Revised supporting information for

Enhanced photocatalytic activity of Eu doped Bi_2S_3 nanoflowers for degradation of organic pollutants under visible light illumination

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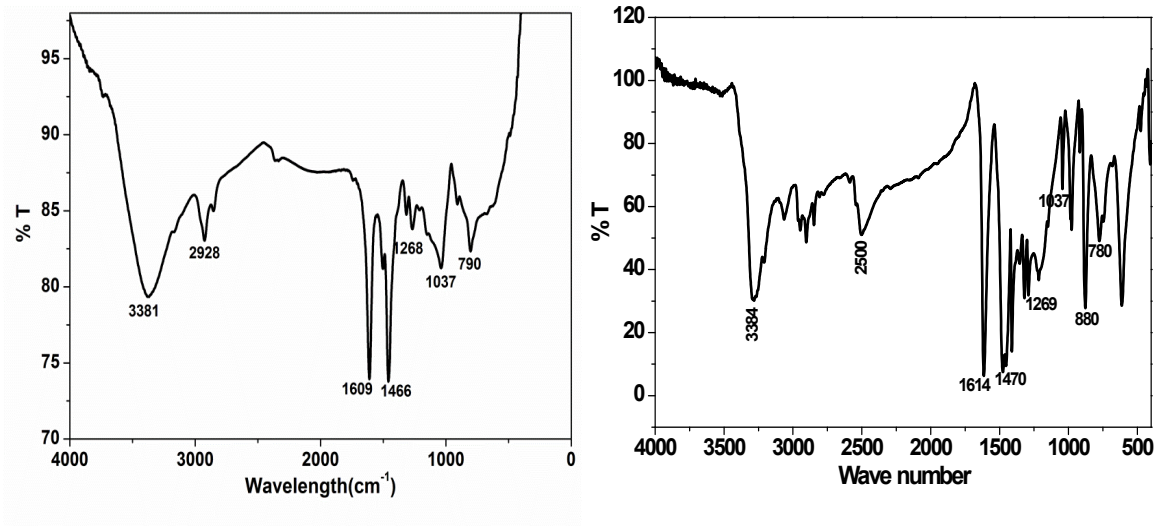


(a) (b)

Fig. S1 IR spectra of (a) [Eu(ACDA)$_3$·H$_2$O] complex and (b) HACDA ligand

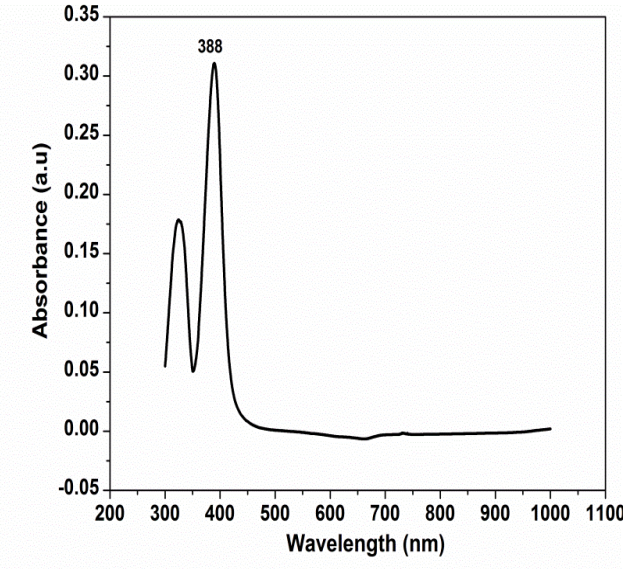
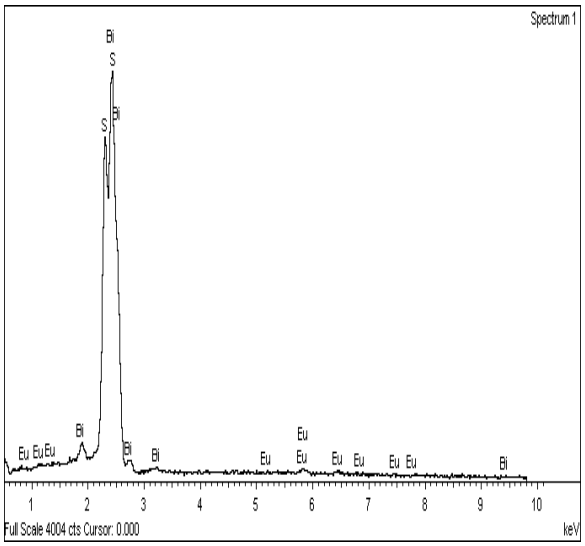
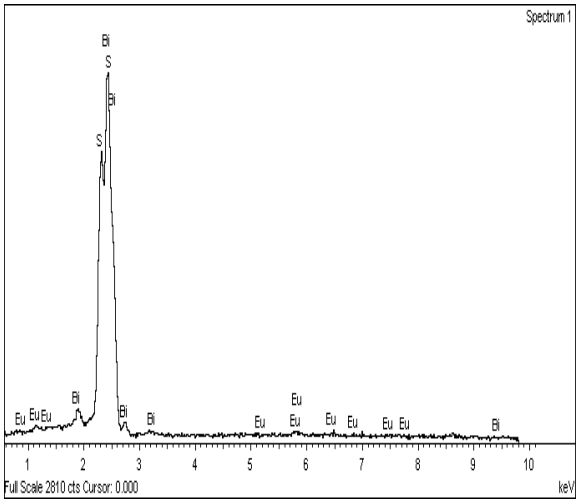


Fig. S2 UV-Vis spectra of [Eu(ACDA)$_3$·H$_2$O]complex



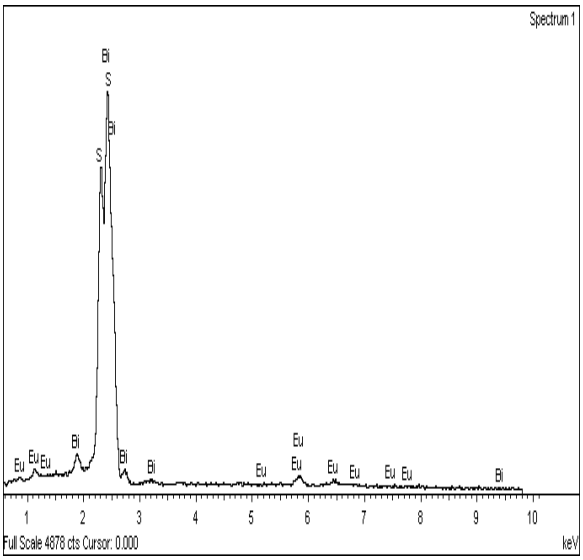
Element	Weight%	Atomic%
S K	17.95	58.48
Eu L	2.69	1.85
Bi M	79.36	39.67
Totals	100.00	

