Electronic Supplementary Material (ESI) for RSC Advances.

Supporting Information

Natural kaolin derived stable SBA-15 as support for Fe/BiOCl: A novel and efficient fenton-like catalyst for degradation of 2-nitrophoenol

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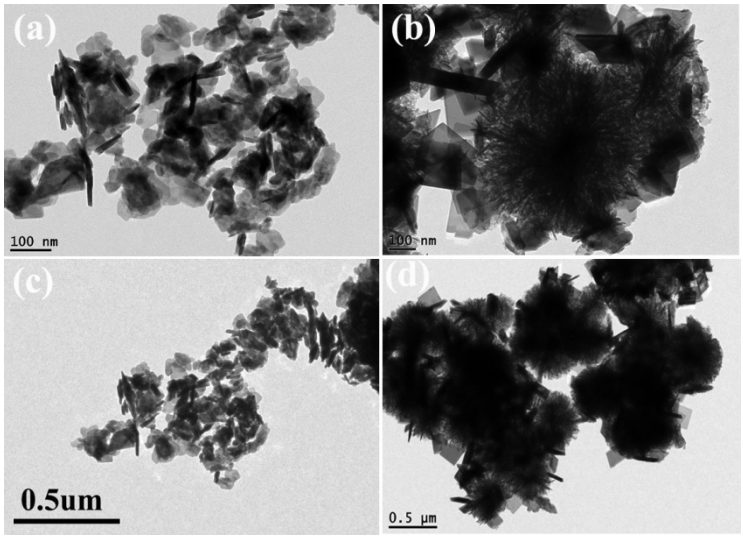

Figure S1 TEM images of pure BiOCl (a and c) and Fe/BiOCl (b and d)

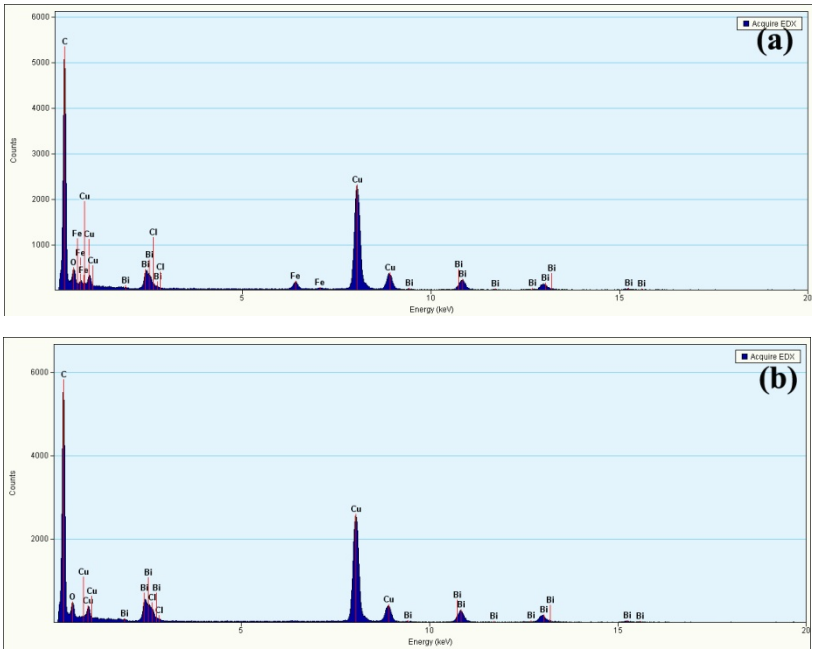

Figure S2 EDS spectrum of flower-like Fe/BiOCl (a) and nanosheet Fe/BiOCl (b) in the catalyst 0.5Fe/BiOCl-FCSBA-15(0.6)

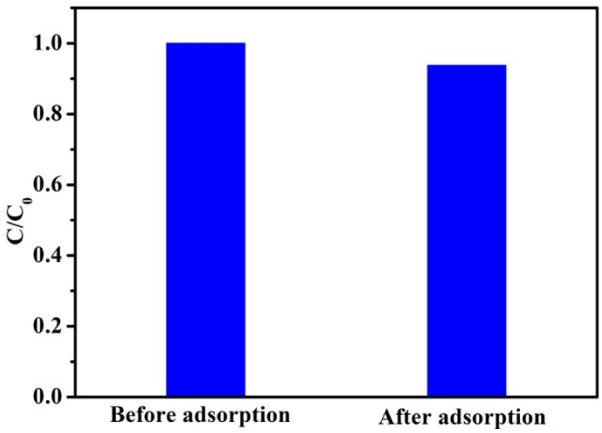

Figure S3 The adsorption behavior of catalyst 0.5Fe/BiOCl-FCSBA-15(0.6) on 2-nitrophenol

