Electronic Supplementary Information (ESI) for

Co^{2+} substituted for Bi^{3+} in $BiVO_4$ and its enhanced photocatalytic activity under visible LED light irradiation

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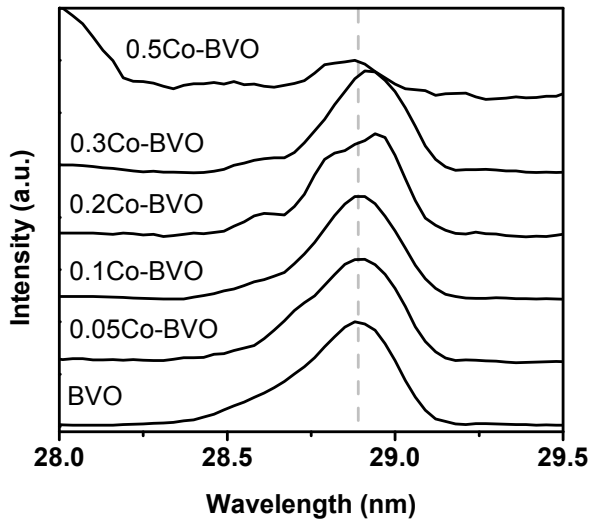


Fig. S1. XRD patterns of the pristine BiVO4 and Co-doped $BiVO_4$ samples.

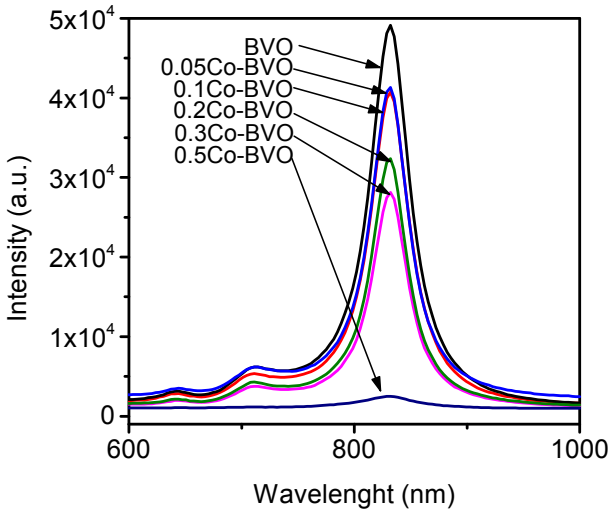


Fig. S2. Raman spectra of the pristine $BiVO_4$ and Co-doped $BiVO_4$ samples.