Fig. S3 EDX result of Eu doped Bi_2S_3 (Eu=1.85%)



Element	Weight%	Atomic%
S K	18.90	59.92
Eu L	3.47	2.32
Bi M	77.63	37.76
Totals	100.00	

Fig. S4 EDX result of Eu doped Bi_2S_3 (Eu=2.32 %)



Element	Weight%	Atomic%
S K	17.80	57.85
Eu L	6.22	4.26
Bi M	75.98	37.89
Totals	100.00	

Fig. S5 EDX result of Eu doped Bi_2S_3 (Eu=4.26%)

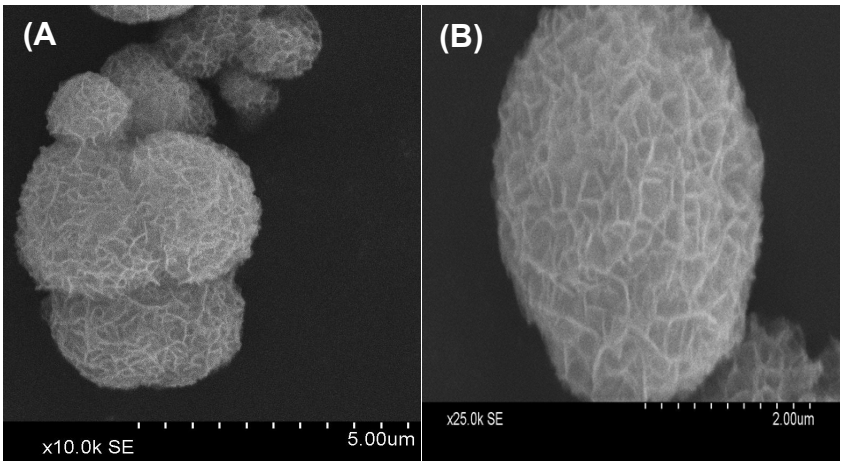


Fig. S6 SEM images of (A) 2.32% Eu^{+3} doped and (B) 4.26% Eu^{+3} doped Bi_2S_3 NPs.

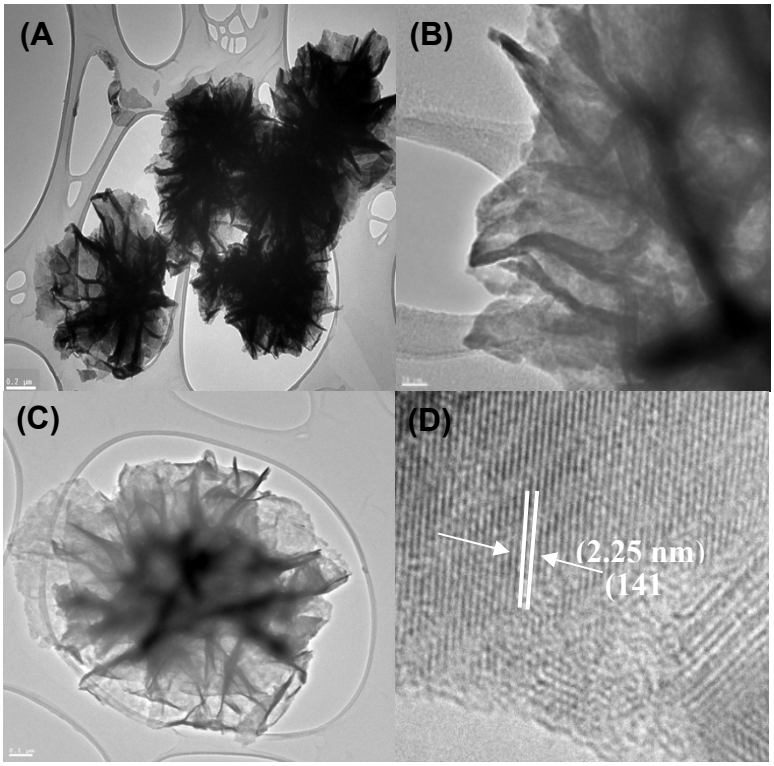


Fig. S7 TEM images of 1.85% Eu doped Bi_2S_3 NPs.

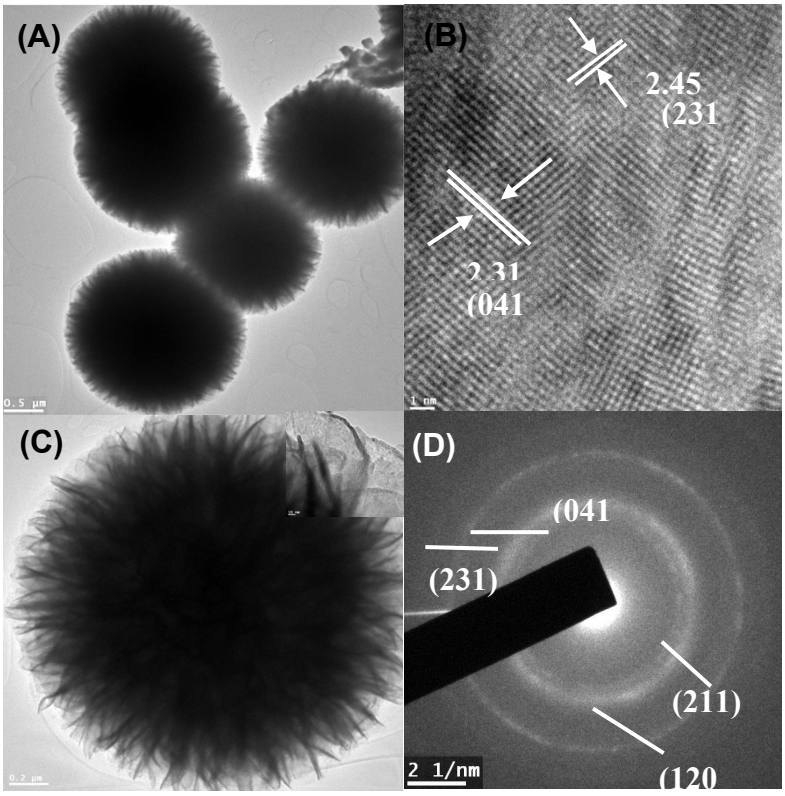


Fig. S8 TEM images of 2.32 % Eu doped Bi_2S_3 NPs.

