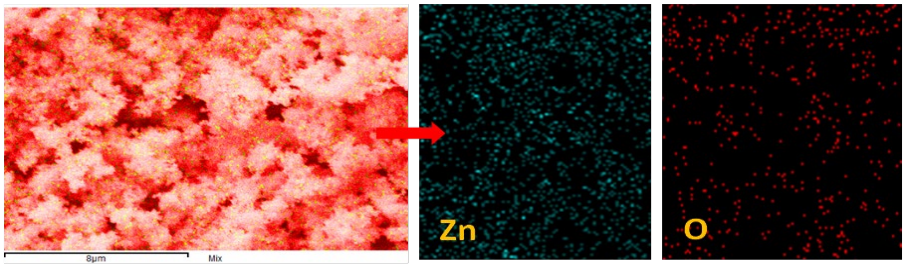
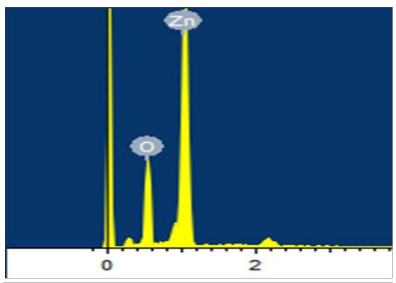


Fig. S10 EDX spectrum and elemental mapping of **ZnO_1_2h** obtained from calcination of **Zn-CBS** at 600 °C for 2 h.