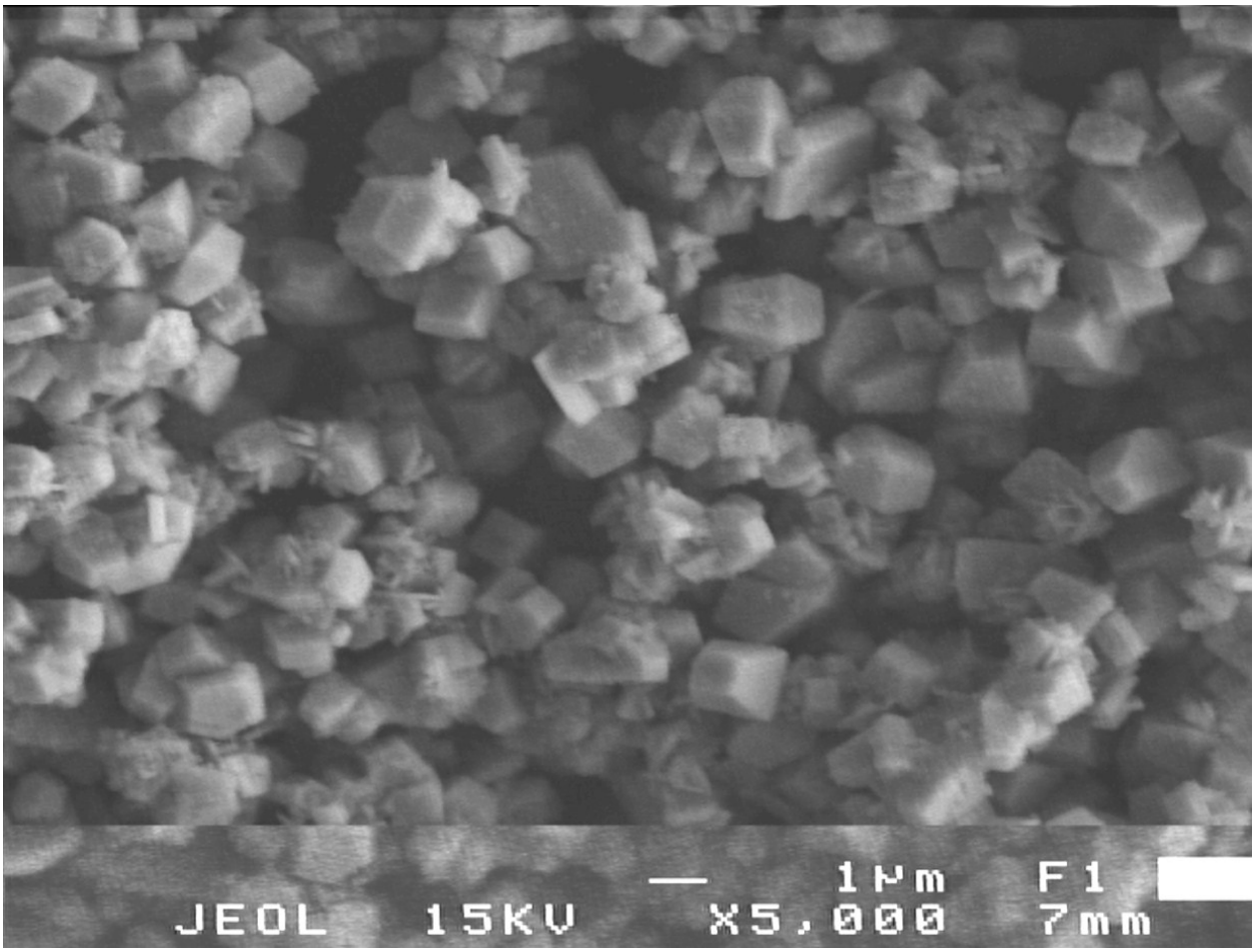


Fig. S3(A). SEM images of the 0.05Co-BVO sample.

