Support information

A $BiVO_4$/UU-200 Heterojunction for Efficient Visible-Light Photocatalytic Degradation of Rhodamine B

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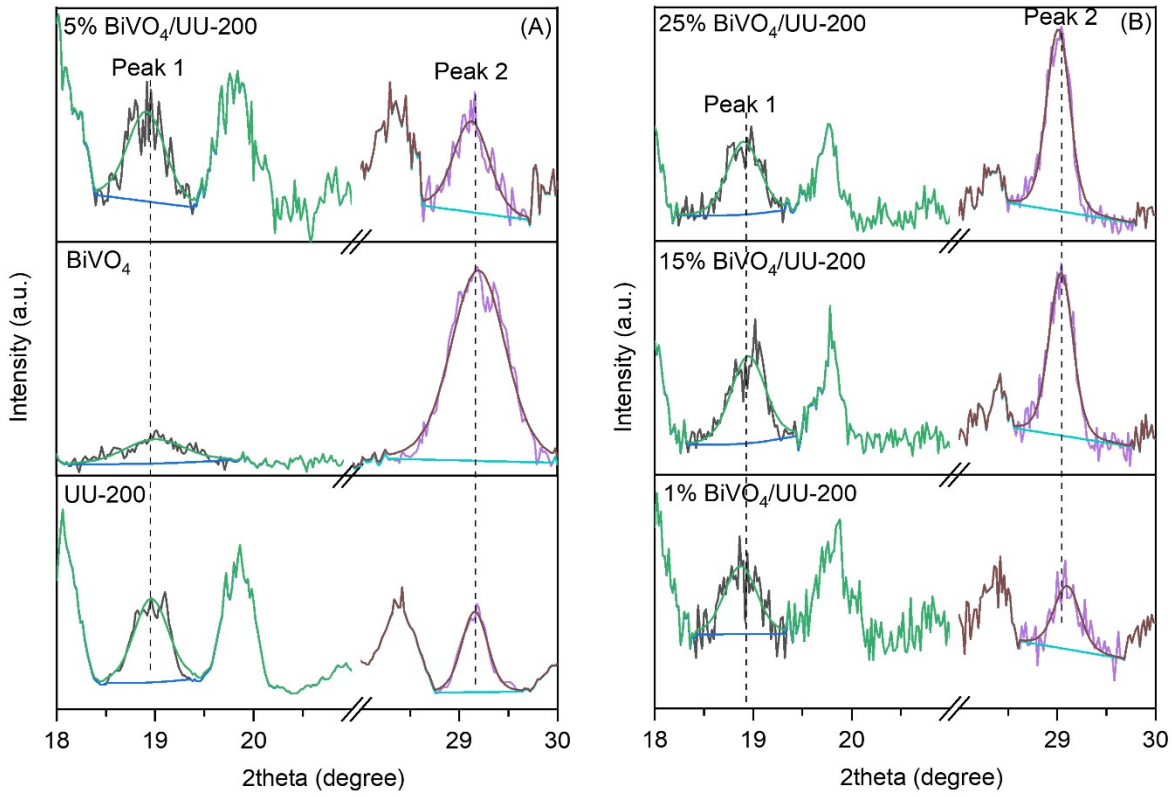


Figure S1. The magnified part of XRD data from 18° to 30° and the deconvolution of the XRD data

Table S1: The weight crystalline fractions of the prepared materials

Samples		Peak		Peak2/Peak1 ratio
		1	2	
UU-200	Position (degree)	18.96	29.16	0.725
	Area	20.040	14.536	
	FWHM	0.414	0.311	
$BiVO_4$	Position (degree)	19.16	29.23	7.044
	Area	13.043	91.878	
	FWHM	0.697	0.624	
1% $BiVO_4$/UU-200	Position (degree)	18.87	29.10	0.736
	Area	32.232	23.722	
	FWHM	0.392	0.310	
5% $BiVO_4$/UU-200	Position (degree)	18.91	29.13	0.957
	Area	13.732	13.149	
	FWHM	0.453	0.428	
15% $BiVO_4$/UU-200	Position (degree)	18.95	29.04	1.280
	Area	64.761	82.867	
	FWHM	0.417	0.285	
25% $BiVO_4$/UU-200	Position (degree)	18.90	29.01	1.753
	Area	55.841	97.902	
	FWHM	0.396	0.279	

