Supplementary Information

Table 1. Viable cell counts at different time intervals for the experiments under visible light irradiation for all the compounds using standard colony counting method

Time (min)	$BiVO_4$ (10^7) CFU/ml	Composite 1 (10^7) CFU/ml	Composite 2 (10^7) CFU/ml	Composite 3 (10^7) CFU/ml	$MnCo_2O_4$ (10^7) CFU/ml
0	1	1	1	1	1
30	0.77	0.45	0.8	0.44	0.96
60	0.72	0.43	0.62	0.43	0.74
90	0.68	0.31	0.4	0.4	0.49
120	0.66	0.2	0.31	0.2	0.44

Table 2. Viable cell counts at different time intervals for the photolysis (with light and without composite) and dark (without light and with composite 3 or composite 1) experiments under visible light irradiation using standard colony counting method

Time (min)	Photolysis (10^7) CFU/ml	Dark (10^7) CFU/ml
0	1	1
30	0.96	0.98
60	0.94	0.88
90	0.93	0.86
120	0.93	0.8

Table 3. Comparison of photocatalytic activity of various photocatalysts († symbol denoted current study)

Sl. no.	Catalyst	Dosage of catalyst	Microbe/pollutant treated	E_g (eV)	Efficiency	Reference
1.	V_2O_5–g-C_3N_4	1.5 g/l	Direct Red-81	2.69	80% in 120 min	34
2.	$BiVO_4/TiO_2$	0.10 g/l	Methylene blue	2.43	90 in 120 min	28
3.	$BiFeO_3/AgVO_3$	1.0 g/l	Rhodamine B	2.40	>95% in 90 min	35
4.	Ag/TiO_2	0.1–2.0 g/l	*Escherichia coli*	3.10	6 log CFU units decrease in 30 min	2
5.	g-C_3N_4	50 mg/100 ml	*Escherichia coli*	–	~100% in 360 min	25
6.	$BiVO_4$	80 ppm	*Escherichia coli*	2.42	96% in 120 min	4
7.	TiO_2	0.25 g/l	*Escherichia coli*	3.02	7-log reduction in 60 min	19
8.	$BiVO_4/MnCo_2O_4$	0.05 g/100 ml	*Escherichia coli*	2.36	80% in 120 min	†