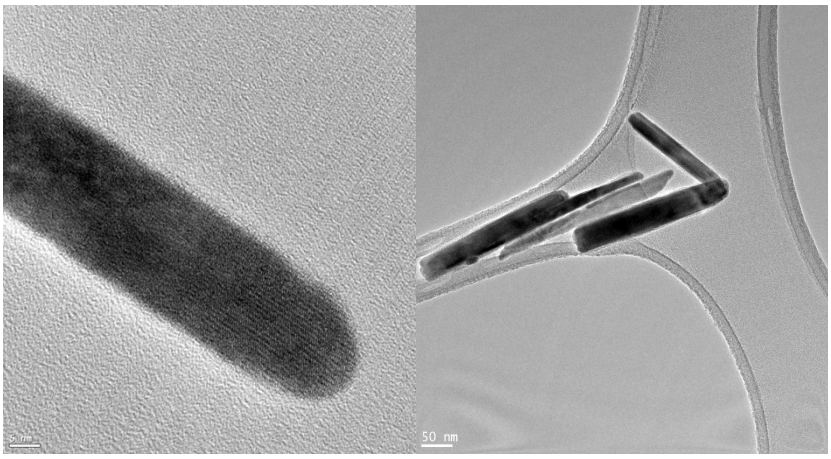


Fig. S9 TEM images of undoped Bi_2S_3 NPs.

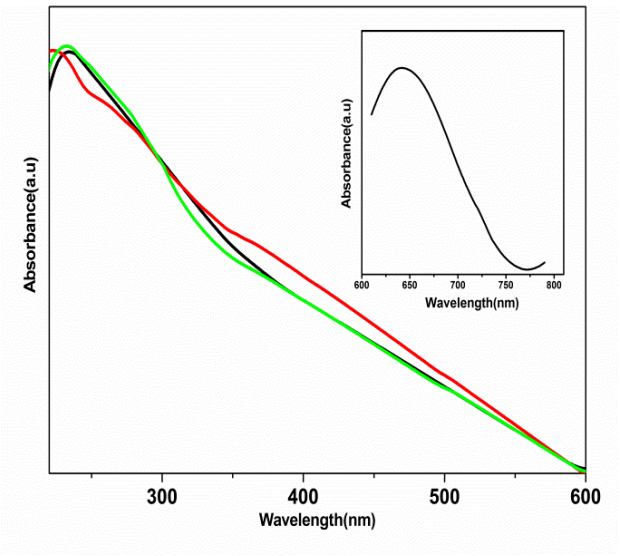


Fig. S10 UV-Vis absorbance spectrum of Eu doped Bi_2S_3 NPs. Inset: UV-Vis absorbance spectrum of undoped Bi_2S_3 NPs.

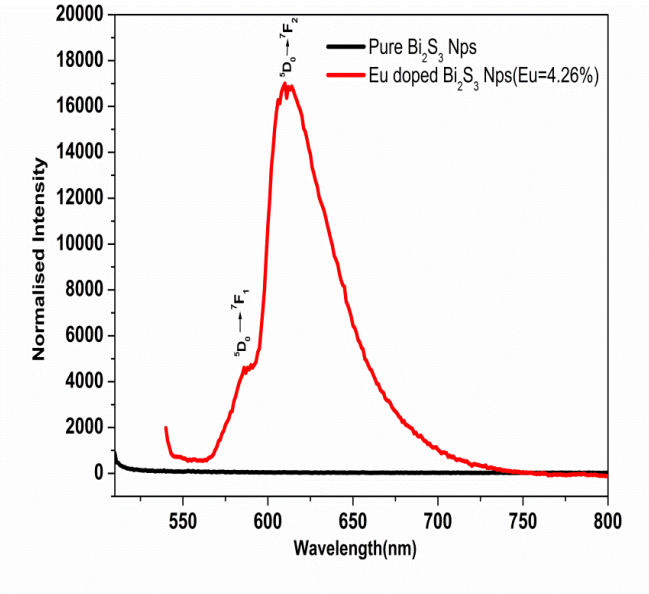


Fig. S11 Photoluminescence spectrum of undoped Bi_2S_3 and Eu doped Bi_2S_3 NPs.

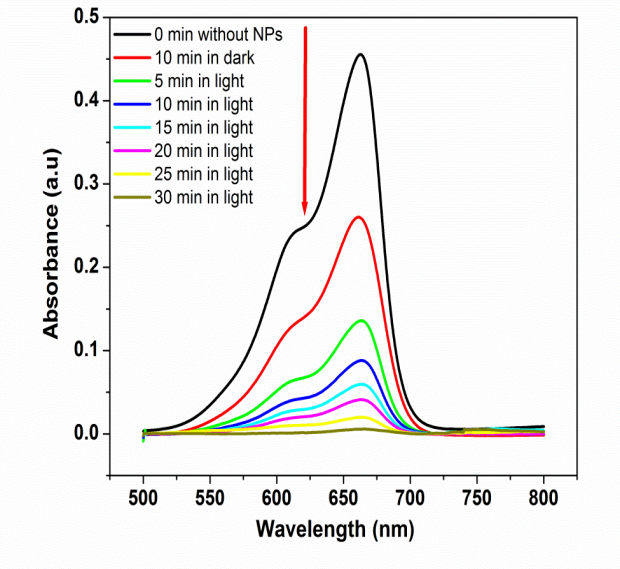


Fig. S12 Time dependent UV-Vis spectral change of MB solution (2×10^{-5}M) catalyzed by 10 mg Eu doped Bi_2S_3 NPs (Eu=1.85%).

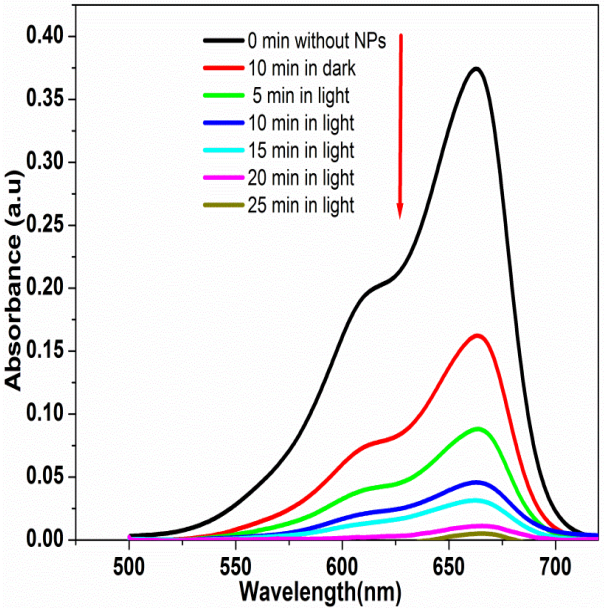


Fig. S13 Time dependent UV-Vis spectral change of MB solution (2× 10^{-5}M) catalyzed by 10 mg Eu doped Bi_2S_3 NPs (Eu=2.32 %).