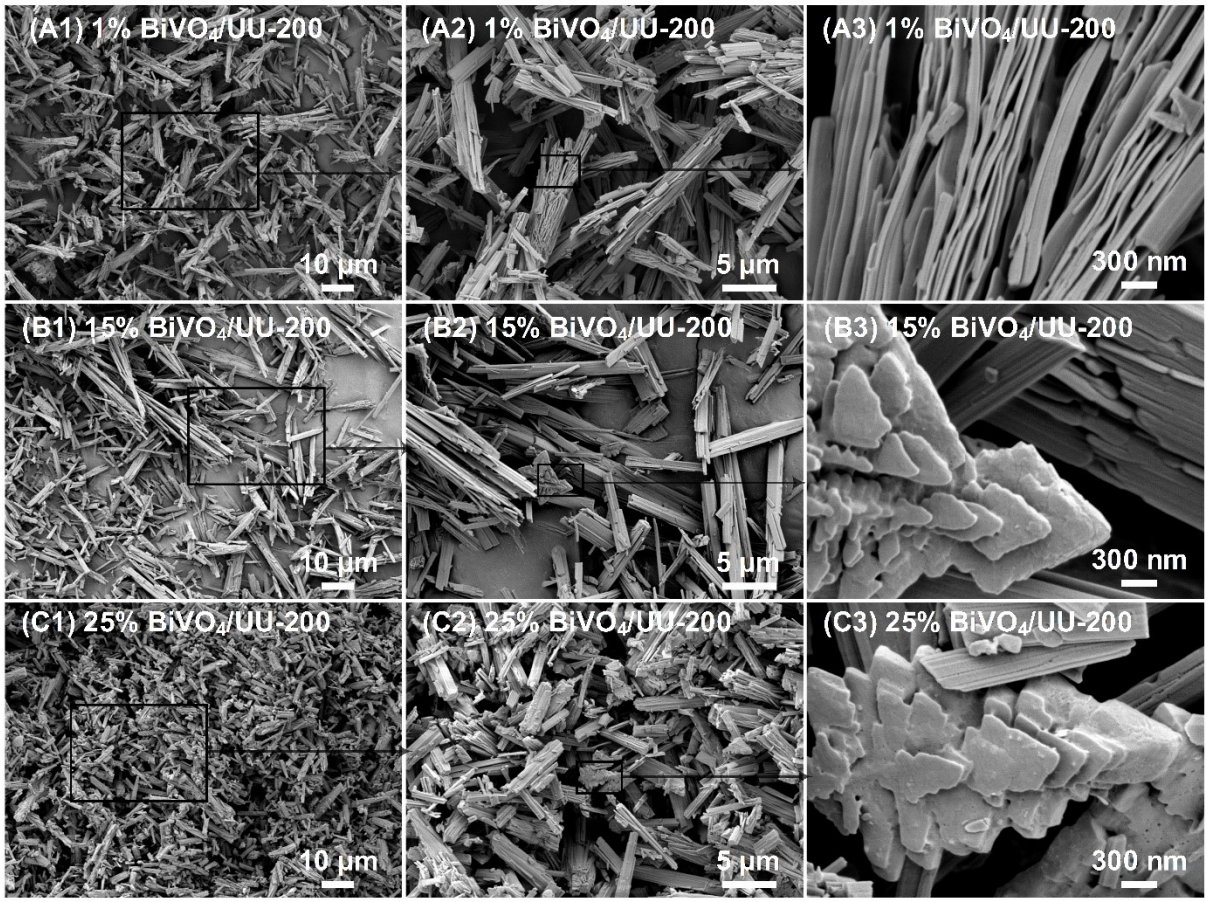


Figure S2. SEM images of 1% $BiVO_4$/UU-200 (A1–A3), 15% $BiVO_4$/UU-200 (B1–B3), and 25% $BiVO_4$/UU-200 (C1–C3)