Element	Weight %	Atomic %
O K	22.19	53.81
Zn K	77.81	46.19
Total	100	

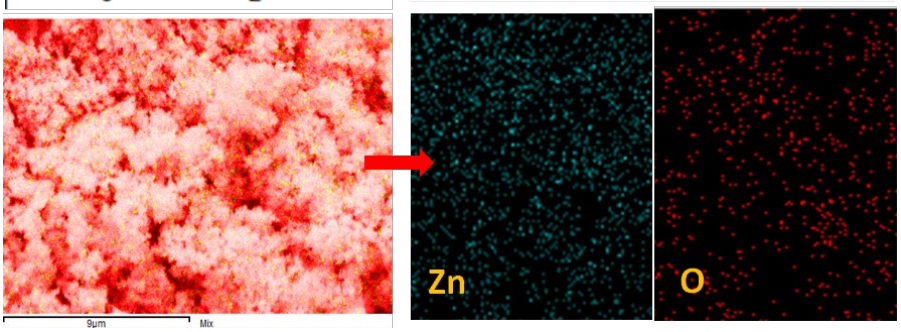
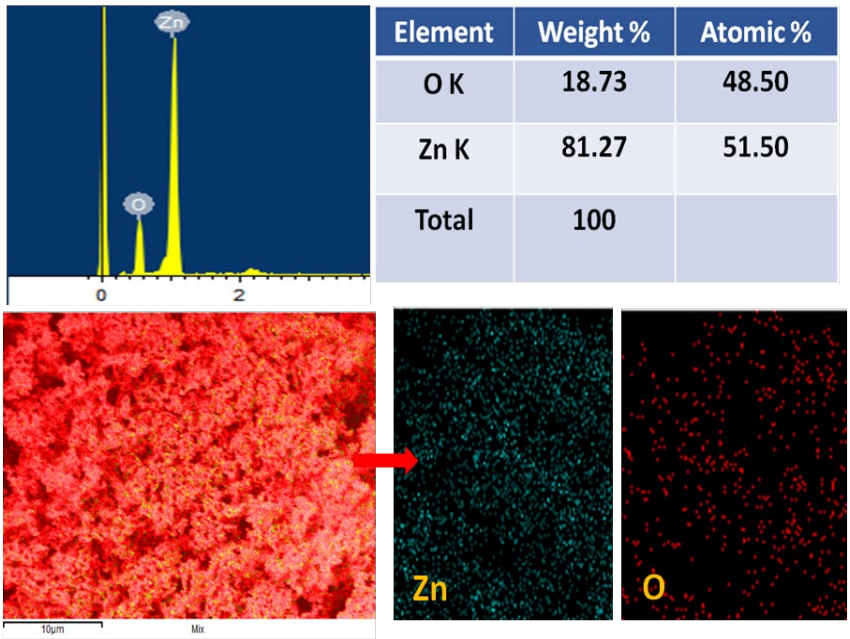
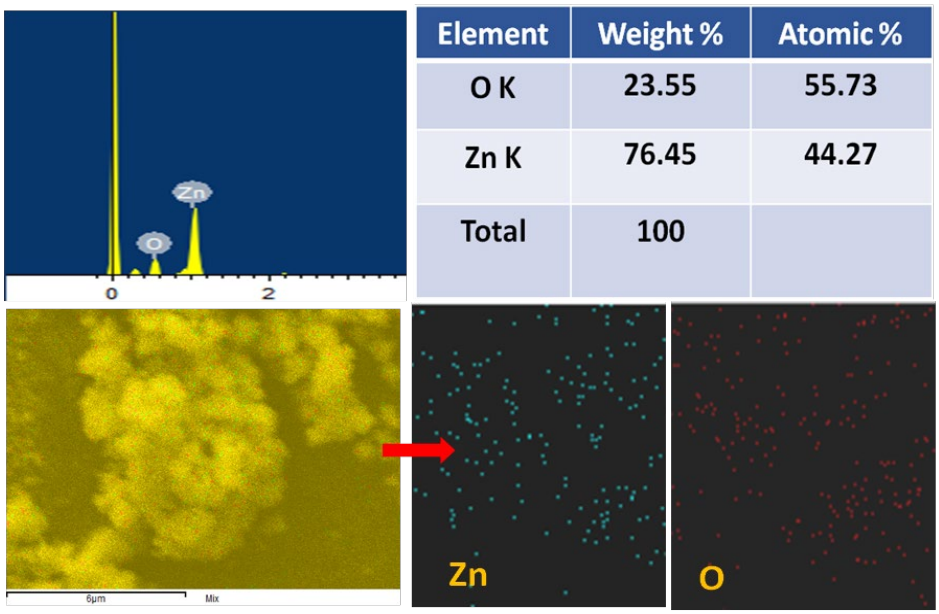


Fig. S11 EDX spectrum and elemental mapping of **ZnO_1_4h** obtained from calcination of **Zn-CBS** at 600 °C for 4 h.



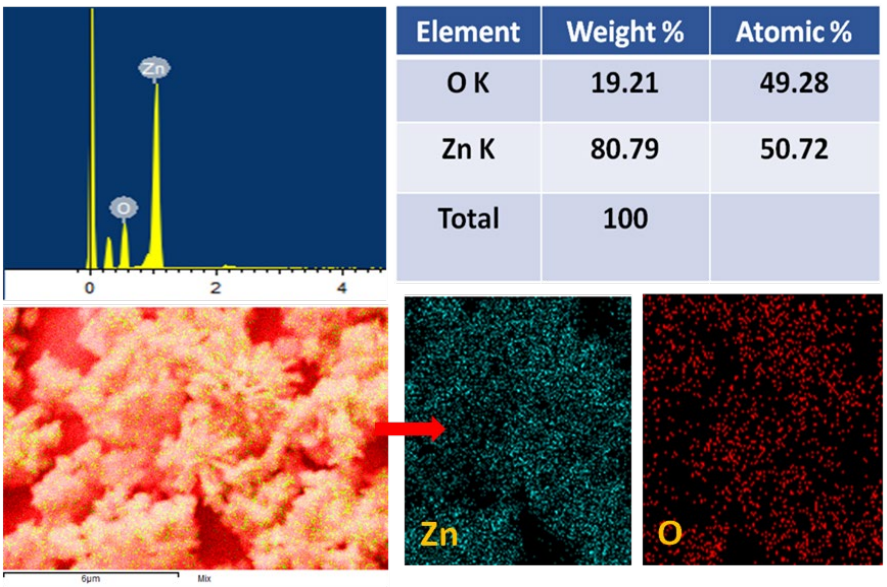
Element	Weight %	Atomic %
O K	18.73	48.50
Zn K	81.27	51.50
Total	100	