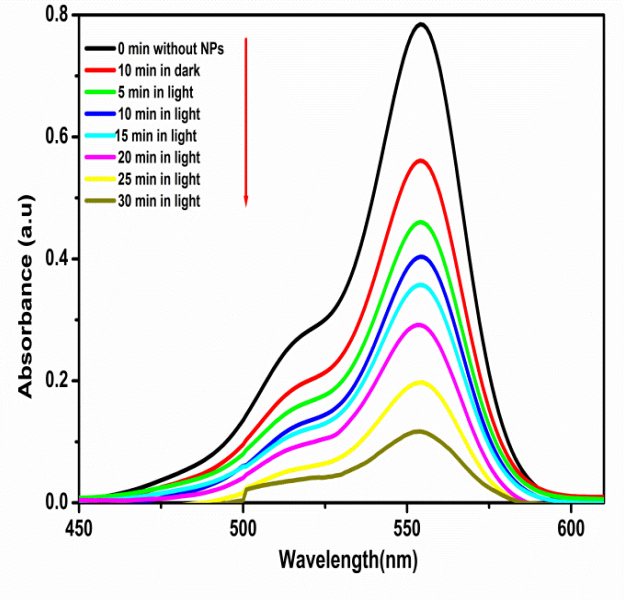


Fig. S14 Time dependent UV-Vis spectral change of Rhodamine B solution (2× 10^{-5}M) catalyzed by 10 mg Eu doped Bi_2S_3 NPs (Eu=4.26 %).

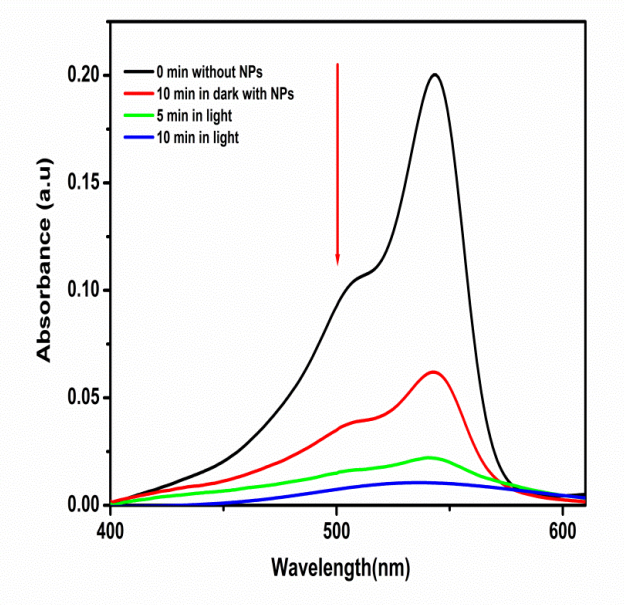


Fig. S15 Time dependent UV-Vis spectral change of Rose bengal solution (2×10^{-5}M) catalyzed by 10 mg Eu doped Bi_2S_3 NPs (Eu=4.26 %).

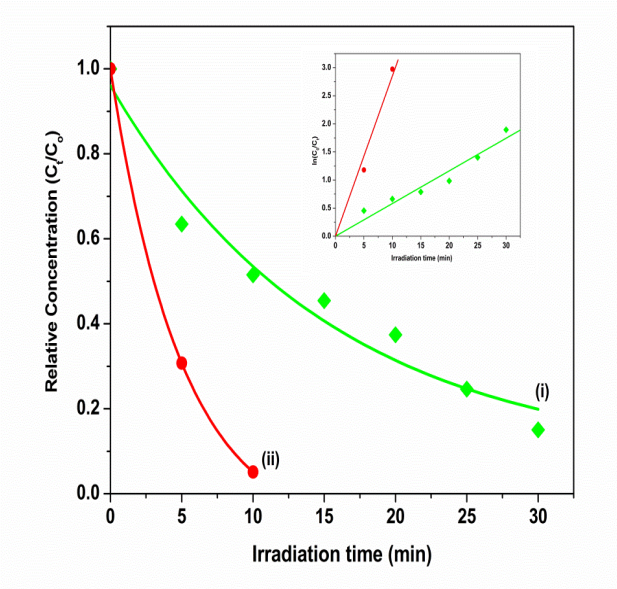


Fig.S16 Relative Concentration (C_t/C_o) vs irradiation time (t) plot of (i) Rose bengal and (ii) Rhodamine B catalyzed by 10 mg Eu doped Bi_2S_3 NPs (Eu=4.26%) under light irradiation. Inset: corresponding kinetic plot.

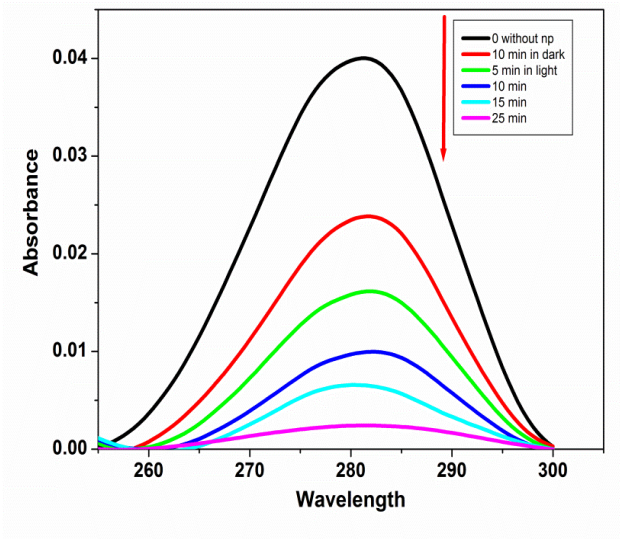


Fig. S17 The time-dependent UV-Vis absorption spectral changes of aqueous 4-Chloro phenol solution (2×10^{-5} M) catalyzed by Eu doped Bi_2S_3 (Eu=4.26%).

