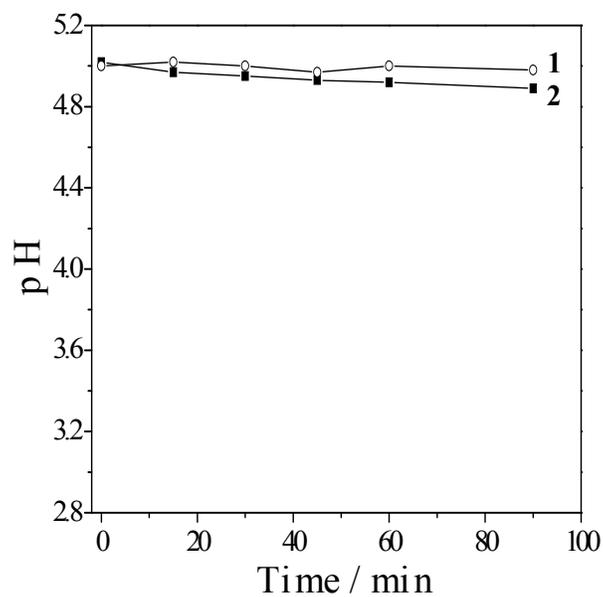
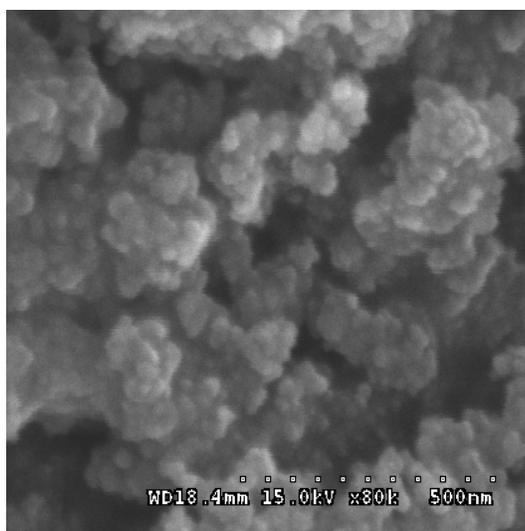