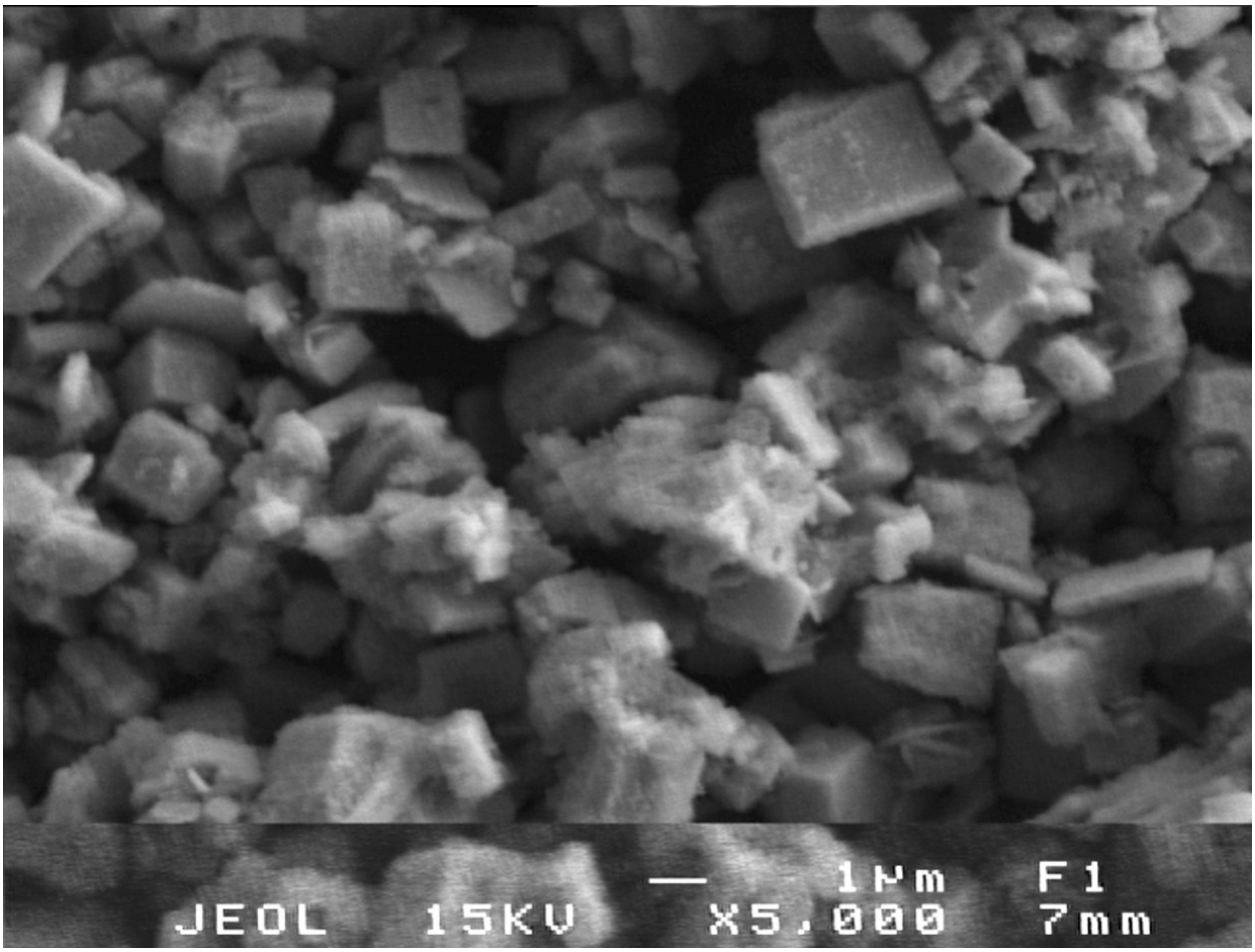


Fig. S3(B). SEM images of the 0.1Co-BVO sample.

