Electronic Supplementary Material for New Journal of Chemistry.

New construction method of Bi_2MoO_6/kaolinite with efficient visible photocatalytic activity

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1. Materials

The kaolinite was obtained from Jingdezhen (Jiangxi, China). Ammonium hydroxide ($NH_3 \cdot H_2O$) was obtained from Guangfu Fine Chemical Research Institute (Tianjin, China). Bismuth nitrate pentahydrate ($Bi(NO_3)_3 \cdot 5H_2O$) was provided by Maya Reagent (Zhejiang, China). Sodium molybdate dihydrate ($Na_2MoO_4 \cdot 2H_2O$) was purchased from Macklin Reagent Co., Ltd (Shanghai, China). Deionized water was used during the entire experiment.

2. Characterization

Rigaku Ultima IV X-ray powder diffractometer with Cu Kα radiation was employed to test the phase of samples. The microscopic photographs of samples were obtained from TESCAN MIRA LMS field emission scanning electron microscope. Thermo Scientific K-Alpha X-ray photoelectron spectrometer with Al Kα radiation was applied to obtain the XPS spectra of samples. The results were calibrated by C 1s (284.8 eV). Thermo Scientific Nicolet iS20 was used to collect the Fourier transform infrared spectroscopy using KBr as background (resolution: 4 cm^{-1}, scanning number: 32). The BET surface area and pore distribution were tested by Micromeritics ASAP 2460. TA-Q600 was used to obtain the TG-DSC results (heating rate of 10 °C/min). The UV-vis diffuse reflectance spectra of samples were collected by UH4150 spectrophotometer (Hitachi). The Bruker EMX PLUS electron paramagnetic resonance spectrometer was used to test the generated free radicals in photocatalysis.

3. Photocatalytic properties test

tetracycline hydrochloride (TC) and rhodamine B (RhB) solution were used as the target pollutants in the experiment. CFLHXF300 xenon lamp (>400 nm) produced by Education Au-Light of China was used as the visible light source. Prior to photocatalytic test, 100 mg of samples was dispersed in 40 mg/L TC (or 10 mg/L RhB) solution. After 30 min of agitation, the light was turned on, and the solution was extracted at time intervals. After filtration through a 0.45 mm filter membrane, the absorbance of solution was measured at 357 nm for TC and 554 nm for RhB to analyze the photocatalytic performance by Cary 60 UV-Vis spectrophotometer (Agilent).

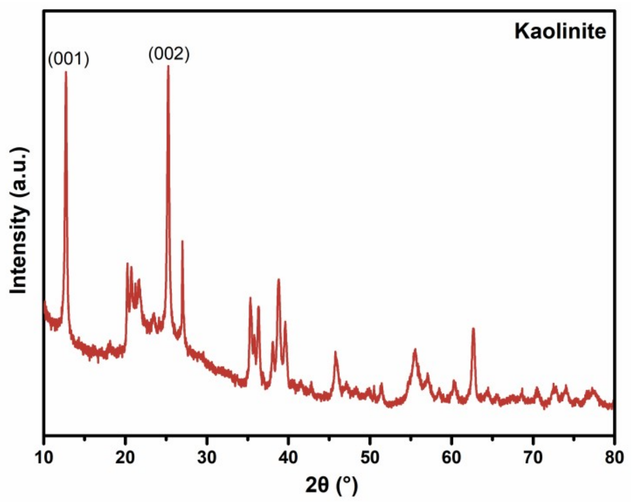

Fig. S1. XRD pattern of kaolinite.

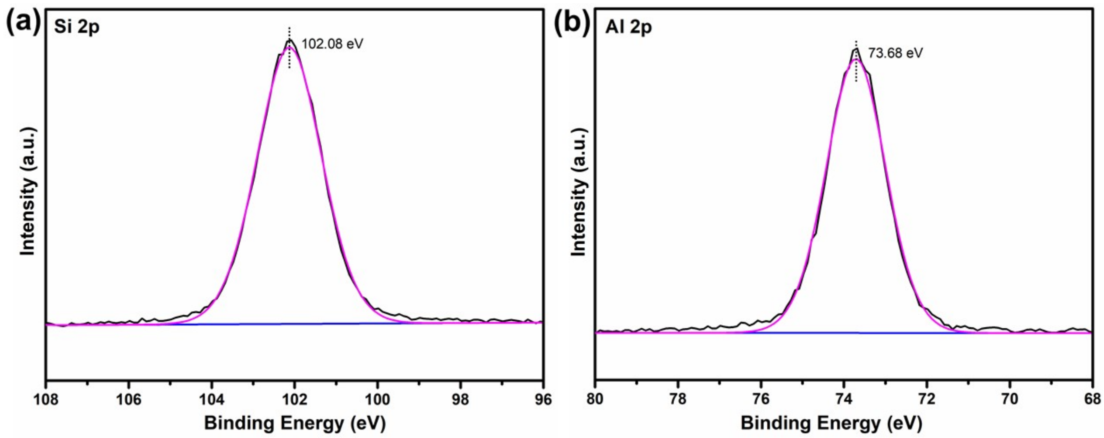

Fig. S2. XPS spectra of kaolinite (a) Si 2p, (b) Al 2p.