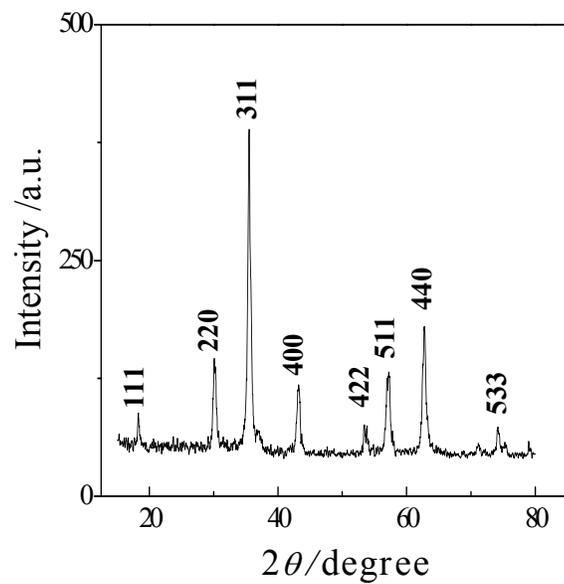
## Electronic Supplementary Information



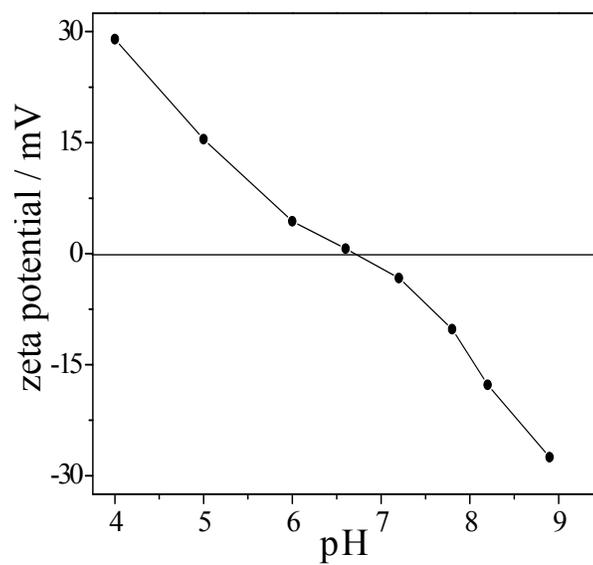
**FIGURE S1.** Profiles of solution pH during the reaction in the systems of (1)  $\text{Fe}_3\text{O}_4$  MNPs- $\text{H}_2\text{O}_2$ -RhB and (2) BFO MNPs- $\text{H}_2\text{O}_2$ -RhB. Reaction conditions: initial RhB concentration  $10 \mu\text{mol L}^{-1}$ , initial  $\text{H}_2\text{O}_2$  concentration  $10 \text{mmol L}^{-1}$ , catalyst load  $0.5 \text{g L}^{-1}$ , and initial solution pH 5.0.



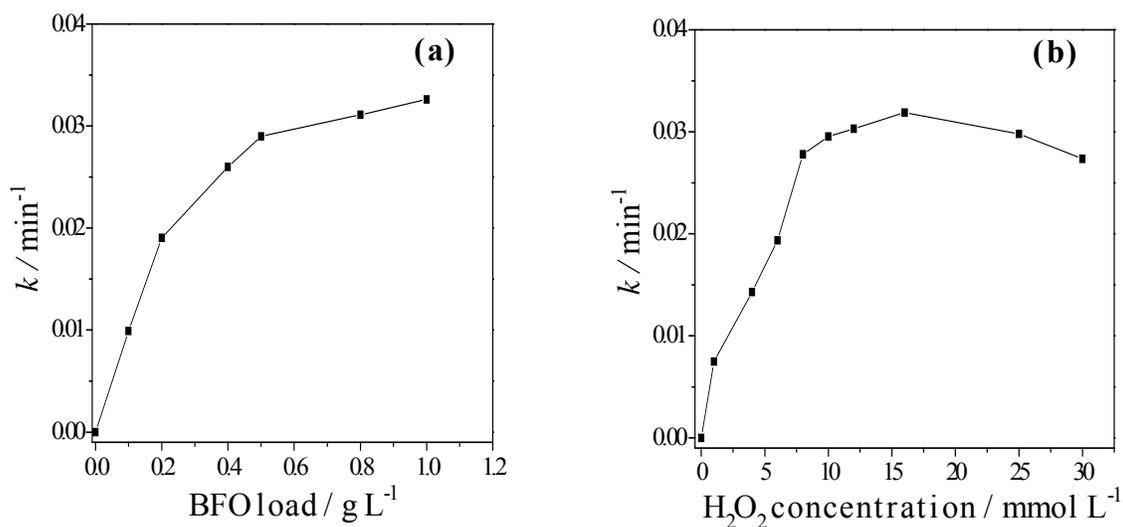
**FIGURE S2.** SEM image of  $\text{Fe}_3\text{O}_4$  MNPs.



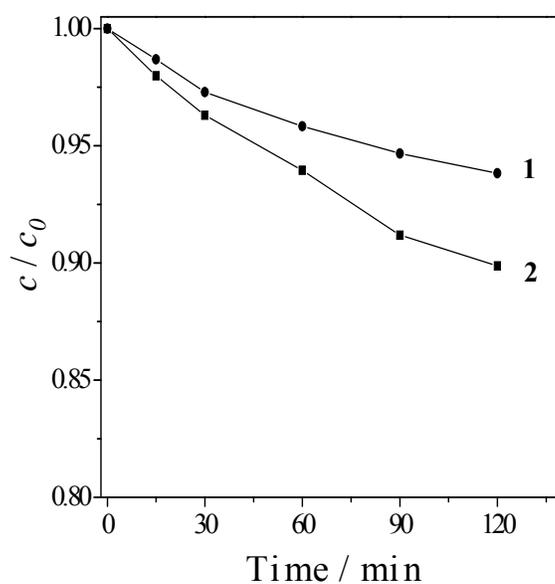
**FIGURE S3. XRD pattern of Fe<sub>3</sub>O<sub>4</sub> MNPs.**