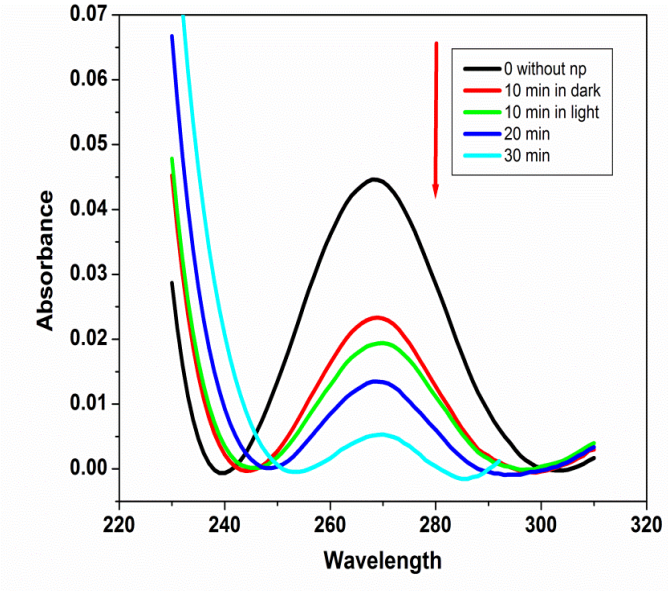


Fig. S18 The time-dependent UV-Vis absorption spectral changes of aqueous Phenol solution (2×10^{-5} M) catalyzed by Eu doped Bi_2S_3 (Eu=4.26%).

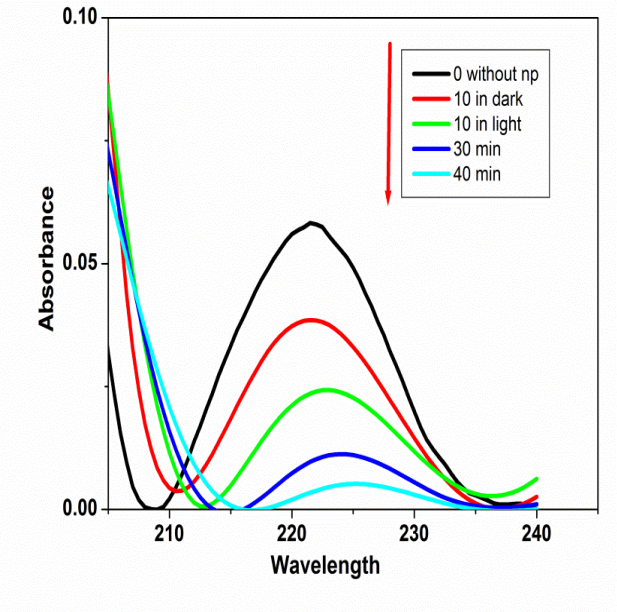


Fig. S19 The time-dependent UV-Vis absorption spectral changes of aqueous p-cresol solution (2×10^{-5} M) catalyzed by Eu doped Bi_2S_3 (Eu=4.26%).