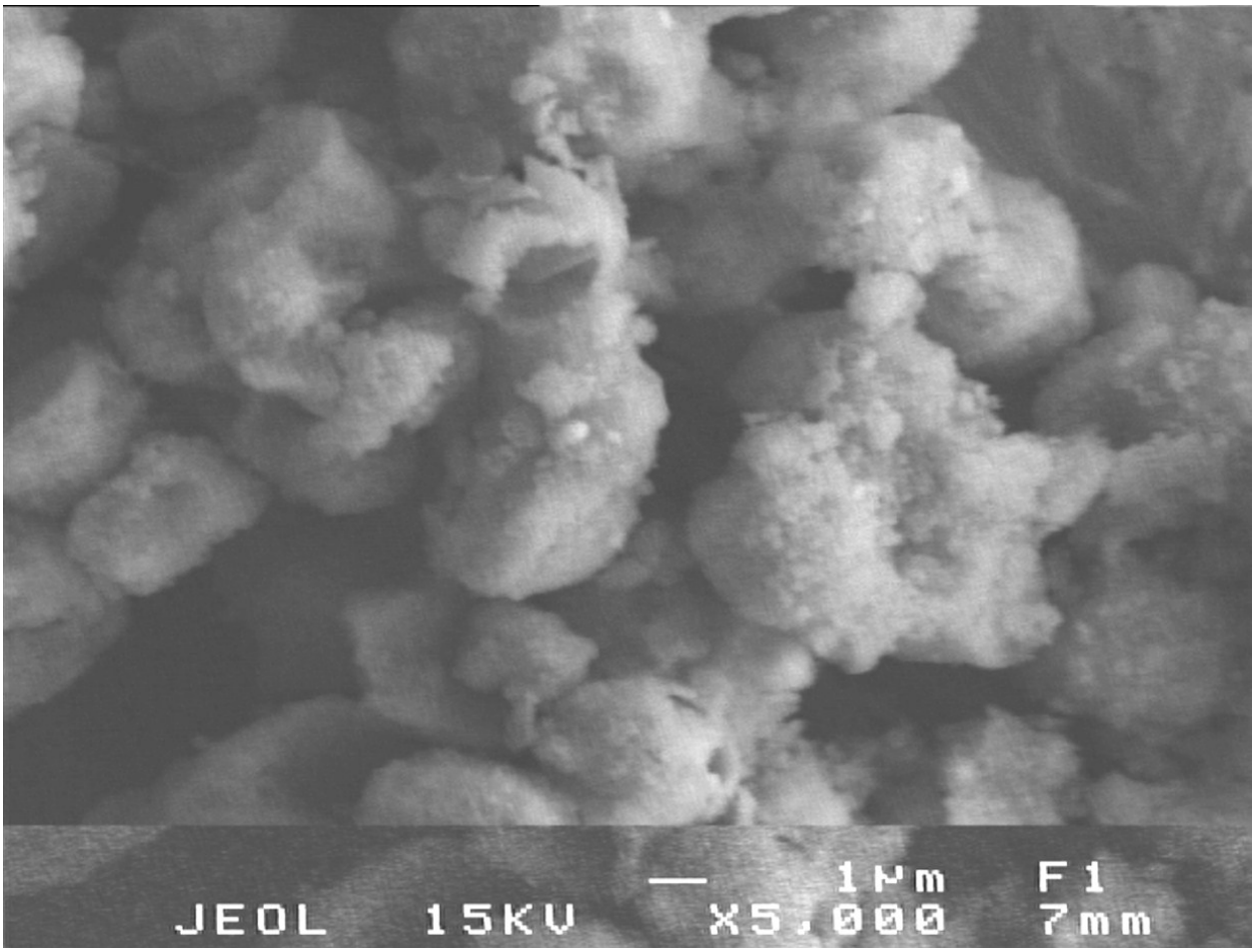


Fig. S3(C). SEM images of the 0.3Co-BVO sample.