**FIGURE S4. Zeta potential of BFO MNPs at different pH values.**

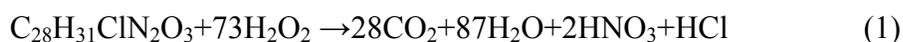


**FIGURE S5.** Effects of BFO MNPs load (a) and  $\text{H}_2\text{O}_2$  concentration (b) on the apparent rate constant  $k$  of RhB removal. The initial RhB concentration was  $10 \mu\text{mol L}^{-1}$ , and the initial solution pH was pH 5.0.



**FIGURE S6.**  $\text{H}_2\text{O}_2$  loss in the systems of (1)  $\text{Fe}_3\text{O}_4$  MNPs- $\text{H}_2\text{O}_2$ -RhB and (2) BFO MNPs- $\text{H}_2\text{O}_2$ -RhB. Reaction conditions: initial RhB concentration  $10 \mu\text{mol L}^{-1}$ , initial  $\text{H}_2\text{O}_2$  concentration  $10 \text{mmol L}^{-1}$ , catalyst load  $0.5 \text{g L}^{-1}$ , and initial solution pH 5.0.

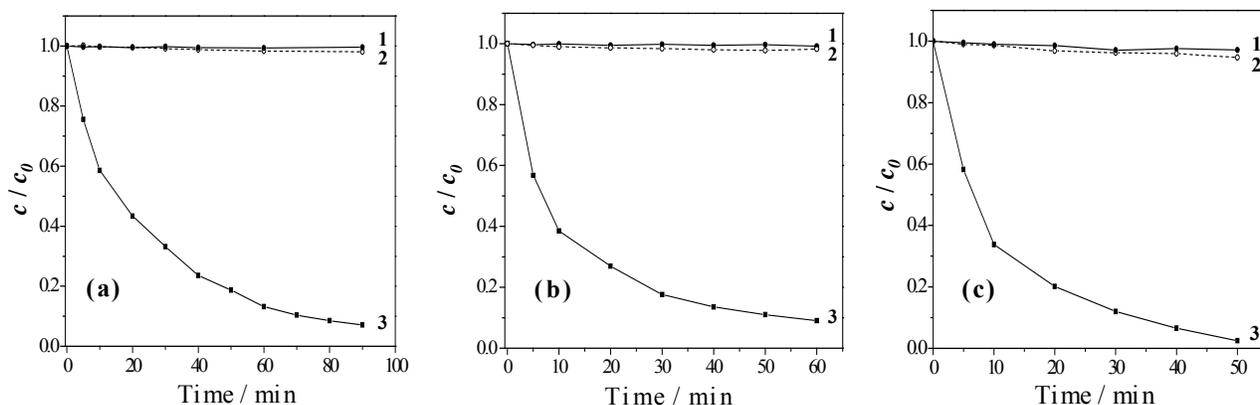
**Calculation of the efficiency of utilization of  $\text{H}_2\text{O}_2$ .** In stoichiometry, the complete mineralization of one mole RhB will consume 73 moles of  $\text{H}_2\text{O}_2$  (eq. 1).