Fig. S12 EDX spectrum and elemental mapping of **ZnO_1_12h** obtained from calcination of **Zn-CBS** at 600 °C for 12 h.



Element	Weight %	Atomic %
O K	23.55	55.73
Zn K	76.45	44.27
Total	100	

Fig. S13 EDX spectrum and elemental mapping of **ZnO_HT** obtained from hydrothermal reaction of Zn-CBS using water as solvent at 180 °C and pH > 13.



Element	Weight %	Atomic %
O K	19.21	49.28
Zn K	80.79	50.72
Total	100	

Fig. S14 EDX spectrum and elemental mapping of **ZnO_HT_1** obtained from the calcination of **ZnO_HT** at 600 °C for 6 h.

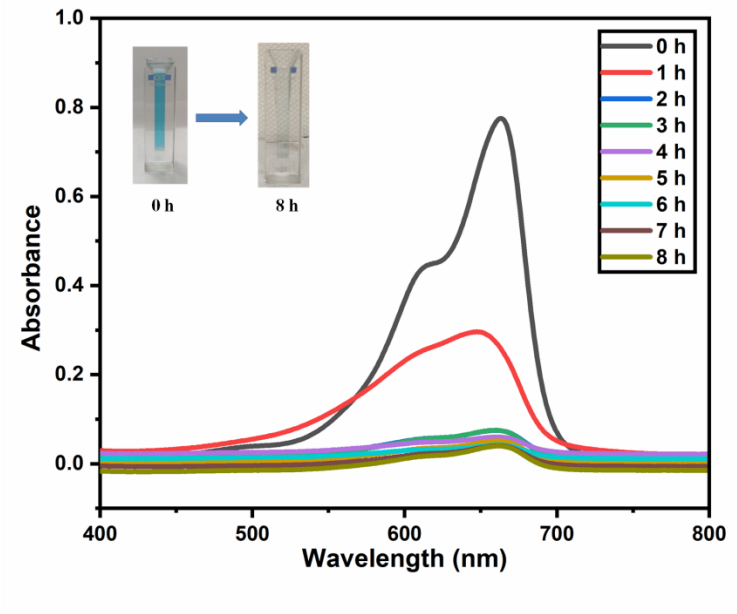


Fig. S15 Change in the absorption spectra of the solution of MB in the presence of **ZnO_3a**.

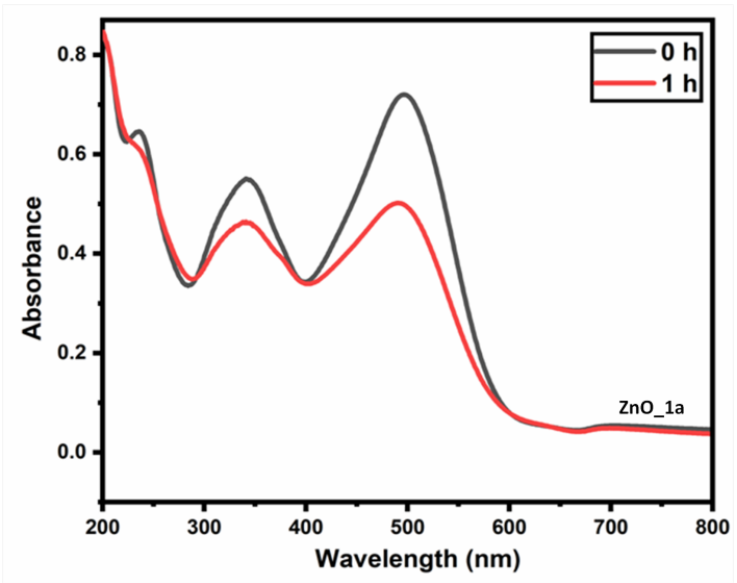


Fig. S16 Change in the absorption spectra of the solution of CR in the presence of **ZnO_1a.**