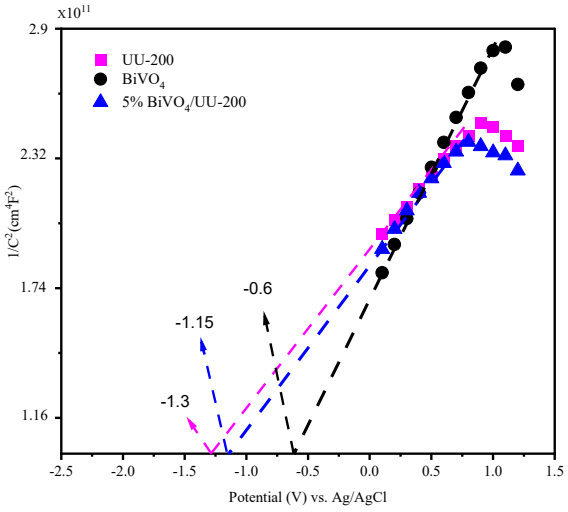


Figure S3. Mott−Schottky plots of BiVO4, UU-200 and 5% BiVO4/UU-200 composite.

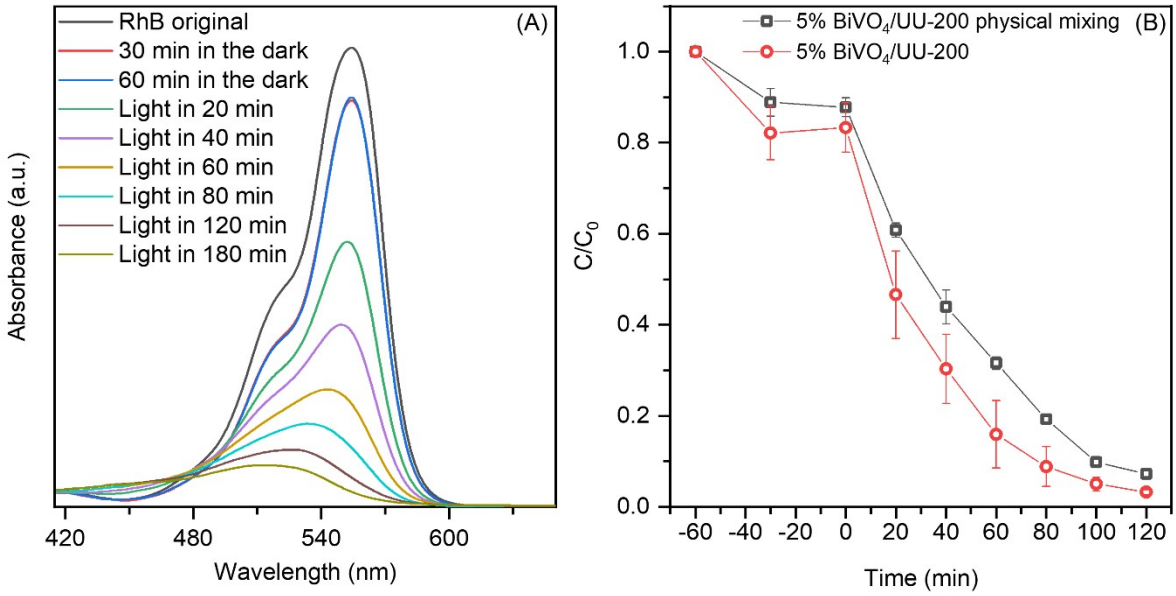
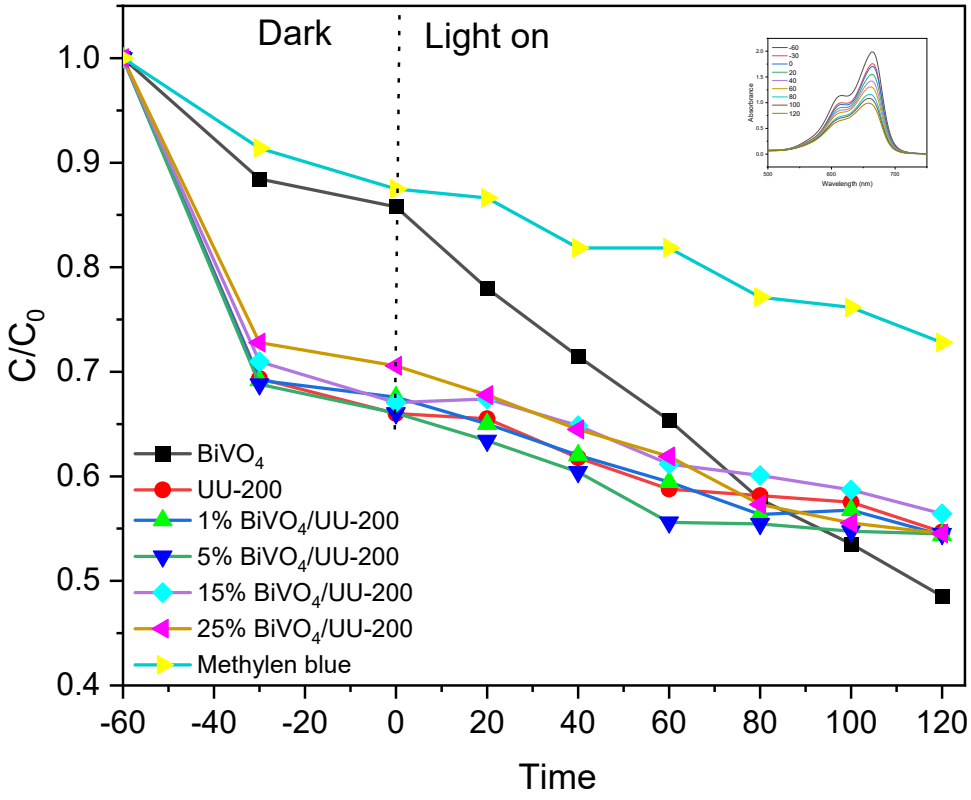