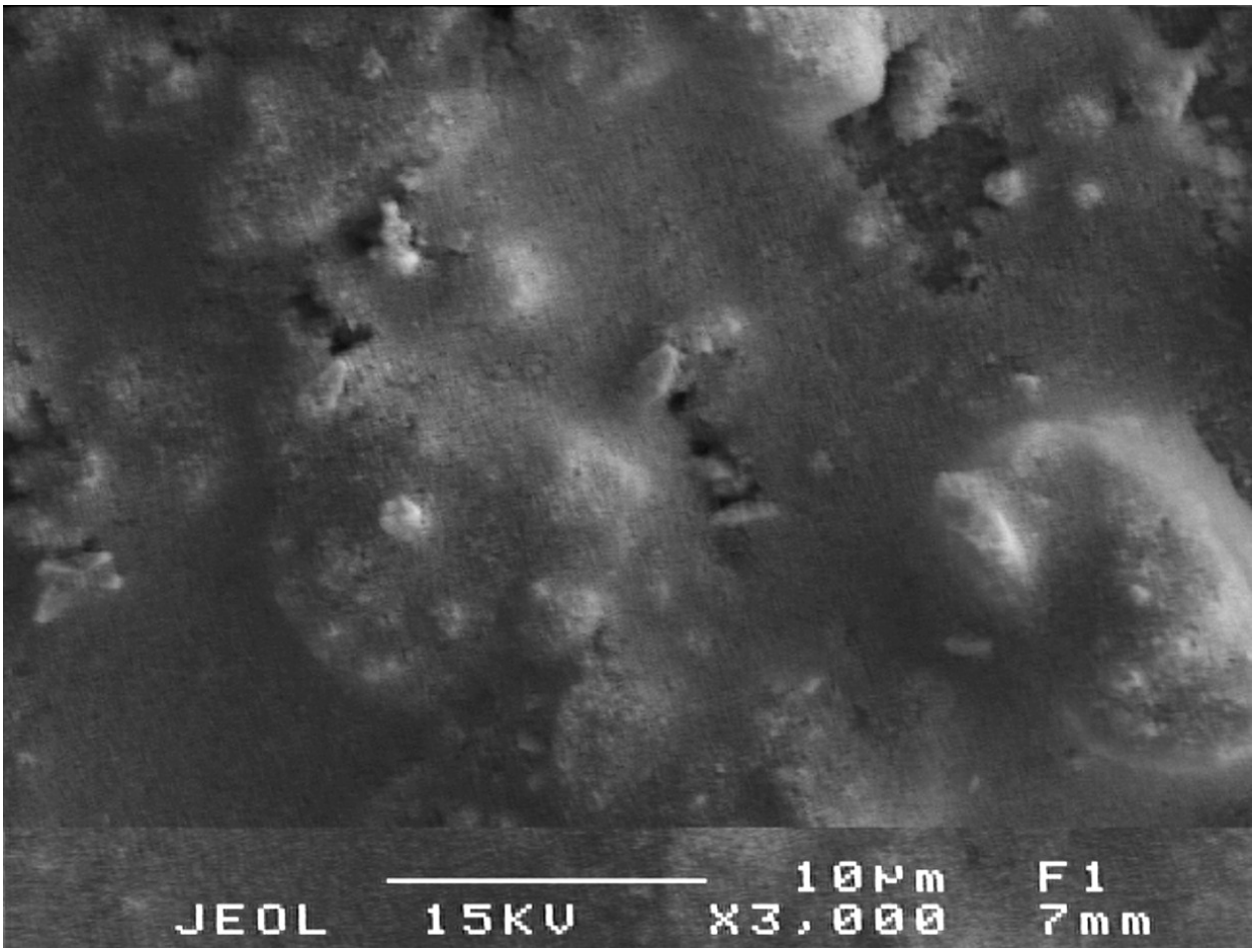
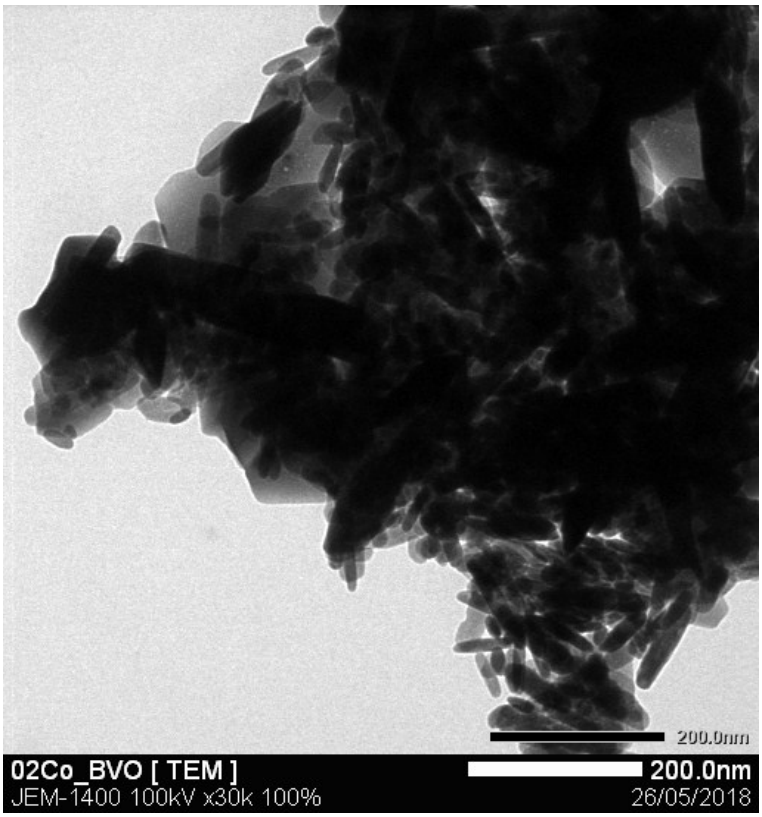