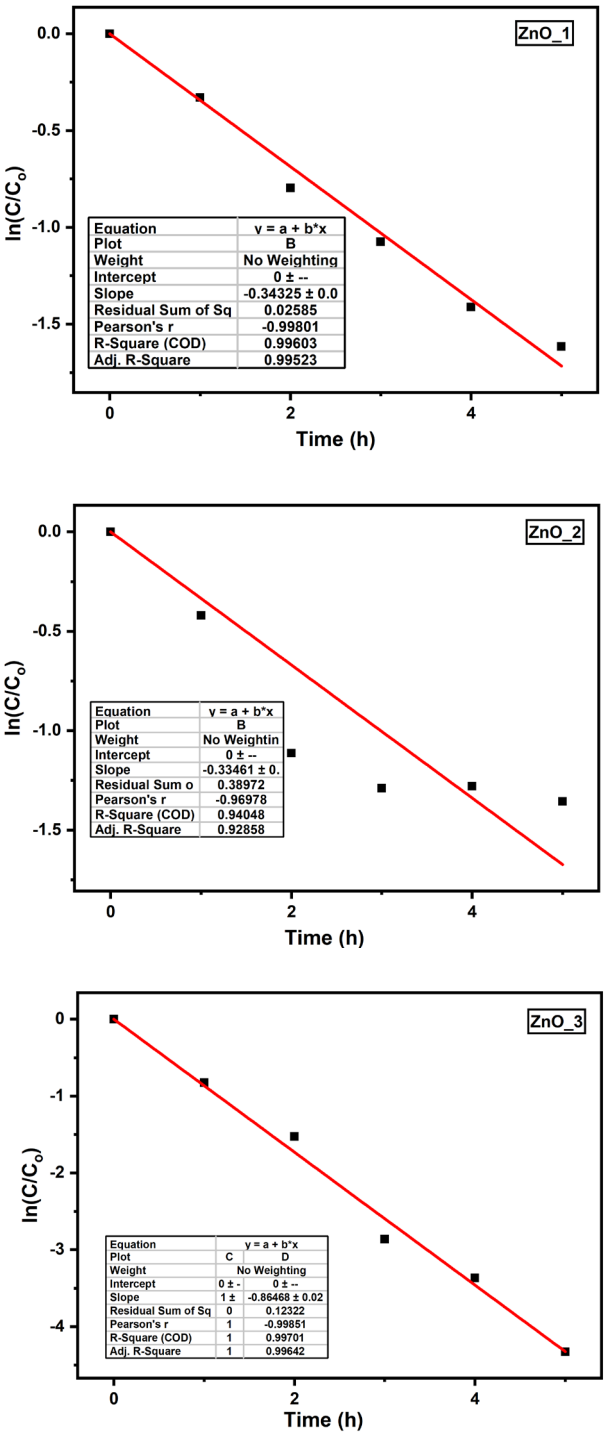


Fig. S17 Kinetic plot of **ZnO_1**, **ZnO_2** and **ZnO_3** for degradation of MB dye.