Figure S4. (A) Time courses of UV−vis absorption spectra of RhB over 5% $BiVO_4$/UU-200; (B) Time courses of photocatalytic degradation of RhB over 5% $BiVO_4$/UU-200 composites and 5% $BiVO_4$/UU-200 physical mixing.



Figsure S5. Photocatalytic degradation of Methylene Blue over $BiVO_4$/UU-200 composites under dark and light irradiation.

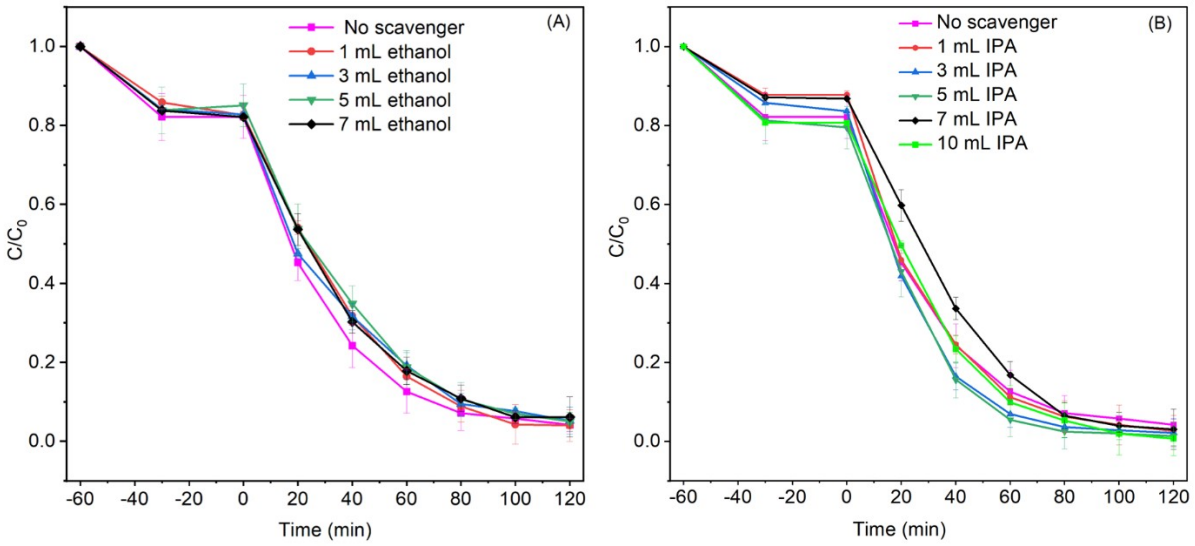


Figure S6. The effect of ethanol (A) and isopropanol (B) as •OH scavengers on the degradation of RhB over the 5% $BiVO_4$/UU-200 photocatalyst.

Table S2. Comparison of photodegradation performances of Bi-MOF-based composite photocatalysts

Photocatalysts	Contaminant	Light sources	Dosage ($g \cdot L^{-1}$)	C_0 ($mg \cdot L^{-1}$)	Time (min)	Degradation rates (%)	Ref.
$BiVO_4$/UU-200	RhB	40 W LED	0.1	15	120	96.8	This work
BiBDC/$BiVO_4$	TC	300 W Xenon	0.2	10	30	96.2	(Zhang et al., 2023)
$BiVO_4$/CAU-17	RhB	300 W Xenon	1.0	10	60	99.3	(Zhou et al., 2024

							)
BiOCl/CAU-17	RhB	40 W LED	0.15	15	60	96.0	(Nguyen et al., 2024)
Bi_2WO_6/CAU-17	RhB	500 W Xenon	0.4	10	60	80	(Yang et al., 2021)
Bi-MOF/BiOI	TC	Xenon	1.0	40	60	77	(Dai et al., 2023)
BiOCl@Bi–MOF	CTC	300 W Xenon	0.5	50	90	75.8	(Zhang et al., 2022)
BiOBr/CAU-17	RhB	500 W Xenon	0.2	20	50	85.7	(Zhu et al., 2017)

Table S3. Control experiments for photodegradation of RhB over the as-synthesized samples. C and C_0 (in units of mol/L) denote the respective concentrations of RhB dye at time points t and 0, where t represents the current time, and 0 denotes the initial time. σ is the standard deviation calculated from 3 samples.