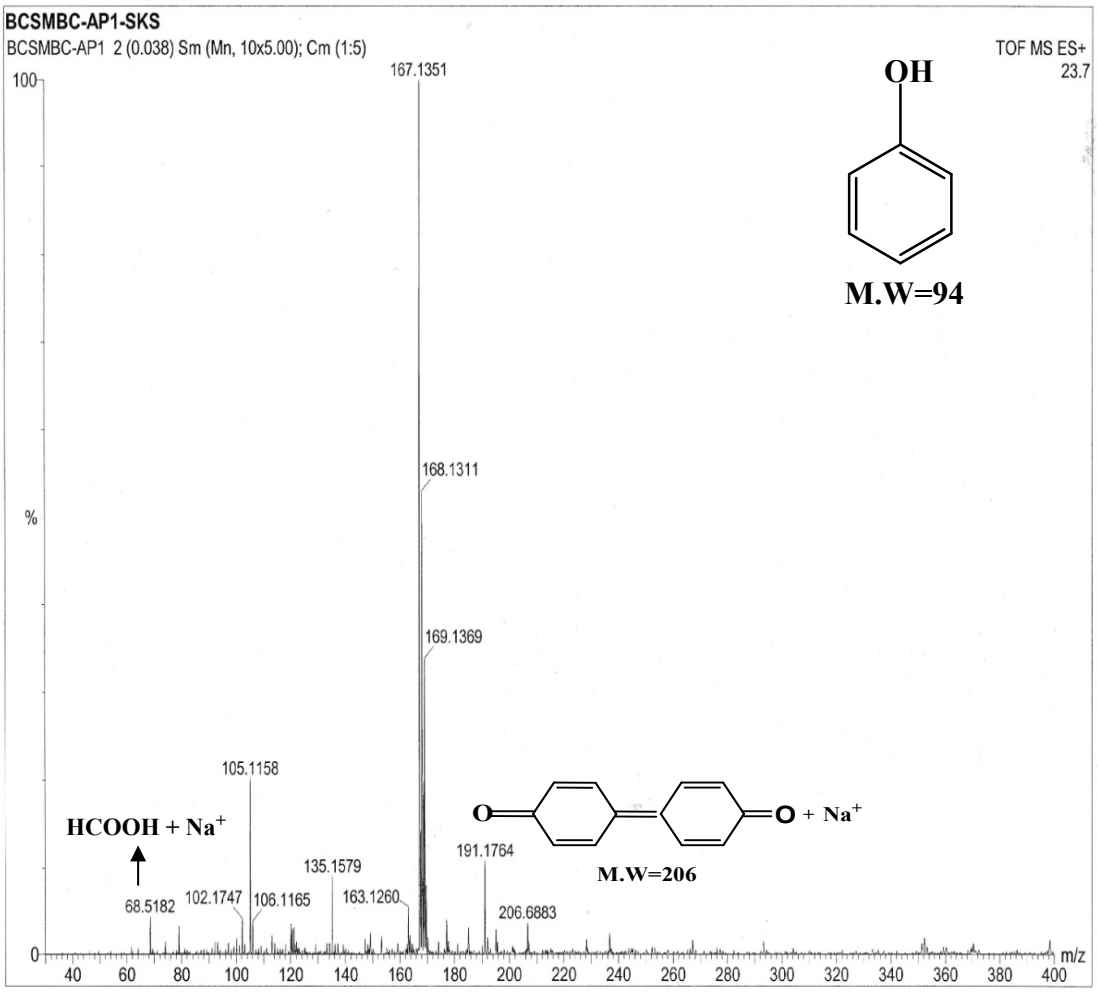


Fig. S20 Mass spectra of aqueous solution of phenol after degradation

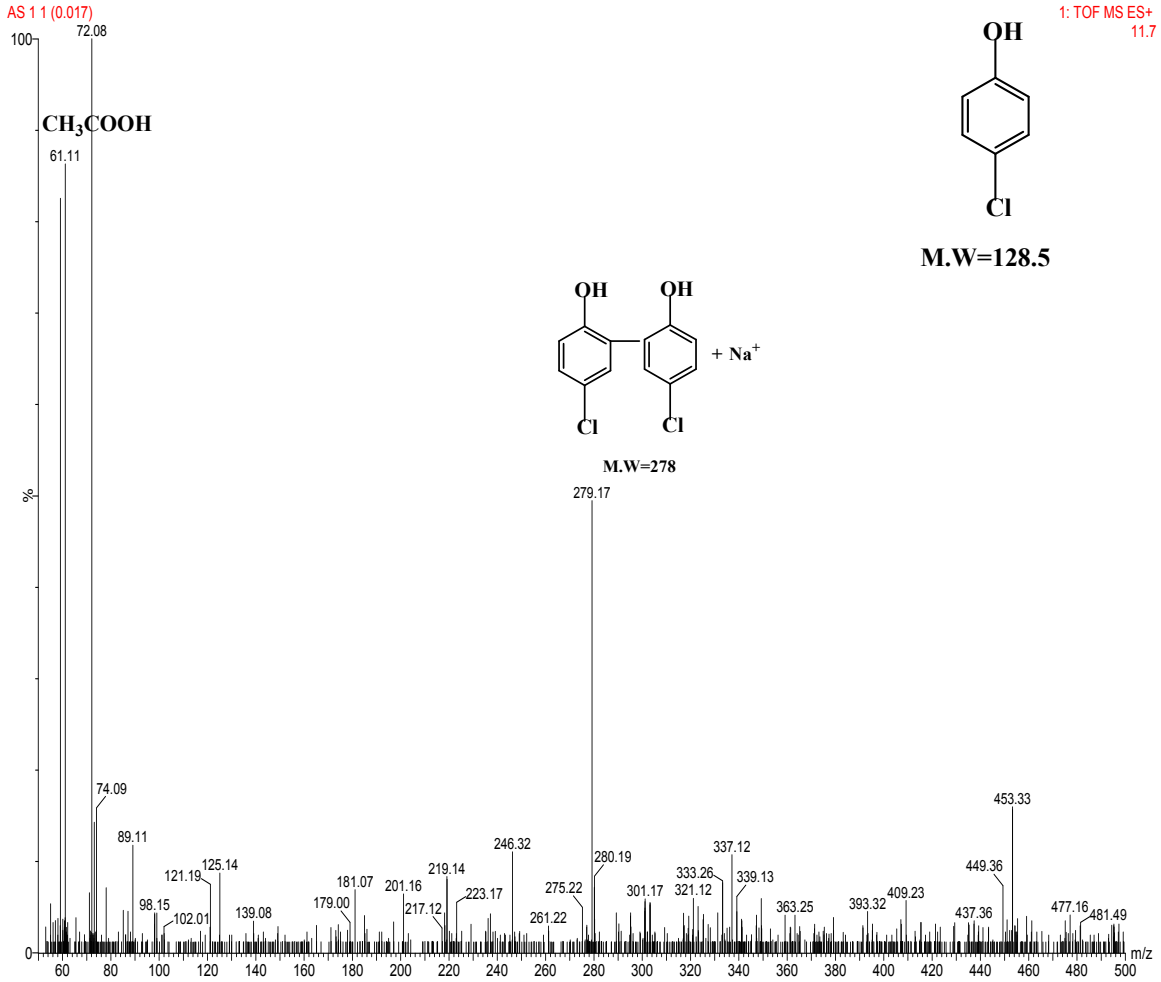


Fig. S21 Mass spectra of aqueous solution of 4-Chloro phenol after degradation

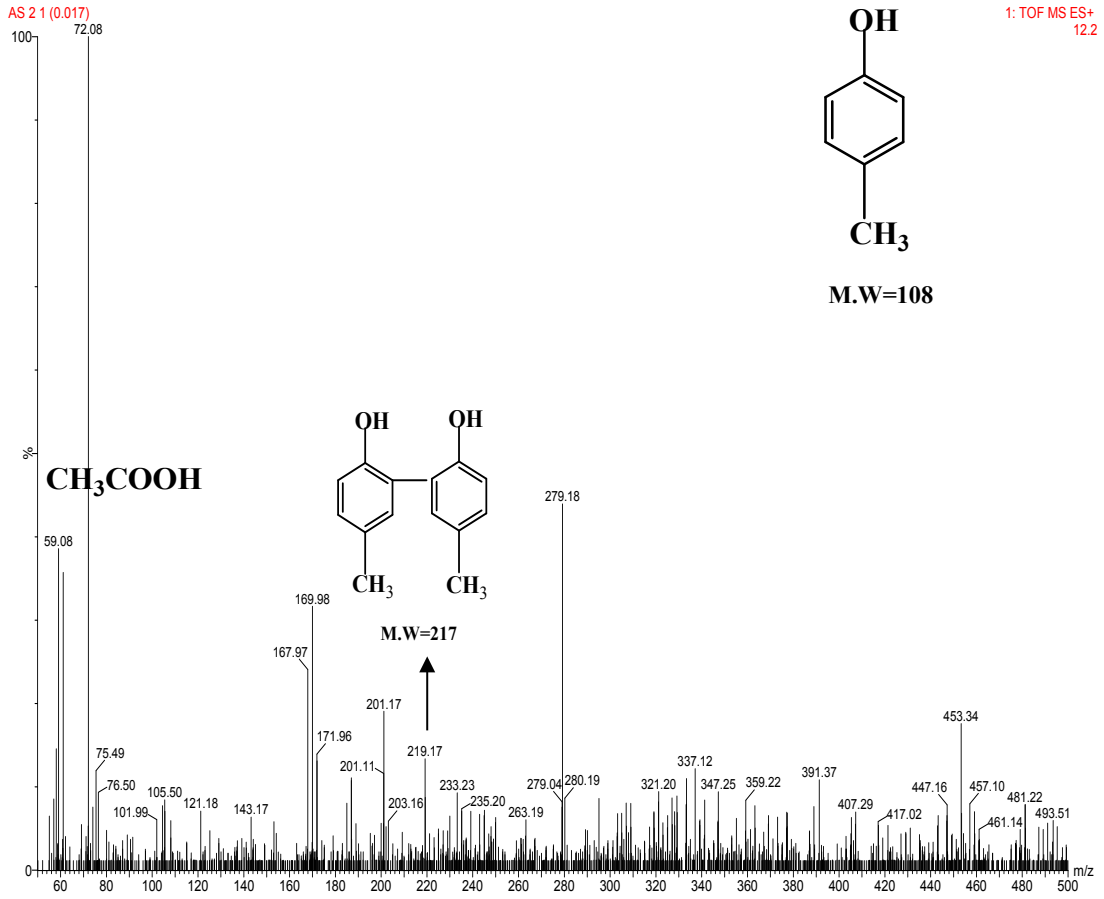