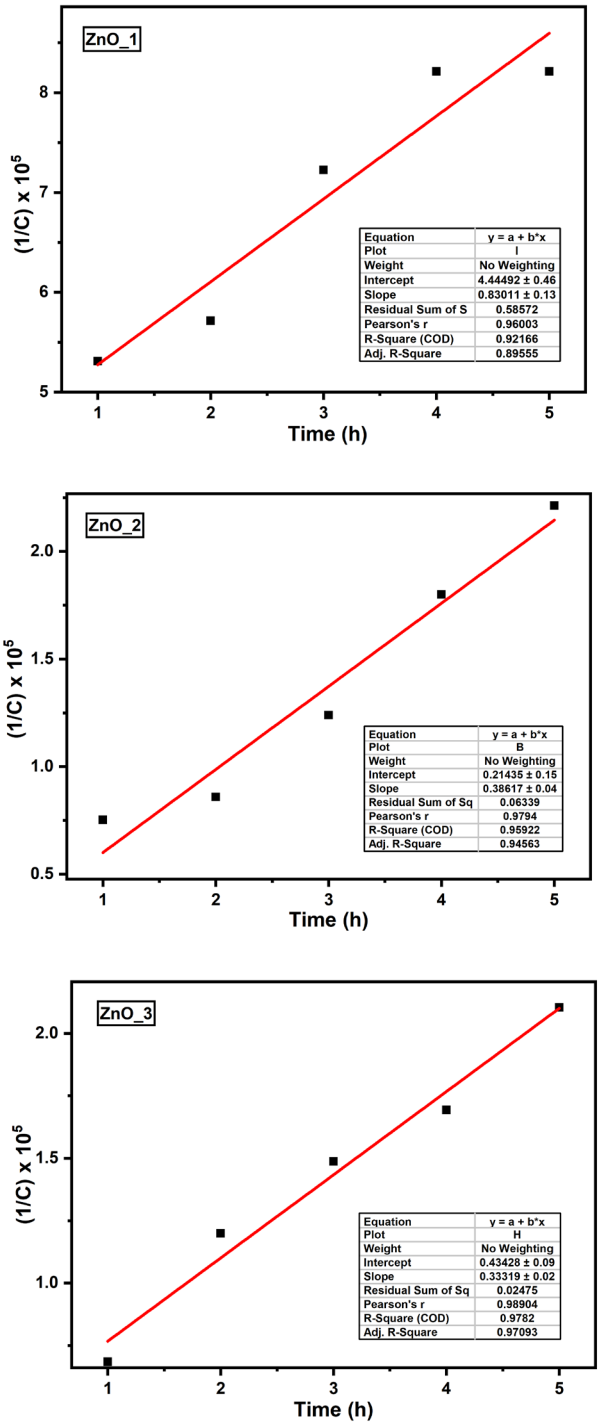


Fig. S18 Kinetic plot of **ZnO_1**, **ZnO_2** and **ZnO_3** for degradation of CR dye.