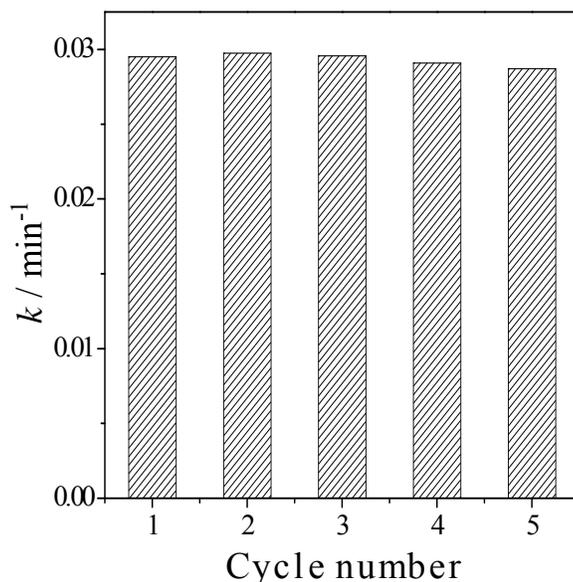
Thus, the stoichiometry efficiency of utilization of  $\text{H}_2\text{O}_2$  ( $\eta$ ) is defined as the ratio of the amount of  $\text{H}_2\text{O}_2$  used for the degradation of RhB ( $\Delta[\text{H}_2\text{O}_2]_{\text{degradation}}$ ) with the total amount of the consumed  $\text{H}_2\text{O}_2$  ( $\Delta[\text{H}_2\text{O}_2]_{\text{decomposition}}$ ) in the reaction, according to eq. 2:

$$\eta = \Delta[\text{H}_2\text{O}_2]_{\text{degradation}} / \Delta[\text{H}_2\text{O}_2]_{\text{decomposition}} \quad (2)$$

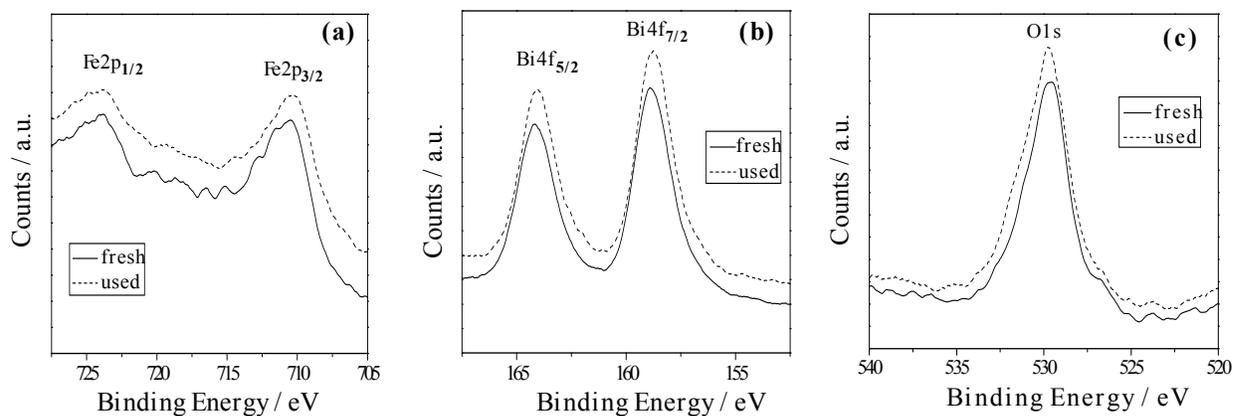
By measuring the TOC change of the RhB solution, we can have the amount of RhB being equivalent to the amount of completely mineralized RhB, and then we can calculate the value of  $\Delta[\text{H}_2\text{O}_2]_{\text{degradation}}$ . The value of  $\Delta[\text{H}_2\text{O}_2]_{\text{decomposition}}$  at different reaction time was measured as shown in Figure S6. In BFO MNPs- $\text{H}_2\text{O}_2$ -RhB and  $\text{Fe}_3\text{O}_4$  MNPs- $\text{H}_2\text{O}_2$ -RhB system, the TOC removal was 90% and 6% after 2 h reaction, as given in the text (Figure 2b). Therefore, the efficiency of the utilization of  $\text{H}_2\text{O}_2$  was calculated as 64.4% and 7.06% for the catalysts of BFO MNPs and  $\text{Fe}_3\text{O}_4$  MNPs, respectively.