Fig. S3(D). SEM images of the 0.5Co-BVO sample.



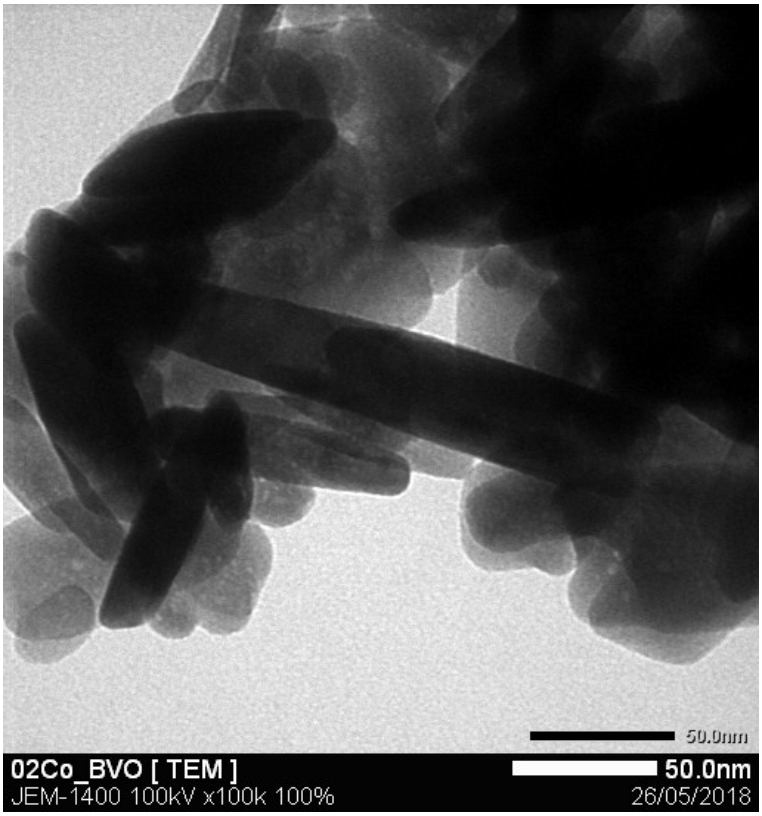


Fig. S4. TEM images of the 0.2Co-BVO sample.

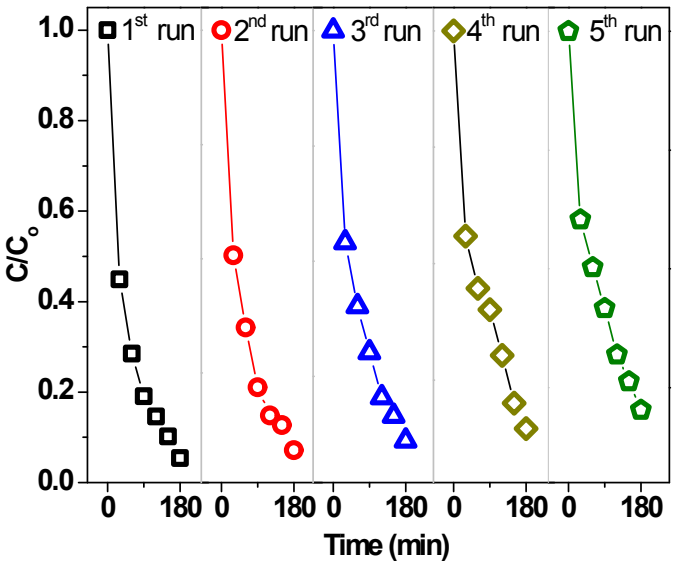


Fig. S5. Photo-stability tests over 0.2Co- $BiVO_4$ for the cycling photodegradation of MB.

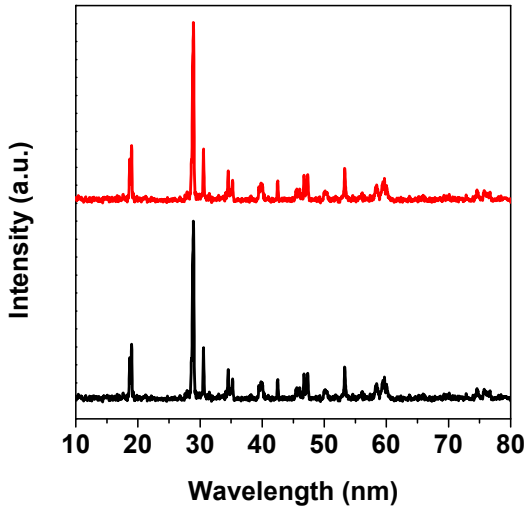


Fig. S6. XRD patterns of 0.2Co-BVO catalyst before/after five runs

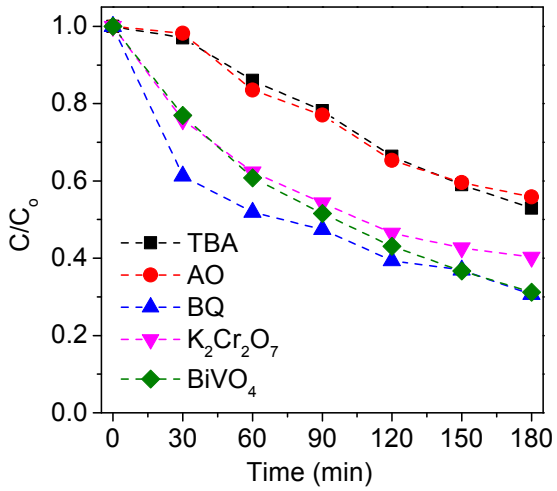


Fig. S7. Trapping experiments of photocatalytic degradation of MB over $BiVO_4$ with the presence of scavengers: TBA (a), AO (b), BQ (c) and $K_2Cr_2O_7$ (d), and without the presence of scavenger (e).