Fig. S22 Mass spectra of aqueous solution of p-cresol after degradation

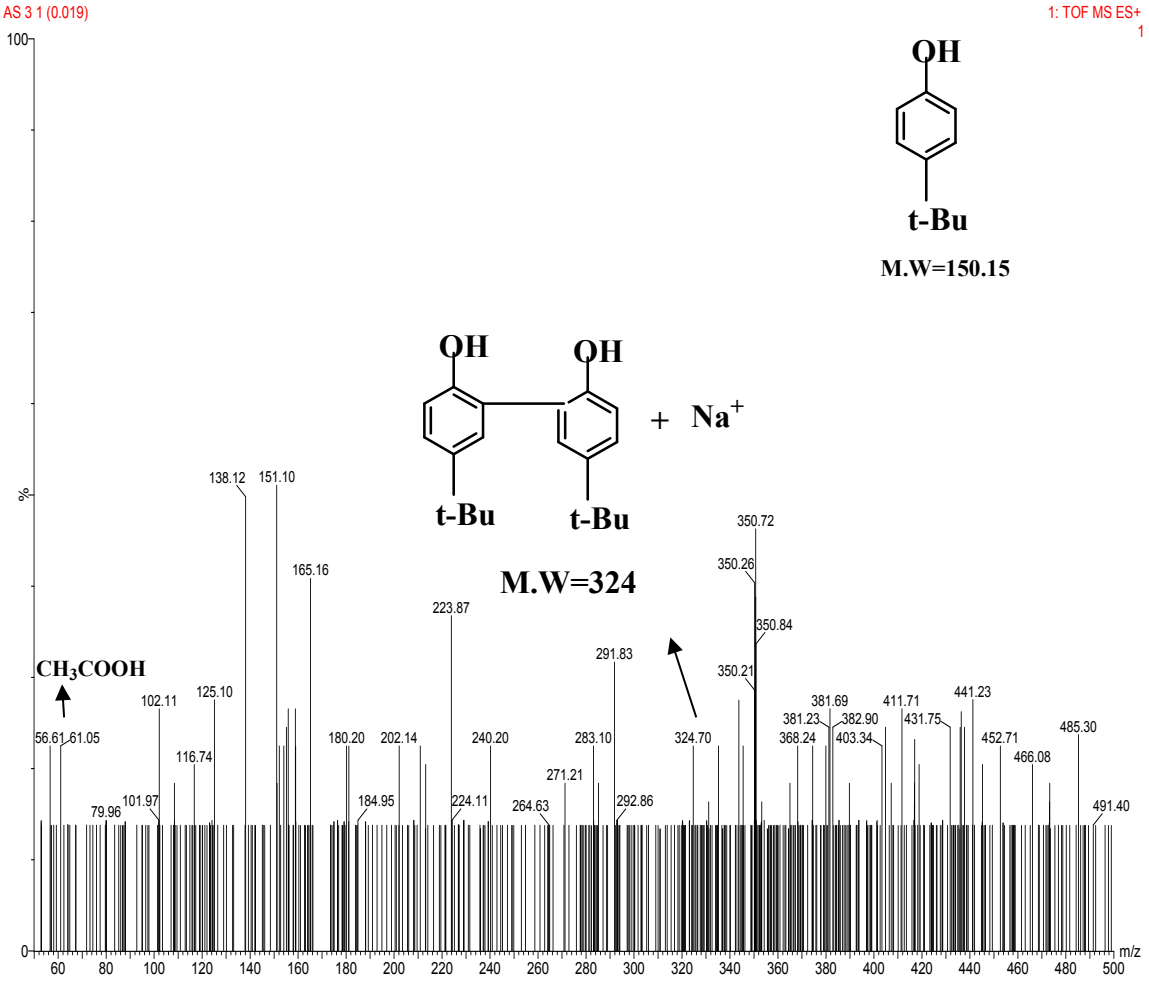


Fig. S23 Mass spectra of aqueous solution of 4-tert-butyl phenol after degradation

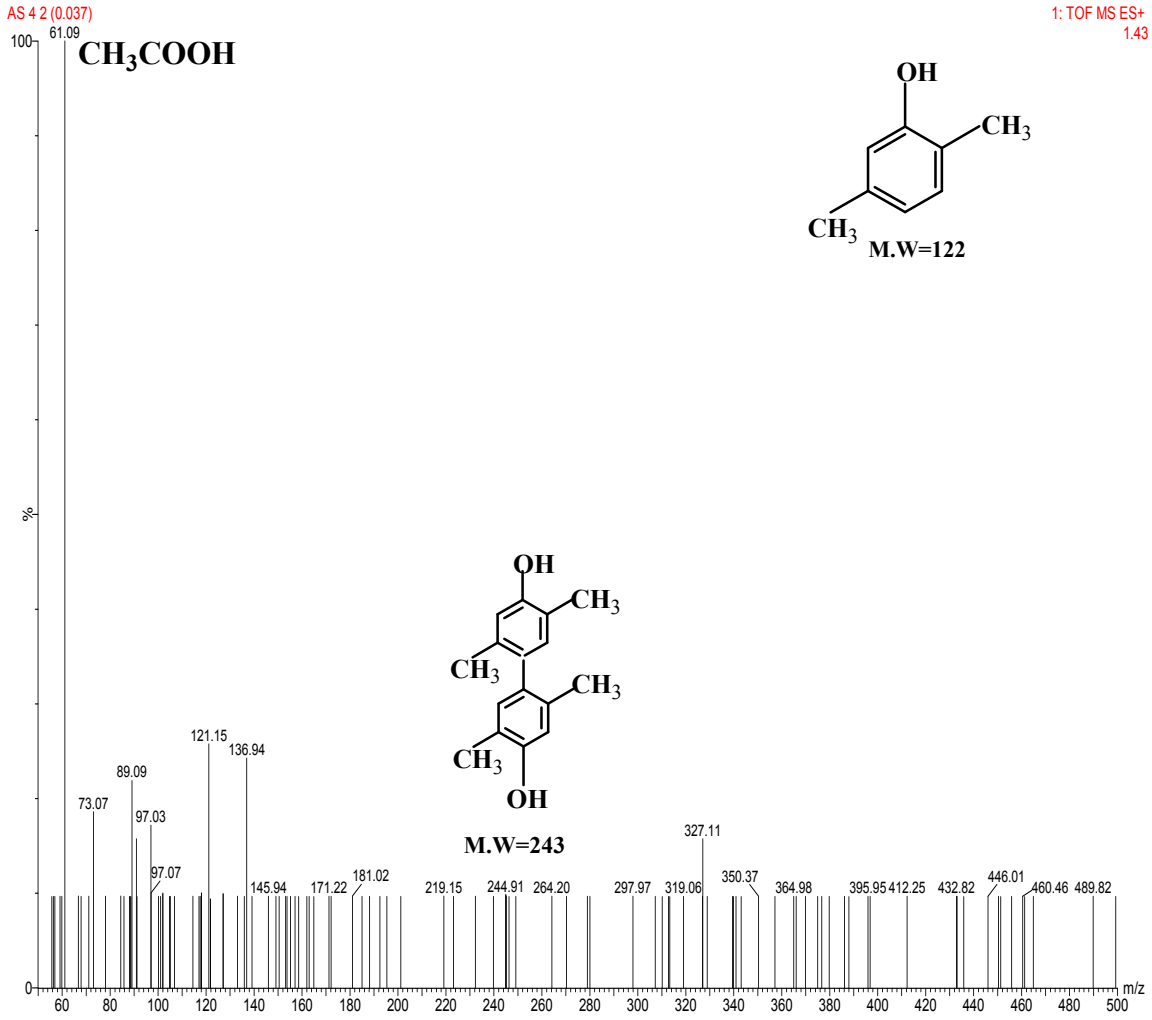


Fig. S24 Mass spectra of aqueous solution of 2,5-dimethyl phenol after degradation