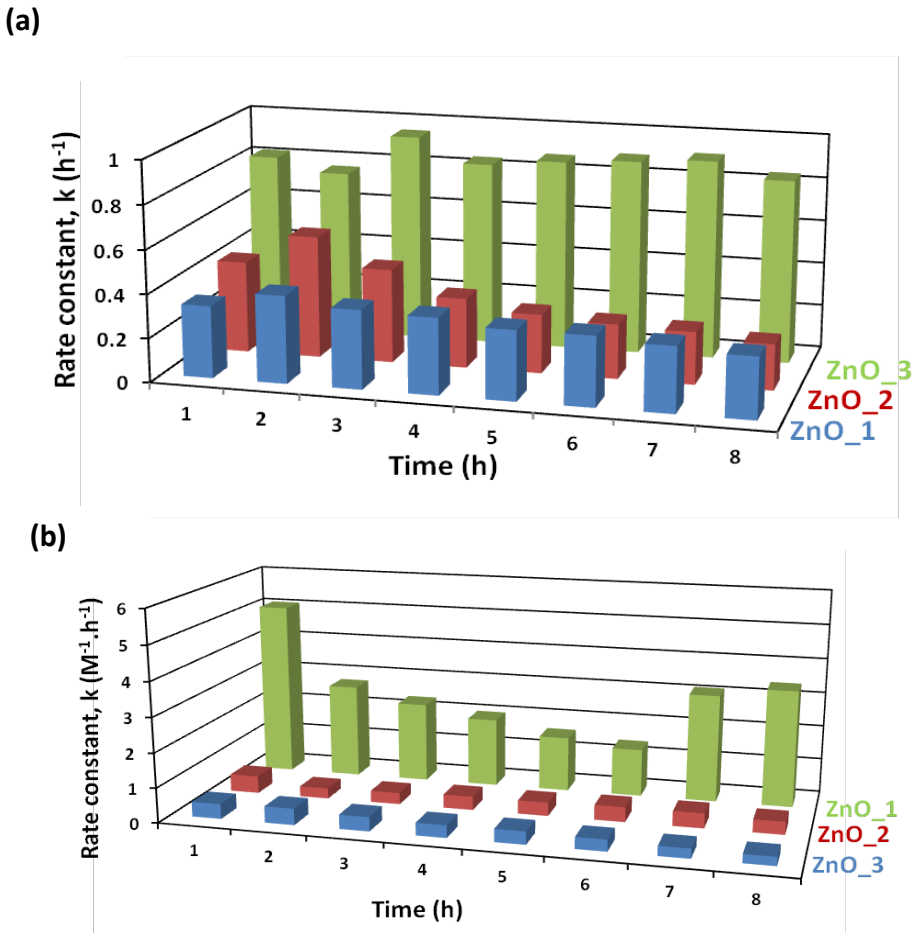


Fig. S19 Comparison of rate constant for the degradation of (a) MB and (b) CR dye by **ZnO_1**, **ZnO_2** and **ZnO_3**.

Percentage decolorization and rate constant values of as-synthesized ZnO nanoparticles

Table S1. Degradation efficiency and rate constant values of the solution of MB in the presence of **ZnO_1** under exposure of UV light at room temperature.

Time (h)	Degradation Efficiency (%)	Rate constant (h^{-1})
0	0	0
1	28.08	0.33
2	54.11	0.40
3	64.41	0.36
4	75.33	0.35
5	80.46	0.32
6	87.36	0.32
7	89.90	0.30
8	92.7	0.28

Table S2. Degradation efficiency and rate constant values of the solution of MB in the presence of **ZnO_2** under exposure of UV light at room temperature.

Time (h)	Degradation Efficiency (%)	Rate constant (h^{-1})
0	0	0
1	53.9	0.42
2	76.9	0.56
3	80.2	0.43
4	80.2	0.32
5	81.9	0.27
6	84.5	0.25
7	87.2	0.24
8	87.2	0.21

Table S3. Degradation efficiency and rate constant values of the solution of MB in the presence of **ZnO_3** under exposure of UV light at room temperature.

Time (h)	Degradation Efficiency (%)	Rate constant (h^{-1})
0	0	0
1	56.1	0.82
2	78.2	0.76
3	94.3	0.95
4	96.6	0.84
5	98.7	0.87
6	99.5	0.89
7	99.8	0.91
8	99.9	0.84

Table S4. Degradation efficiency and rate constant values of the solution of CR in the presence of **ZnO_1** under exposure of UV light at room temperature.

Time (h)	Degradation Efficiency (%)	Rate constant ($M^{-1}.h^{-1}$)
0	0	0
1	95.2	5.06
2	95.5	2.73
3	96.5	2.32
4	96.8	1.99
5	96.8	1.59
6	97	1.38
7	98.8	3.12
8	99.1	3.39

Table S5. Degradation efficiency and rate constant values of the solution of CR in the presence of **ZnO_2** under exposure of UV light at room temperature.