Table S1. A comparison of photocatalytic activity of photocatalysts.

No.	Catalyst	MB volume and concentration	Light source	t[a]	H[b]	k_{app}[c]	Reff.
1	$CeO_2/BiVO_4$ composite	~50 µM	Simulated solar illumination (100 mW cm^{-2}).	6h	-	~1.2 (h^{-1})	[1]
2	$TiO_2/BiVO_4$ composite	~50 µM	Simulated solar illumination (100 mW cm^{-2}).	6h	-	~1.1 (h^{-1})	[1]
3	$WO_3/BiVO_4$ composite	~50 µM	Simulated solar illumination (100 mW cm^{-2}).	6h	-	~0.8 (h^{-1})	[1]
4	Monoclinic $BiVO_4$ powders	100 mL, 20 mgL^{-1}	A300 W tungsten halogen lamp and a 420- nm cutoff filter	3h	96%	-	[2]
5	Monoclinic $BiVO_4$	50 ml, 10^{-5} M	Simulated visible light	240 min	62%	-	[3]
6	Composite-phase $BiVO_4$ (scheelite-tetragonal and scheelite-monoclinic)	250 mL, 10 mgL^{-1}	A 500-W Xe lamp with a 420 nm cutoff filte	120 min	95%	-	[4]
7	Cobalt-doped $BiVO_4$ (Co-$BiVO_4$)	100 mL, 10 mgL^{-1}	A 150-W Xe lamp with a 420 nm cutoff filter	5 h	85%	-	[5]
8	Yb^{+3}, Er^{+3}, and Tm^{+3} doped $BiVO_4$ (with 6:3:3 mole percentage of Yb^{+3}: Er^{+3}: Tm^{+3})	70 mL, 20 ppm	A 100 W infrared lamp (NIR light source)	480 min	74.4 %	0.00276 min^{-1}	[6]
9	Yb^{+3}, Er^{+3}, and Tm^{+3} doped $BiVO_4$ (with 6:3:3 mole percentage of Yb^{+3}: Er^{+3}: Tm^{+3})	70 mL, 20 ppm	UV cut off solar light simulator (visible light source)	180 min	92.98%	0.013 min^{-1}	[6]
10	Yttrium-doped $BiVO_4$ (3% at)	250 mL, 10 ppm	A Hg-Xe lamp of 200 W	120 min	100%	4. 10^{-4} s^{-1}	[7]
11	Yb^{3+}, Er^{3+}-codoped $BiVO_4$ with an Er^{3+} to Yb^{3+} ratio of 1:4.	150 mL, 10 ppm	An Hg−Xe lamp of 250 W	120 min	100%	12.10^{-4} s^{-1}	[8]
12	Er-doped $BiVO_4$ (3 at%)	50 mL, 10 mg L^{-1}	a 150 W Xe lamp	120 min	100%	6.10^{-4} s^{-1}	[9]
13	Tb^{3+} doped $BiVO_4$ (2	300 mL	A 500 W xenon	120	99.9%		[10]

	at%)	ofMB (10 mg/L	lamp	min			
14	PPy/Bi_2WO_6 (PPy 0.5 wt%) composites (shown	100 mL, 10^{-5} mol/L	A 500 W Xe lamp with a UV cut-off filter (420 nm)	30 min	100%		[11]
15	Poly-o-phenylenediamine modified TiO_2 nanocomposites	30 ml, 40 mg/L	A 1000 W xenon lamp	180 min	-	0.0033 min^{-1}	[12]
16	SiO_2@α-Fe_2O_3 Nanocomposites Deposited on SnS_2Flowers	100 mL, 5 ppm	A 410 nm LED light	100 min	96%	-	[13]
17	Monoclinic $BiVO_4$	100 mL, 15 $mg.L^{-1}$	Six LED lamps (XLamp XT-E White, Cree X6) with the max power of 10 W and max light output of 1040 lm	180 min	72%	0.633 (10^{-3}.min^{-1})	This study
18	0.2Co-BVO	100 mL, 15 $mg.L^{-1}$	Six LED lamps (XLamp XT-E White, Cree X6) with the max power of 10 W and max light output of 1040 lm	180 min	98%	1.882 (10^{-3}.min^{-1})	This study
[a]Time of irradiation [b]The degradation rate [c]Apparent first-order rate constants of MB degradation							

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