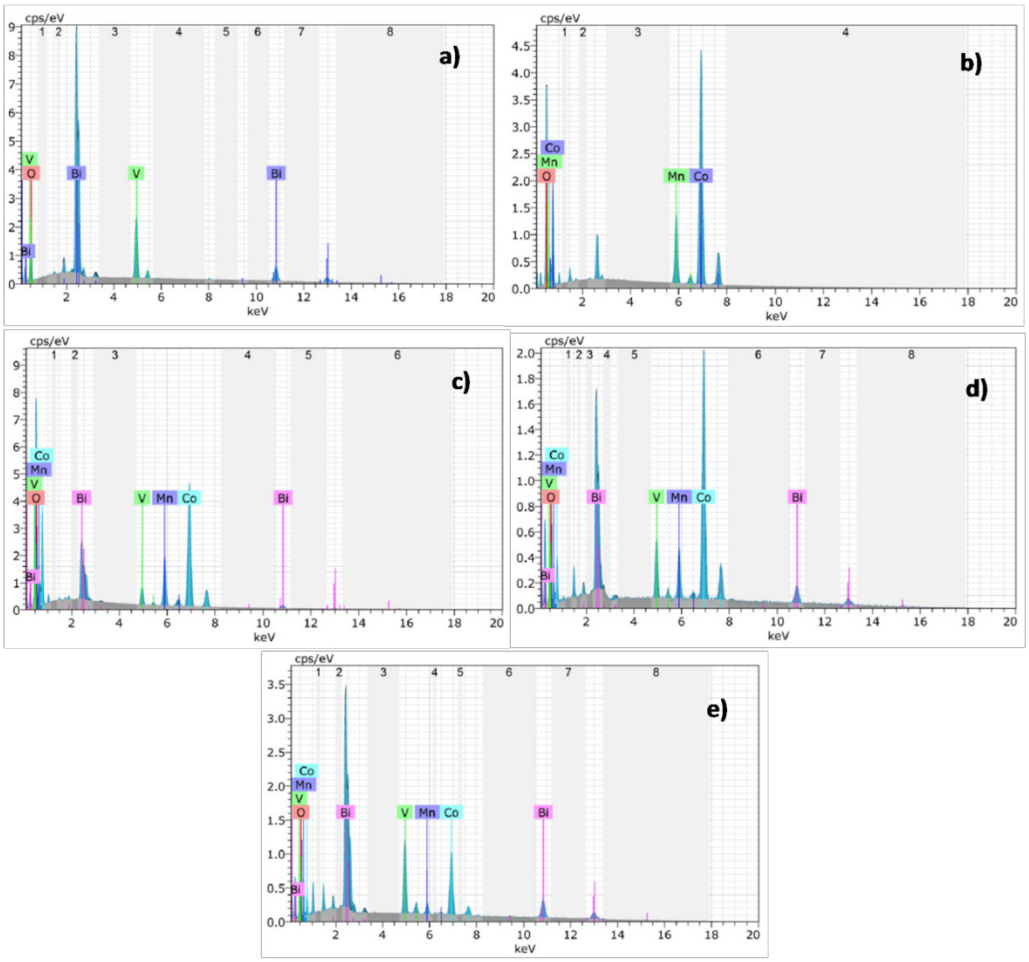

Figure 1. EDS spectra of all the as-prepared powder samples. (***a***) $BiVO_4$, (***b***) Composite 1, (***c***) Composite 2, (***d***) Composite 3 and (***e***) $MnCo_2O_4$.

Preparation of $BiVO_4$

0.1 mmol of $Bi(NO_3)_3{\cdot}5H_2O$ and 0.1 mmol of NH_4VO_3 precursors were taken in a 25 ml clean and dry Teflon container along with 15 ml of double distilled water. This mixture was stirred for thirty minutes in a magnetic stirrer at 50°C and the pH was 7. The Teflon container was transferred to a stainless-steel autoclave and sealed tightly. This assembly was heated at 180 °C for six hours and the $BiVO_4$ powder was produced[17]. The final product was centrifuged for separation and washed several times using double distilled water and dried around 70°C for overnight.

Preparation of $MnCo_2O_4$

0.2 mmol of $MnCl_2{\cdot}4H_2O$ and 0.4 mmol of $CoCl_2{\cdot}6H_2O$ were taken along with 50 ml double distilled water and stirred for 30 min at room temperature. To this mixture, 0.2 M NaOH was added dropwise with continuous stirring to form a clear suspension and further, 0.1 M ascorbic acid was added. This mixture was heated at 70°C for one hour. Finally, the precipitate formed was centrifuged and washed several times with double distilled water and ethanol. The precipitate was dried at room temperature and calcined at 450°C for two hours. Finally, $MnCo_2O_4$ was obtained as a black color powder[18].

Preparation of $BiVO_4/MnCo_2O_4$ composites

$BiVO_4/MnCo_2O_4$ composites were prepared by mixing different weight ratios of $BiVO_4$ and $MnCo_2O_4$ powders and ground for thirty minutes in an agate mortar where acetone was used as a mixing medium. This mixture was heated at 200°C for 3 h in a furnace atmosphere. Thus, three different compositions namely, 25 wt% $BiVO_4$ + 75 wt% $MnCo_2O_4$ (mixed 0.125 g of $BiVO_4$ and 0.375 g of $MnCo_2O_4$ and heated), 50 wt% $BiVO_4$ + 50 wt% $MnCo_2O_4$ (mixed 0.25 g of $BiVO_4$ and 0.25 g of $MnCo_2O_4$ and heated) and 75 wt% $BiVO_4$ + 25 wt% $MnCo_2O_4$ (mixed 0.375 g of $BiVO_4$ and 0.125 g of $NiFe_2O_4$ and heated) were prepared by solid state reactions. The heating rate was kept as 5°C/min and the cooling rate was kept as 2°C/min for all the reactions.