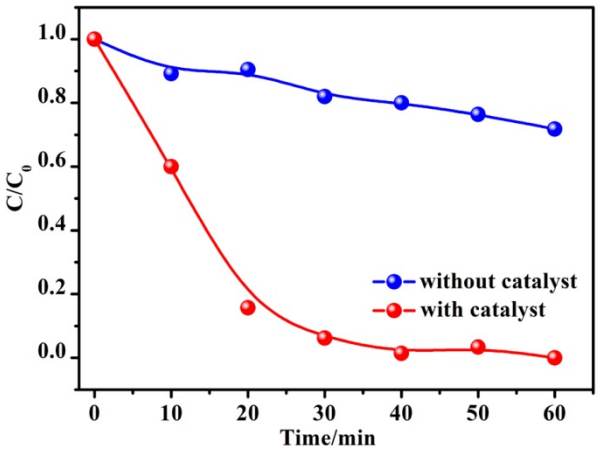

Figure S4 The degradation efficiency of 2-nitrophenol with or without catalyst (*T*=60ºC, pH=4, H_2O_2 dosage=800 mg/L, Fe/Bi molar ratio=0.5, Bi/Si molar ratio=0.6)

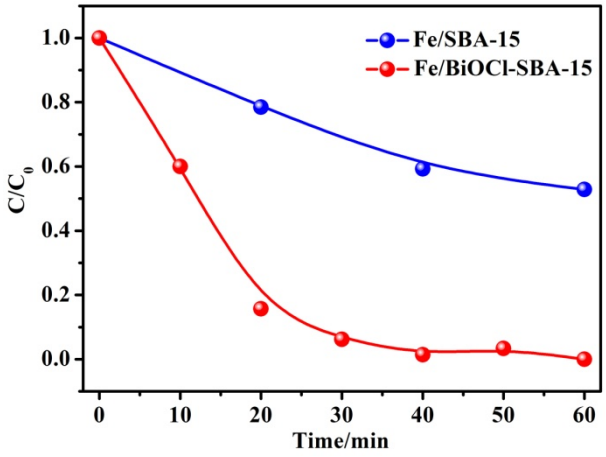

Figure S5 The degradation efficiency of 2-nitrophenol over catalysts Fe/FCSBA-15 and Fe/BiOCl-FCSBA-15 (T=60ºC, pH=4, H_2O_2 dosage=800 mg/L)

The synthesis procedure of Fe/FCSBA-15 was as follows: 2.02 g $Fe(NO_3)_3 \cdot 9H_2O$ was dissolved in 20 mL deionized water, subsequently a certain amount of FCSBA-15 was added with stirring for 1 h. The mixture was then transferred into a 100 mL Teflon-lined stainless steel autoclave, heated up to 110 ºC and kept at this temperature for 8 h. The resulting precipitate was collected by centrifugation, then washed with ethanol and deionized water for several times, then dried at 60 ºC in vacuum and treated at 400 ºC for 3 h.

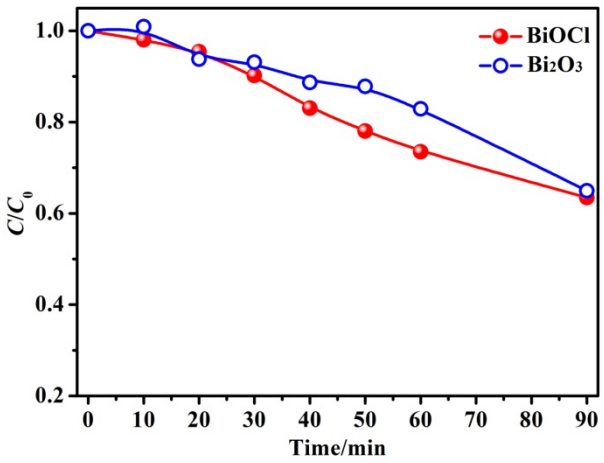

Figure S6 The degradation efficiency of 2-nitrophenol over BiOCl and Bi_2O_3 (T=60ºC, pH=4, H_2O_2 dosage=800 mg/L)

