

# Supporting Information

## For

### NaFeSi<sub>2</sub>O<sub>6</sub> Nanocrystal as a Catalyst for Heterogeneous Photo-Fenton Degradation of Organic Wastewater

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#### Experimental section

##### Materials

Iron (III) nitrate nonahydrate (Fe(NO<sub>3</sub>)<sub>3</sub>·9H<sub>2</sub>O), sodium silicate nonahydrate (Na<sub>2</sub>SiO<sub>3</sub>·9H<sub>2</sub>O), Terephthalic acid and Ethanol were obtained from Sinopharm Chemicals Reagent Co., Ltd. (Shanghai, China). Sodium hydroxide (NaOH) was purchased from Tianjin Damao Chemical Reagent Factory. (China). Ethylene glycol and Hydrochloric acid (HCl) was obtained from Laiyang Economic and Technological Development Zone fine chemical plant (China). All chemicals used in this study are of analytical grade and without further purification.

##### Preparation of NaFeSi<sub>2</sub>O<sub>6</sub>

NaFeSi<sub>2</sub>O<sub>6</sub> was synthesized by the one-step hydrothermal method, in which 2.5296 g sodium silicate (Na<sub>2</sub>SiO<sub>3</sub>·9H<sub>2</sub>O) and 2.3836 g ferric nitrate (Fe(NO<sub>3</sub>)<sub>3</sub>·9H<sub>2</sub>O) were respectively dissolved into 30 mL of water/ethylene glycol mixed solution with a volume ratio of 1:1. The above solutions were mixed and stirred for 1 h. The suspension was transferred into a Teflon-lined stainless steel autoclave with a capacity of 100 mL. Then the sealed reactor was heated to 180°C and maintained for 24 h. After being

cooled to room temperature, the product was collected through a filter and washed with deionized water and ethanol several times. The sample was finally dried at 60 °C.

### **Characterizations**

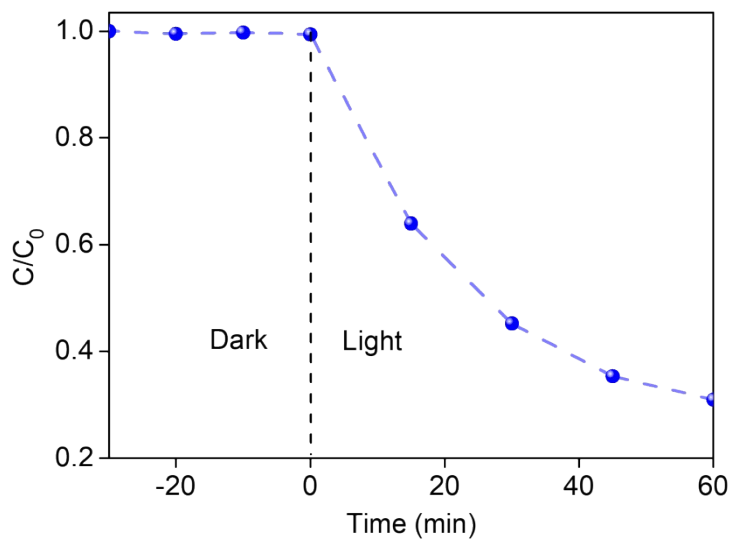
The XRD patterns of samples were operated on a Miniflex 600-C X-ray diffractometer with Cu K $\alpha$  radiation, which was operated at 40 kV and 15 mA. Nitrogen adsorption/desorption isotherms were measured at 77 K using a Micrometrics ASAP2020 system and the Brunauere-Emmette-Teller (BET) method was applied to calculate the specific surface area of the sample. The element composition was conducted on Thermo ESCALAB 250Xi X-ray photoelectron spectroscopy (XPS) with an Al K $\alpha$  as the X-ray source and hemispherical analyzer. The content of elements was measured by ICP-OES/AES:Varian (720-ES). The high-resolution transmission electron microscope (HRTEM, FEI Tecnai G20) was carried out to study the detailed structure and elemental analysis, which was operated at an accelerating voltage of 200 kV. UV–Vis diffuse reflectance spectroscopy (DRS, Agilent Cary 5000) while BaSO<sub>4</sub> was the reference. Hydroxyl radical was captured by an A200 electron paramagnetic resonance spectroscopy (EPR, Bruker Germany) at room temperature. Mott-Schottky plots were obtained in a conventional three-electrode electrochemical workstation (CHI 660E, CH Instruments, Chenhua Co., Shanghai, China) with Ag/AgCl electrode as the reference electrode and Pt wire as the counter electrode. 0.2M of aqueous Na<sub>2</sub>SO<sub>4</sub> solution was used as the supporting electrolyte. The sample electrode was prepared according to the following process: 50 mg sample was suspended in 0.5 mL of DMF, which was used for spreading the sample onto the Fluorine doped Tin Oxide (FTO) glass of 0.5×0.5 cm.