Time (h)	Degradation Efficiency (%)	Rate constant ($M^{-1}.h^{-1}$)
0	0	0
1	66.1	0.50
2	70.33	0.30
3	79.40	0.33
4	85.84	0.39
5	86.26	0.39
6	91.09	0.43
7	92.12	0.43
8	92.10	0.37

Table S6. Degradation efficiency and rate constant values of the solution of CR in the presence of **ZnO_3** under exposure of UV light at room temperature.

Time (h)	Degradation Efficiency (%)	Rate constant ($M^{-1}.h^{-1}$)
0	0	0
1	62.78	0.43
2	78.72	0.47
3	82.86	0.41
4	84.93	0.36
5	87.87	0.37
6	88.64	0.33
7	88.60	0.28
8	88.73	0.25

Table S7. Comparison of percentage degradation efficiency of MB dyes by the ZnO nanostructures with literature values.

ZnO (morphology)	Time	Degradation Efficiency (%)	Light source	Rate constant (k)	Ref.*
ZnO (Particles)	70 min	93.25	Sunlight	0.0347 min^{-1}	46
ZnO (Thin film)	2.5 h	95	Sunlight	0.344 h^{-1}	47
ZnO (Hexagonal prism)	60 min	95	UV	0.093 min^{-1}	48
ZnO (nano-pencils)	4.5 h	95	Sunlight	-	49
ZnO (Hexagonal disks)	240 min	91.6	UV	8.30×10^{-3} min^{-1}	50
ZnO (Dumbbell like- bipods)		73.4		4.40×10^{-3} min^{-1}	
ZnO (Rices)		100		1.59×10^{-2} min^{-1}	
ZnO (Rods)		64.7		3.30×10^{-3} min^{-1}	
ZnO-bpma-12 (nano-spheres)	8 h	91	UV	0.00502 min^{-1}	51
ZnO-bpea-12 (1D micro-rods)		60		0.00191 min^{-1}	
ZnO-bpta-12 (3D polyhedrons)		93		0.00543 min^{-1}	
TiO_2 (Aggregated particles)	120 min	97	UV	0.018 min^{-1}	52
TiO_2 (Aggregated nanoparticles)	9 h	85	UV	-	53
TiO_2 (NA)	30 min	97	UV	0.44 min^{-1}	54
TiO_2 (NA)	180	-	UV	0.0547 min^{-1}	55
TiO_2 (Spherical particles)	90 min	96.8	Sunlight		56
ZnO_1 (3D Microflowers)	8 h	92.7	UV	0.34 h^{-1}	This work
ZnO_2 (3D Polyhedrons)		87.2		0.33 h^{-1}	This work
ZnO_3 (1D Nanorods)		99.9		0.86 h^{-1}	This work

*****reference number as appeared in the paper.

Table S8 Comparison of percentage degradation efficiency of CR dye by the ZnO nanostructures with literature values.

ZnO (morphology)	Time	Degradation Efficiency (%)	Light source	Rate constant (k)	Ref.*
ZnO (Hollow flower)	50 min	-	UV	0.02937 min^{-1}	57
ZnO (Nano-flower)	3 h	81	UV	0.92 x 10^{-2} min^{-1}	58
ZnO (Nano-rods)	48 h	94.6	dark	-	59
ZnO (Rod like)	30 min	99.21	UV	0.1119 min^{-1}	60
ZnO (Rod like)	100 min	80	Visible	-	61
ZnO (Flower-like)		65			
ZnO (Rod-flower like)		57			
ZnO (Particles-like)		51			
ZnO (Rod-like)		86	UV	-	
ZnO (Flower-like)		71.5			
ZnO (Rod flower-like)		62			
ZnO (Particles-like)		54			
ZnO (Porous)	20 min	77.5	Blue LED	2.13 x 10^{-2} g mg^{-1}.min^{-1}	62
TiO_2 (NA)	180	-	UV	0.0254 min^{-1}	55
TiO_2 (NA)	80 min	99.7	UV	-	53
TiO_2 (NA)	30 min	66.99	UV	-	63
		64.72	Sunlight	-	
ZnO_1 (3D Microflowers)	8 h	99.1	UV	0.83 $M^{-1}.h^{-1}$	This work
ZnO_2 (3D Polyhedrons)		92		0.38 $M^{-1}.h^{-1}$	This work
ZnO_3 (1D Nanorods)		88.7		0.33 $M^{-1}.h^{-1}$	This work