The synthesis procedure of BiOCl was as follows: 4 mmol $Bi(NO_3)_3 \cdot 5H_2O$ was dissolved in 190 mL of glycerol, denoted as solution A. Then, 4 mmol KCl was dissolved in 10 mL of deionized water (solution B), which was subsequently poured into solution A. The mixture was transferred into a 200 mL Teflon-lined stainless steel autoclave, heated to 150 ºC and kept at this temperature for 8 h. The resulting precipitate was collected by centrifugation, then washed with ethanol and deionized water for several times, and dried at 60 ºC in vacuum to obtain BiOCl powder.

In a typical synthesis procedure of Bi_2O_3, 0.364 g $Bi(NO_3)_3 \cdot 5H_2O$ was dissolved in 10 mL of 1M dilute HNO_3. Then 0.16 g urea, a certain amount of ethylene glycol and subsequently 0.6 g PVP were added with stirring. The obtained mixture was transferred into a Teflon-lined stainless steel autoclave and kept at 150 ºC for 3 h. The resulting precipitate was collected by centrifugation, then washed with ethanol and deionized water for several times, and dried at 60 ºC for 12 h. After treatment at 600 ºC for 3 h, Bi_2O_3 powder was obtained.

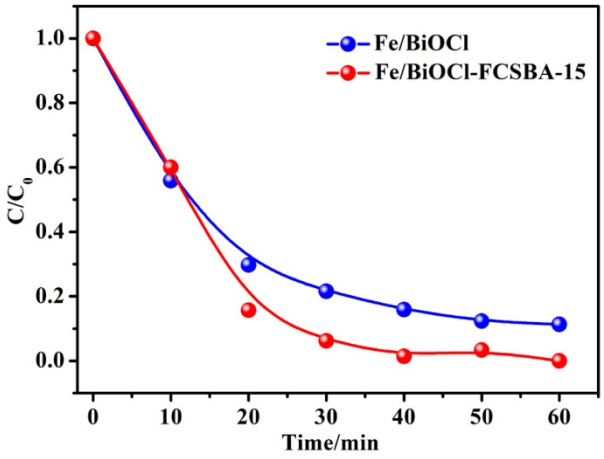

Figure S7 The degradation efficiency of 2-nitrophenol over catalysts Fe/BiOCl with or without matrix FCSBA-15 (T=60ºC, pH=4, H_2O_2 dosage=800 mg/L, Fe/Bi molar ratio=0.5, Bi/Si molar ratio=0.6)

The synthesis process of Fe/BiOCl was the same as that of Fe/BiOCl-FCSBA-15, except the addition of the matrix FCSBA-15.