### **Catalytic activity measurements**

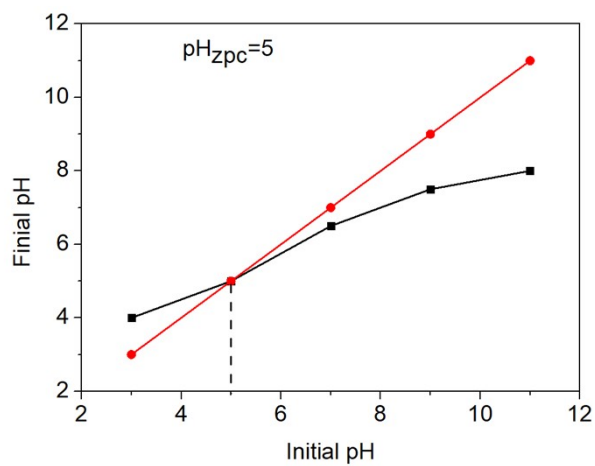
80 mg of the as-prepared sample and 80 mL (5 ppm) RhB solution were mixed in a 100 mL reactor. After dark adsorption for 30 minutes, a certain amount of hydrogen peroxide was added, and the reaction was irradiated by a 300 W xenon lamp (CEL-HXF300, Beijing Zhongjiaojinyuan Co., Ltd.) with a UV-cutoff filter (410 nm-800 nm). A 3 mL aliquot was taken at every 15 minute intervals during the experiment and centrifuged to remove the powders. The residual concentration of RhB was analyzed

on a Shanghai Youke UV756CRT spectrophotometer. The degradation efficiency is reported as  $C/C_0$ , where  $C_0$  is the initial concentration of RhB, while  $C$  represents the corresponding concentration at a certain time interval.

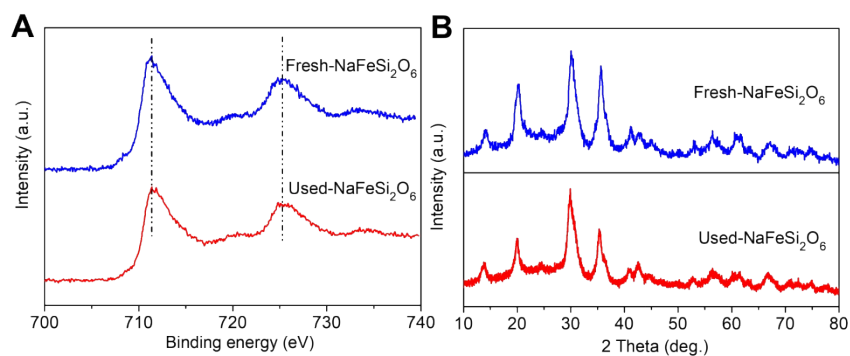
The pH was adjusted to the expected value by addition of 0.1 mol/L HCl or 0.1 mol/L NaOH while investigating pH on the effect of RhB removal.



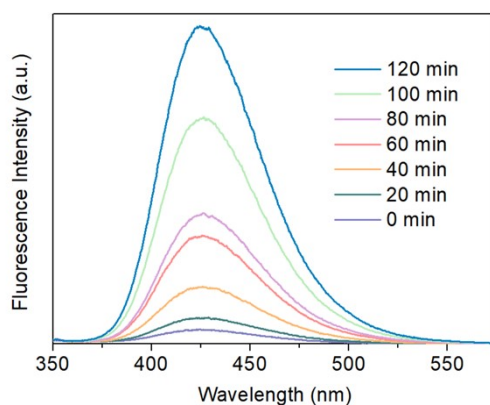
**Fig. S1.** Reaction process for dark adsorption and photocatalytic oxidation of  $\text{NaFeSi}_2\text{O}_6$ .



**Fig. S2.** The zero point potential date of  $\text{NaFeSi}_2\text{O}_6$



**Fig. S3.** (A) XPS spectra and (B) XRD pattern of NaFeSi<sub>2</sub>O<sub>6</sub> before and after cycling test.



**Fig. S4.** Fluorescence spectra of NaFeSi<sub>2</sub>O<sub>6</sub> in a terephthalic acid solution irradiated by visible light at different irradiation times (excitation at 320 nm) for 2 h.

**Table S1.** The element content of the NaFeSi<sub>2</sub>O<sub>6</sub> sample.

Elements	Na	Fe	Si	O
Content ratio (%)	10.6	23.2	22.5	43.7