*****reference number as appeared in the paper.

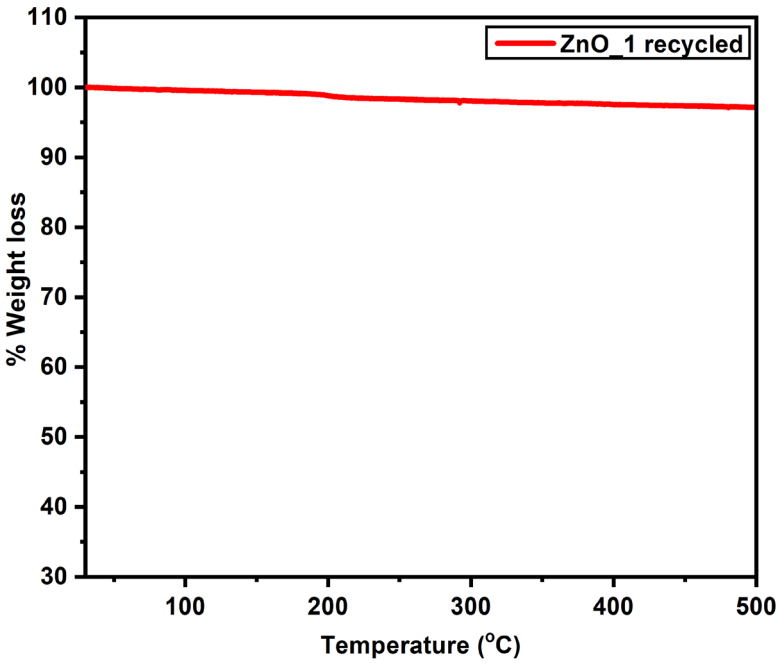


Fig. S20 TGA pattern of recycled **ZnO_1**.

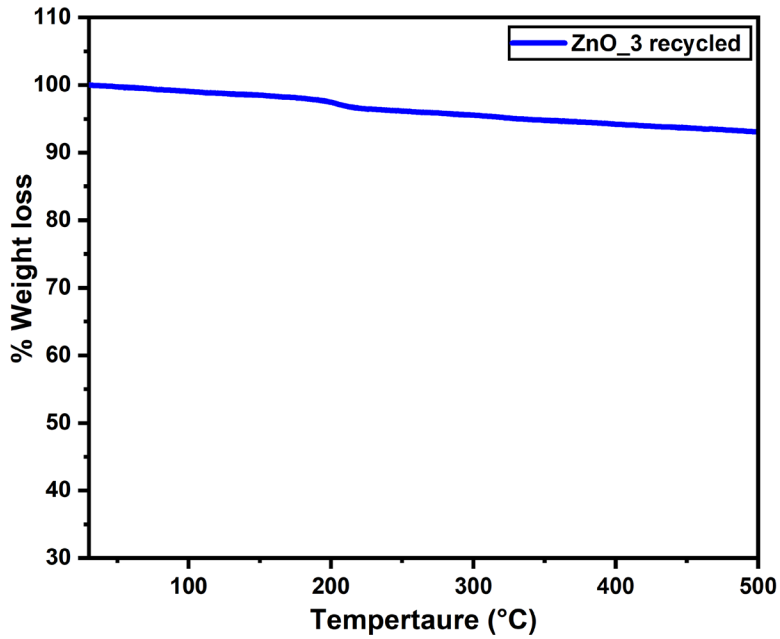


Fig. S21 TGA pattern of recycled **ZnO_3**.