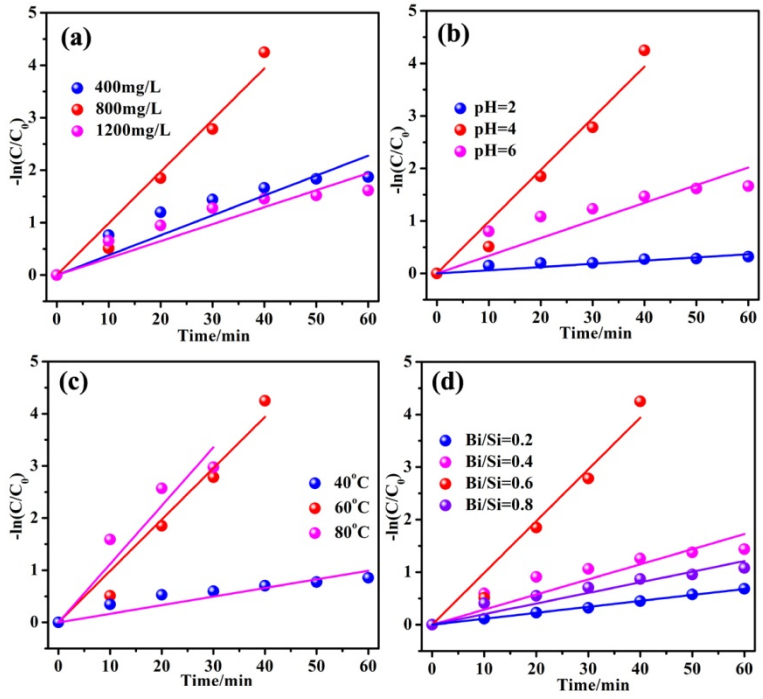

Figure S8 Effect of various variables on reaction rate constants in the degradation of 2-nitrophenol over catalyst Fe/BiOCl-FCSBA-15. (a) Effect of H_2O_2 dosage (*T*=60ºC, pH=4, Fe/Bi molar ratio=0.5, Bi/Si molar ratio=0.6); (b) Effect of pH value (*T*=60ºC, H_2O_2 dosage=800 mg/L, Fe/Bi molar ratio=0.5, Bi/Si molar ratio=0.6); (c) Effect of oxidation temperature (pH=4, H_2O_2 dosage=800 mg, Fe/Bi molar ratio=0.5, Bi/Si molar ratio=0.6); (d) Effect of Bi/Si molar ratio (*T*=60ºC, pH=4, H_2O_2 dosage=800 mg/L, Fe/Bi molar ratio=0.5)

Table S1

Reaction rate constants in the degradation of 2-nitrophenol over catalyst Fe/BiOCl-FCSBA-15

Parameters		Reaction rate constants (10^{-2} min^{-1})
H_2O_2 dosage (mg/L)	400	3.80
	800	9.85
	1200	3.24
pH values	2	0.61
	4	9.85
	6	3.36
Temperature (ºC)	40	1.65
	60	9.85
	80	11.18
Fe/Bi molar ratio	0.2	2.74
	0.5	9.85
	1.0	4.30
Bi/Si molar ratio	0.2	1.13
	0.4	2.02
	0.6	9.85
	0.8	2.87

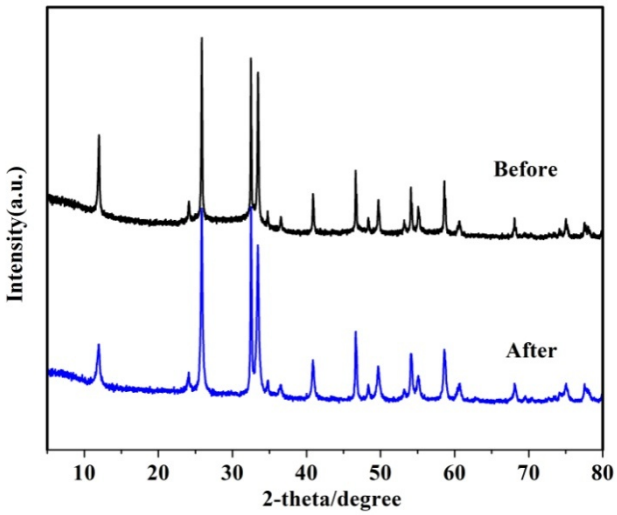

Figure S9 XRD patterns of catalyst 0.5Fe/BiOCl-FCSBA-15(0.6) before and after Fenton-like reaction (*T*=60ºC, pH=4, H_2O_2 dosage=800 mg/L)

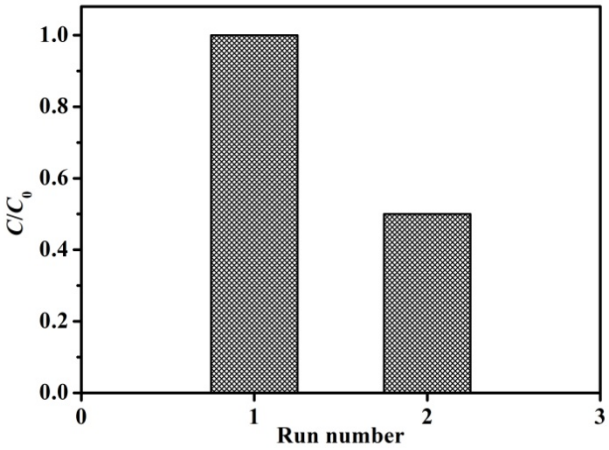

Figure S10 The reusability of catalyst 0.5Fe/BiOCl-FCSBA-15(0.6) (*T*=60ºC, pH=4, H_2O_2 dosage=800 mg/L)