Sample	Time [min]	$C/C_0 \pm \sigma$	$-\ln(C/C_0)^{(a)}$	Sample	Time [min]	$C/C_0 \pm \sigma$	$-\ln(C/C_0)^{(a)}$
No catalyst	-60	1±0	--	BiVO4	-60	1±0	--
	-30	0.99438±0.00197	--		-30	0.96985±0.00658	--
	0	0.99392±0.00226	0		0	0.96439±0.000560367	0
	20	0.99252±0.00378	8.56773E-4		20	0.96034±0.00785	0.00866
	40	0.99167±0.00278	0.00139		40	0.95206±0.00304	0.01472
	60	0.99114±0.00273	0.00281		60	0.94631±0.00179	0.02927
	80	0.98973±0.00303	0.00258		80	0.93264±0.00775	0.04963
	100	0.98996±0.00802	0.00805		100	0.91384±0.00501	0.08559
	120	0.98456±0.00472	0.01048		120	0.88156±0.01343	0.09116
UU-200	-60	1±0	--	1% $BiVO_4$/UU-200	-60	1±0	--
	-30	0.86438±0.01798	--		-30	0.90269±0.02483	--
	0	0.84498±0.01242	0		0	0.91373±0.02935	0
	20	0.62436±0.03735	0.31731		20	0.64731±0.04491	0.24783
	40	0.4546±0.04305	0.78126		40	0.50522±0.03973	0.57529
	60	0.28585±0.02348	1.10706		60	0.36414±0.01696	0.95903
	80	0.20637±0.01674	1.64209		80	0.24809±0.00993	1.33709
	100	0.12086±0.02043	2.09917		100	0.16999±0.0068	1.78617
	120	0.07652±0.02206	2.821		120	0.10849±0.00267	2.4672
5% $BiVO_4$/UU-200	-60	1±0	--	15% $BiVO_4$/UU-200	-60	1±0	--
	-30	0.79802±0.02601	--		-30	0.86495±0.00571	--
	0	0.817±0.01536	0		0	0.86949±0.01319	0
	20	0.52961±0.03803	0.56003		20	0.52384±0.03338	0.28918
	40	0.30251±0.02242	0.98711		40	0.39229±0.03086	0.61419
	60	0.19736±0.02733	1.5565		60	0.28344±0.02323	1.14739
	80	0.11168±0.0199	2.29265		80	0.1663±0.02061	1.58808
	100	0.05349±0.01048	2.80266		100	0.10703±0.02865	2.11773
	120	0.03212±0.00561	3.25595		120	0.06302±0.00876	2.3139
25% $BiVO_4$/U	-60	1±0	--	5% $BiVO_4$/UU-200	-60	1±0	

U-200	-30	0.88431±0.00236	--	physical mixing	-30	0.889±0.0304
	0	0.85692±0.02826	0		0	0.878±0.0208
	20	0.60211±0.0054	0.24605		20	0.608±0.0154
	40	0.47078±0.03151	0.59062		40	0.439±0.0369
	60	0.33356±0.03834	1.08787		60	0.316±0.0139
	80	0.20287±0.03779	1.62291		80	0.193±0.00811
	100	0.11881±0.02145	2.11851		100	0.0978±0.00626
	120	0.07238±0.01106	2.63476		120	0.0718±0.00803

(a) C_0 (in units of mol/L) denote the respective concentrations of RhB at time points t = 0 min

Table S4. Effect of catalyst dosage on the degradation of RhB over the 5% $BiVO_4$/UU-200 sample. C and C_0 (in units of mol/L) denote the respective concentrations of RhB dye at time points t and 0, where t represents the current time, and 0 denotes the initial time.

Catalyst dosage	Time [min]	C/C_0	Sample	Time [min]	C/C_0
m = 5 mg	0	1	m = 10 mg	0	1
	20	0.986		20	0.748
	40	0.978		40	0.577
	60	0.908		60	0.397
	80	0.788		80	0.240
	100	0.684		100	0.141
	120	0.548		120	0.0702
m = 15 mg	0	1	m = 20 mg	0	1
	20	0.776		20	0.698
	40	0.666		40	0.449
	60	0.354		60	0.243
	80	0.182		80	0.123
	100	0.0937		100	0.0576
	120	0.0371		120	0.0234

Table S5. Effect of initial RhB concentration on the degradation of RhB over the 5% $BiVO_4$/UU-200 sample. C and C_0 (in units of mol/L) denote the respective concentrations of RhB dye at time points t and 0, where t represents the current time, and 0 denotes the initial time.

RhB concentration	Time [min]	C/C_0	Sample	Time [min]	C/C_0
[RhB] = 15 ppm	0	1	[RhB] = 20 ppm	0	1
	20	0.643		20	0.731
	40	0.430		40	0.558
	60	0.254		60	0.341
	80	0.147		80	0.220
	100	0.0729		100	0.0998
	120	0.0377		120	0.0524
[RhB] = 25 ppm	0	1	[RhB] = 30 ppm	0	1
	20	0.691		20	0.942
	40	0.522		40	0.813
	60	0.373		60	0.578
	80	0.249		80	0.325
	100	0.150		100	0.196
	120	0.0848		120	0.100
[RhB] = 35 ppm	0	1			
	20	0.985			
	40	0.949			
	60	0.841			
	80	0.584			
	100	0.394			
	120	0.273			