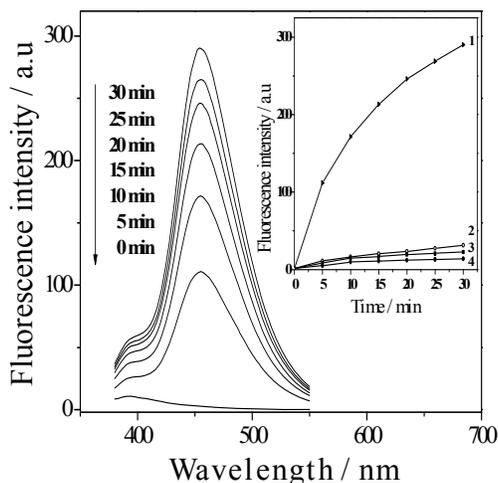
**FIGURE S7.** Degradation kinetics of RhB at pH of (a) 5.0, (b) 4.0 and (c) 3.0 in solutions of (1)  $\text{H}_2\text{O}_2$ , (2) the leaching solution, and (3) BFO MNPs- $\text{H}_2\text{O}_2$ . Other reaction conditions: BFO MNPs  $0.5 \text{ g L}^{-1}$ , initial RhB concentration  $10.0 \mu\text{mol L}^{-1}$  and initial  $\text{H}_2\text{O}_2$  concentration  $10.0 \text{ mmol L}^{-1}$ .



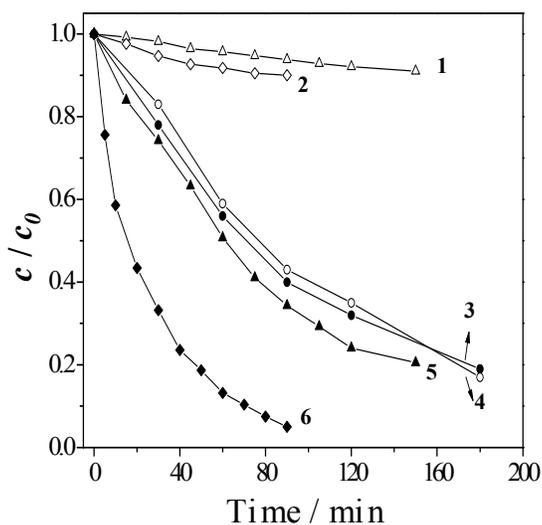
**FIGURE S8. Degradation of RhB with the recycled BFO MNPs at pH 5.0. Reaction conditions in each cycle: BFO MNPs concentration  $0.5 \text{ g L}^{-1}$ , initial RhB concentration  $10.0 \text{ } \mu\text{mol L}^{-1}$  and initial  $\text{H}_2\text{O}_2$  concentration  $10.0 \text{ mmol L}^{-1}$ .**



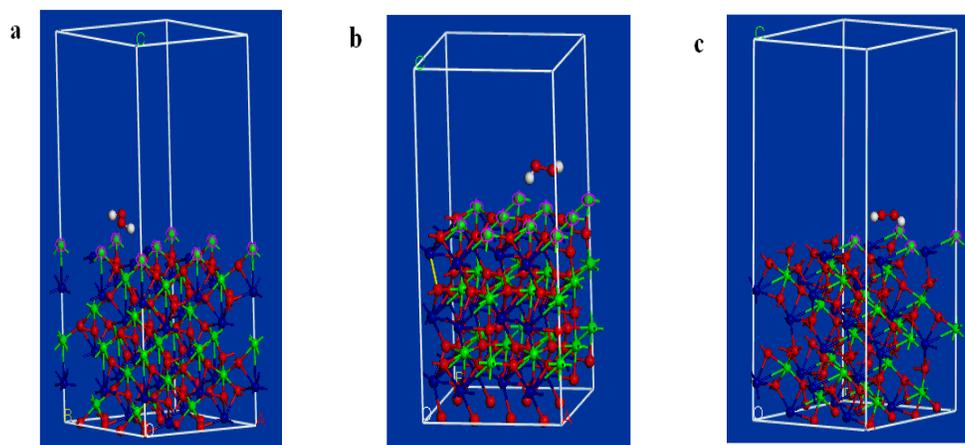
**FIGURE S9. XPS spectra of (a) Fe  $2p_{1/2}$ , (b) Bi  $4f_{5/2}$  and (c) O  $1s$  in BFO MNPs before and after the degradation reaction. The oxidation states of  $\text{Fe}^{3+}$ ,  $\text{Bi}^{3+}$  and  $\text{O}^{2-}$  are confirmed to be not changed before and after the degradation reaction.**