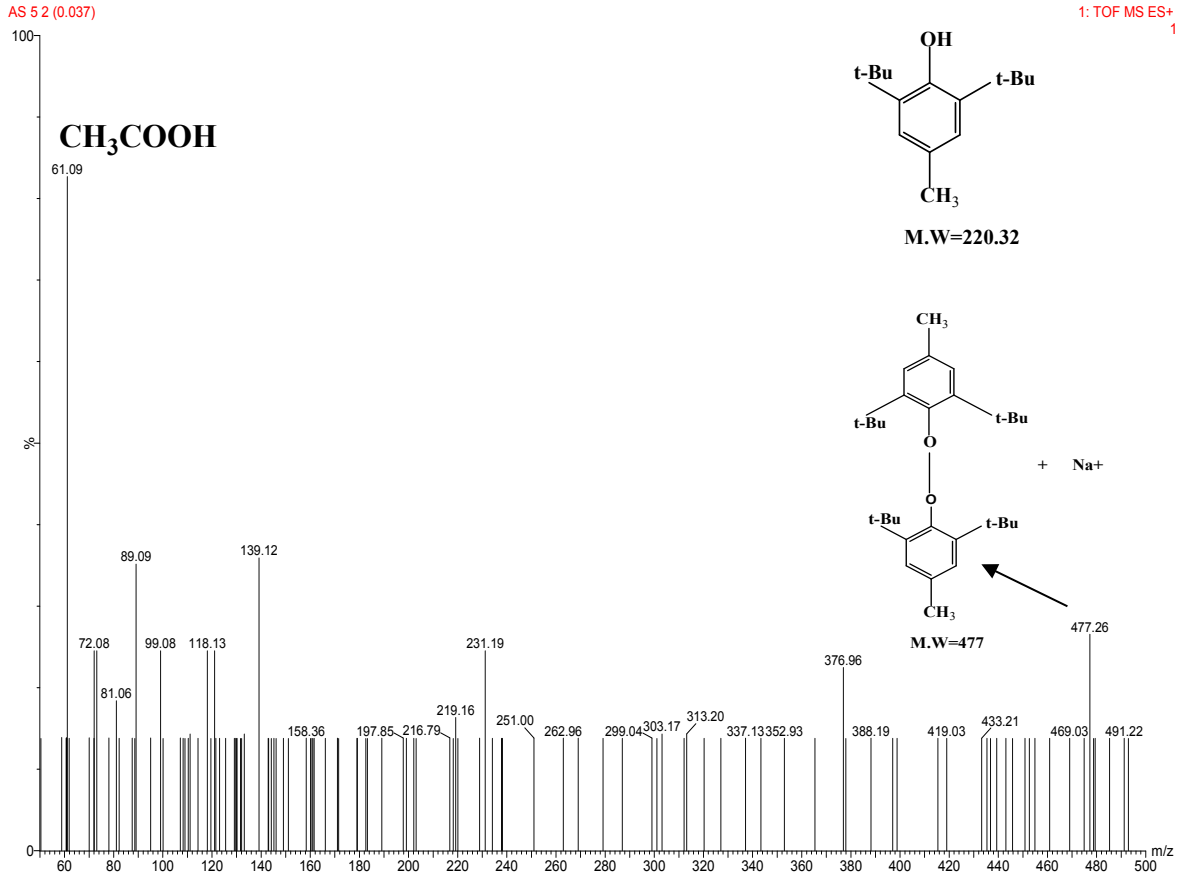


Fig. S25 Mass spectra of aqueous solution of 2,6-di-tert-butyl-p-cresol phenol after degradation.

Table S1. Comparison of the Rate Constants of three different ratios of Eu doped Bi_2S_3, pure Bi_2S_3 and WO_3.

Photocatalyst	Rate constant (k) (min^{-1})(MB)
Pure Bi_2S_3 NPs	3.93×10^{-3}
WO_3	4.12×10^{-3}
Eu doped Bi_2S_3 NPs (Eu=1.85%)	1.17×10^{-1}
Eu doped Bi_2S_3 NPs (Eu=2.32%)	1.50×10^{-1}
Eu doped Bi_2S_3 NPs (Eu=4.26%)	2.62×10^{-1}

Table S2. Comparison of the Rate Constants of Rose bengal and Rhodamine B dyes catalysed by 10 mg of Eu doped Bi_2S_3 (Eu=4.26%).

Photocatalyst	Rate constant (k) (min^{-1})
Eu doped Bi_2S_3 NPs (Eu=4.26%)	5.64×10^{-2} (Rhodamine B)
	2.97×10^{-1} (Rose bengal)

Table S3. Comparison of kinetic parameters in terms of rate constant.

Photocatalyst	Rate constant (k) (min^{-1})
Eu doped Bi_2S_3 (Eu=4.26%)	9.65×10^{-2} (4-Chrolo Phenol)
Eu doped Bi_2S_3 (Eu=4.26%)	7.13×10^{-2} (Phenol)
Eu doped Bi_2S_3 (Eu=4.26%)	6.43×10^{-2} (p-Cresol)
Eu doped Bi_2S_3 (Eu=4.26%)	2.17×10^{-2} (4-tert-butyl phenol)

Table S4. Comparison of the substitution effects of various phenolic compounds using Eu doped Bi_2S_3 (Eu=4.26%) catalyst.

Types of phenol	**End product**	**Dimmerization occur through**
Phenol	Formic Acid	para position
4-Choro Phenol	Acetic Acid	ortho position
p-cresol	Acetic Acid	ortho position
4-tert-butyl phenol	Acetic Acid	ortho position
2,5-dimethyl phenol	Acetic Acid	para position
2,6-di-tert-butyl -p-cresol	Acetic Acid	para position