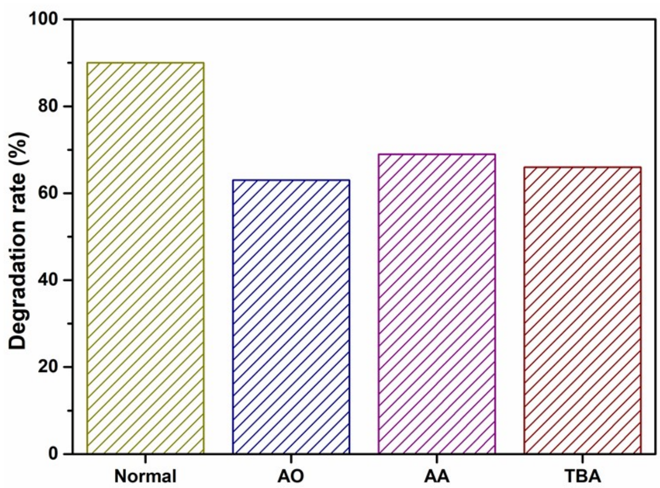

Fig. S3. Free radical quenching experiments of Bi_2MoO_6/kaolinite for RhB degradation.

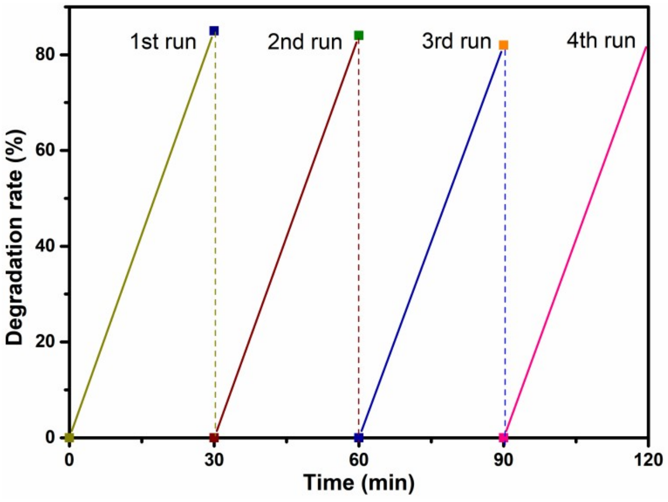

Fig. S4. Cycling test of Bi_2MoO_6/kaolinite for RhB degradation.

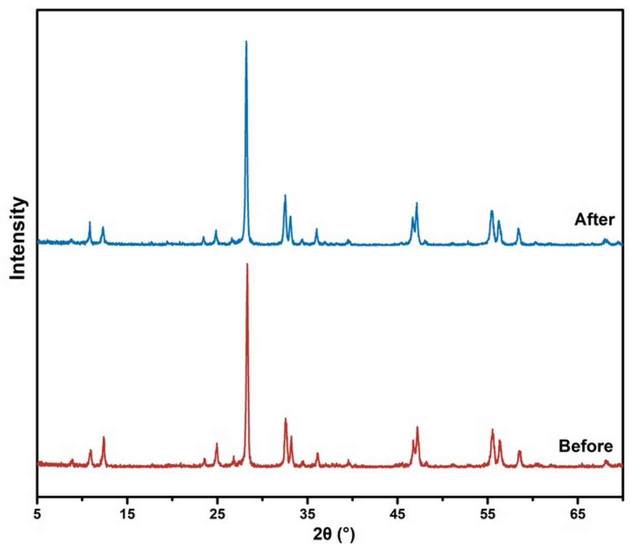

Fig. S5. XRD patterns of Bi_2MoO_6/kaolinite before and after photocatalysis.

Table S1 Comparison of photocatalytic performance of Bi_2MoO_6-based photocatalysts.

Photocatalysts	Preparation method	Light source	Dosage	Initial concentration	Degradation efficiency	Reference
$BiOCl-Bi_2MoO_6$	solvothermal method	350 W Xe lamp (λ>420 nm)	1 g/L	10 mg/L TC	97% (100 min)	[1]
$Ni(OH)_2/Bi_2MoO_6$	solvent-thermal method	300 W Xe lamp (λ>420 nm)	0.4 g/L	10 mg/L RhB	98% (135 min)	[2]
$In(OH)_3/Bi_2MoO_6$	solvothermal method	500 W Xe lamp (λ>420 nm)	1 g/L	10 mg/L RhB	86% (200 min)	[3]

$MoS_2/CdS/Bi_2MoO_6$	solvothermal method	300 W Xe lamp (λ>420 nm)	0.6 g/L	10 mg/L RhB	71% (120 min)	[4]
Pt/Bi_2MoO_6	solvothermal method	Xe lamp (λ>420 nm)	1 g/L	≈4.8 mg/L RhB	99% (120 min)	[5]
$FeIn_2S_4/Bi_2MoO_6$	solvothermal method	Xe lamp (λ>420 nm)	1 g/L	20 mg/L TC	83% (35 min)	[6]
Bi_2MoO_6/(Zn/Ti)LDH	solvothermal method	500 W Xe lamp (λ>400 nm)	1 g/L	10 mg/L RhB	100% (60 min)	[7]
$Bi_2MoO_6@Bi_2O_3$	solvothermal method	5 W LED	0.25 g/L	10 mg/L TC	96% (180 min)	[8]
Bi_2MoO_6/kaolinite	precipitation-calcined method	300 W Xe lamp (λ>400 nm)	1 g/L	10 mg/L RhB 40 mg/L TC	90% (30 min) 75% (50 min)	This work

Reference

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