Table S6. Effect of initial solution pH on the degradation of RhB over the 5% $BiVO_4$/UU-200 sample. C and C_0 (in units of mol/L) denote the respective concentrations of RhB dye at time points t and 0, where t represents the current time, and 0 denotes the initial time.

initial solution pH	Time [min]	C/C_0	Sample	Time [min]	C/C_0
pH 2	0	1	pH 4	0	1
	20	0.298		20	0.874
	40	0.0283		40	0.691
	60	0.00353		60	0.534
	80	0.00199		80	0.357
	100	0.00202		100	0.187
	120	0.00106		120	0.0955
pH 6	0	1	pH8	0	1
	20	0.869		20	0.936
	40	0.717		40	0.856
	60	0.562		60	0.779
	80	0.463		80	0.726
	100	0.327		100	0.656
	120	0.259		120	0.624
pH 10	0	1			
	20	1.006			
	40	1.000			
	60	1.002			
	80	0.997			
	100	0.997			
	120	1.000			

Table S7. Active species trapping experiments for photodegradation of RhB over 5% $BiVO_4$/UU-200 sample. C and C_0 (in units of mol/L) denote the respective concentrations of RhB and TCH at time points t and 0, where t represents the current time, and 0 denotes the initial time. σ is the standard deviation calculated from 3 samples.

Scavenger	Time [min]	C/C0 ± σ	Scavenger	Time [min]	C/C0 ± σ
IPA	-60	1±0	BQ	-60	1±0
	-30	0.981±0.00724		-30	0.987±0.00319
	0	0.986±0.000756		0	0.985±0.00579
	20	0.852±0.0399		20	0.973±0.00637
	40	0.617±0.0283		40	0.968±0.00992
	60	0.361±0.0343		60	0.965±0.0129
	80	0.218±0.0334		80	0.961±0.0129
	100	0.126±0.0160		100	0.961±0.0119
	120	0.0560±0.00577		120	0.956±0.0120
$Na_2C_2O_4$	-60	1±0	$K_2Cr_2O_7$	-60	1±0
	-30	0.987±0.00223		-30	0.980±0.0170
	0	0.989±0.00571		0	0.981±0.0103
	20	0.928±0.0122		20	0.907±0.0168
	40	0.786±0.0336		40	0.855±0.0237
	60	0.626±0.0337		60	0.771±0.0197
	80	0.521±0.0269		80	0.706±0.0400
	100	0.410±0.00243		100	0.629±0.0507
	120	0.257±0.0155		120	0.581±0.0526

Table S8. Recycling runs for photodegradation of RhB over 5% $BiVO_4$/UU-200 sample. C and C_0 (in units of mol/L) denote the respective concentrations of RhB dye at time points t and 0, where t represents the current time, and 0 denotes the initial time. σ is the standard deviation calculated from 3 samples.

Cycle run	Time [min]	C/C0 ± σ	Cycle run	Time [min]	C/C0 ± σ
Cycle 1	-60	1±0	Cycle 2	-60	1±0
	-30	0.867±0.00958		-30	0.951±0.0153
	0	0.880±0.0152		0	0.950±0.0158
	20	0.608±0.107		20	0.743±0.0231
	40	0.459±0.0713		40	0.637±0.00360
	60	0.328±0.0630		60	0.521±0.0290
	80	0.219±0.0674		80	0.392±0.0192
	100	0.132±0.0487		100	0.227±0.0384
	120	0.0746±0.0196		120	0.0946±0.0171
Cycle 3	-60	1±0			
	-30	0.969±0.0148			
	0	0.974±0.0172			
	20	0.844±0.0110			
	40	0.706±0.0120			
	60	0.556±0.0280			
	80	0.406±0.0212			
	100	0.311±0.0255			
	120	0.1423±0.00512			

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