**FIGURE S10.** Variations of emission spectra of the solution during the reaction in the BFO MNPs-H<sub>2</sub>O<sub>2</sub>-coumarin system. The inset shows the reaction time dependence of the emission intensity in the systems of (1) BFO MNPs-H<sub>2</sub>O<sub>2</sub>-coumarin, (2) Fe<sub>3</sub>O<sub>4</sub> MNPs-H<sub>2</sub>O<sub>2</sub>-coumarin, (3) BFO MNPs-H<sub>2</sub>O<sub>2</sub>-coumarin-DPPH and (4) H<sub>2</sub>O<sub>2</sub>-coumarin (Excited at 346 nm, and detected at 456 nm). Reaction conditions: pH 5.0, BFO or Fe<sub>3</sub>O<sub>4</sub> MNPs 0.5 g L<sup>-1</sup>, H<sub>2</sub>O<sub>2</sub> 10.0 mmol L<sup>-1</sup>, DPPH 5.0 μmol L<sup>-1</sup>, and coumarin 1.0 mmol L<sup>-1</sup>.



**FIGURE S11.** Degradation kinetics of (1) MB in the suspension of 0.5 g L<sup>-1</sup> Fe<sub>3</sub>O<sub>4</sub> MNPs +10.0 mmol L<sup>-1</sup> H<sub>2</sub>O<sub>2</sub> + 20 μmol L<sup>-1</sup> MB at pH 7.2, (2) RhB in the suspension of 0.5 g L<sup>-1</sup> Fe<sub>3</sub>O<sub>4</sub> MNPs + 10.0 mmol L<sup>-1</sup> H<sub>2</sub>O<sub>2</sub> + 10 μmol L<sup>-1</sup> RhB at pH 5.0, (3) phenol in the suspension of 0.5 g L<sup>-1</sup> BFO MNPs + 60.0 mmol L<sup>-1</sup> H<sub>2</sub>O<sub>2</sub> + 3.0 mmol L<sup>-1</sup> phenol at pH 3.0, (4) phenol in the suspension of 0.5 g L<sup>-1</sup> Fe<sub>3</sub>O<sub>4</sub> MNPs + 60.0 mmol L<sup>-1</sup> H<sub>2</sub>O<sub>2</sub> + 3.0 mmol L<sup>-1</sup> phenol at pH 3.0, (5) MB in the suspension of 0.5 g L<sup>-1</sup> BFO MNPs + 10.0 mmol L<sup>-1</sup> H<sub>2</sub>O<sub>2</sub> + 20 μmol L<sup>-1</sup> MB at pH 7.2, and (6) RhB in the suspension of 0.5 g L<sup>-1</sup> BFO MNPs + 10.0 mmol L<sup>-1</sup> H<sub>2</sub>O<sub>2</sub> + 10 μmol L<sup>-1</sup> RhB at pH 5.0.



**FIGURE S12.** Images of  $\text{H}_2\text{O}_2$  adsorption configuration on BFO MNPs facets. (a) on (111), (b) on (110), (c) on (100). The white, red, green and blue spheres stand for H, O, Fe and Bi atoms, respectively.