Supporting Information for

Piezoelectric Catalytic Performance of BaTiO3 for Sulfamethoxazole Degradation

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Submitted to

Environmental Science Water Research & Technology

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Table S1. Parameters during the optimization of BTO.

Factors	A Ba/Ti	B [NaOH] (M)	C T (°C)	D T (h)	E EtOH (%)
1	0.5:1	0	120	4	0
2	1:1	0.25	140	8	25
3	1.5:1	0.5	160	12	50
4	2:1	0.75	180	20	75
5	2.5:1	1	200	24	100

Table S2. Corresponding experimental conditions and performance of BTO samples during the optimization by orthogonal design.

BTO-number	Ba/Ti	[NaOH] (M)	T (°C)	t (h)	EtOH (%)	Empty column	*Performance (%)
BTO-1	0.5/1	0	120	4	0	1	66.1
BTO-2	1	1	120	8	50	4	83.9
BTO-3	1.5/1	0.75	120	12	100	2	86.5
BTO-4	2	0.5	120	20	25	5	84.6
BTO-5	2.5/1	0.25	120	24	75	3	82.3
BTO-6	2.5/1	0.5	140	4	100	4	56.2
BTO-7	0.5/1	0.25	140	8	25	2	66.1
BTO-8	1	0	140	12	75	5	59.2
BTO-9	1.5/1	1	140	20	0	3	61.7
BTO-10	2	0.75	140	24	50	1	68.2
BTO-11	2	1	160	4	75	2	55.0
BTO-12	2.5/1	0.75	160	8	0	5	79.7
BTO-13	0.5/1	0.5	160	12	50	3	82.9
BTO-14	1	0.25	160	20	100	1	67.4
BTO-15	1.5/1	0	160	24	25	4	73.0
BTO-16	1.5/1	0.25	180	4	50	5	63.6
BTO-17	2	0	180	8	100	3	70.1
BTO-18	2.5/1	1	180	12	25	1	73.2
BTO-19	0.5/1	0.75	180	20	75	4	73.6
BTO-20	1	0.5	180	24	0	2	75.5
BTO-21	1	0.75	200	4	25	3	63.2
BTO-22	1.5/1	0.5	200	8	75	1	60.9
BTO-23	2	0.25	200	12	0	4	87.9
BTO-24	2.5/1	0	200	20	50	2	68.4
BTO-25	0.5/1	1	200	24	100	5	82.3

* Performance (%): Degradation rate of SMX in the presence of BTO samples and ultrasonic irradiation.

(Conditions: ultrasonic frequency: 45 kHz, ultrasonic power 300 W, reaction volume: 20 ml, initial SMX

concentration: 1 mg·L^{-1}, BTO dosage: 0.05 g, and the reaction time is 12 min.)

Table S3. Variance analysis.

Source	*DOF	Adj SS	Adj MS	*F value	*F$_{0.05}$
A	4	2298.2	574.55	3.13	2.49
B	4	172	43.01	0.23	
C	4	1135.4	283.84	1.55	
D	4	292.9	73.23	0.4	
E	4	2399.2	599.79	3.27	
Deviation	4	734.5	183.63		
Sum	24	7032.2			

*DOF: Degree of freedom.

*F value: Significance of the influence of the factors.

*F$_{0.05}$: F$_{0.05}$ < 3.13 and 3.27. This indicated the significant influence of the addition amount of ethanol and the feed ratio.

Table S4. Mean response analysis.

Factors	A	B	C	D	E	F
K$_1$	371	336.8	403.4	304.1	370.9	335.8
K$_2$	349.2	367.3	311.4	360.7	360.1	351.5
K$_3$	345.7	360.1	358	389.7	367	360.2
K$_4$	345.7	371.2	356	355.7	331	374.6
K$_5$	359.8	356.1	362.7	381.3	362.5	369.4
k$_1$	74.2	67.36	80.68	60.82	74.18	67.16
k$_2$	69.84	73.46	62.28	72.14	72.02	70.3
k$_3$	69.14	72.02	71.6	77.94	73.4	72.04
k$_4$	69.14	74.24	71.2	71.14	66.2	74.92
k$_5$	71.96	71.22	72.54	76.26	72.5	73.88
R	5.06	6.88	18.4	17.12	7.98	7.76
Rank	6	5	1	2	3	4
Correlation	negative & positive	positive	positive	positive	negative & positive	-
*Optimized BTO	A$_5$	B$_2$	C$_5$	D$_5$	E$_5$	

*Optimized BTO: The results of optimization process for preparing BTO with significant performance.
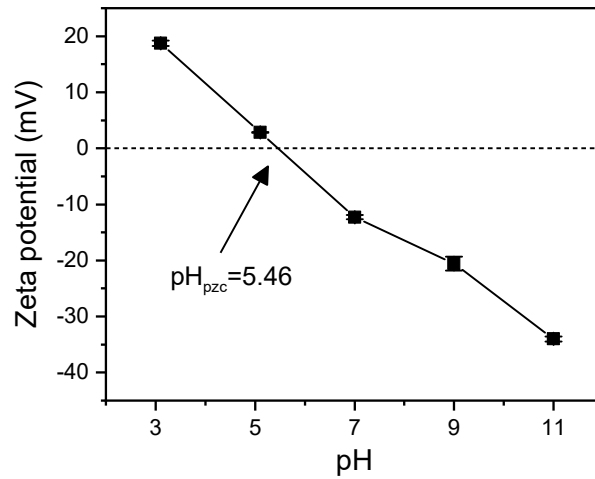
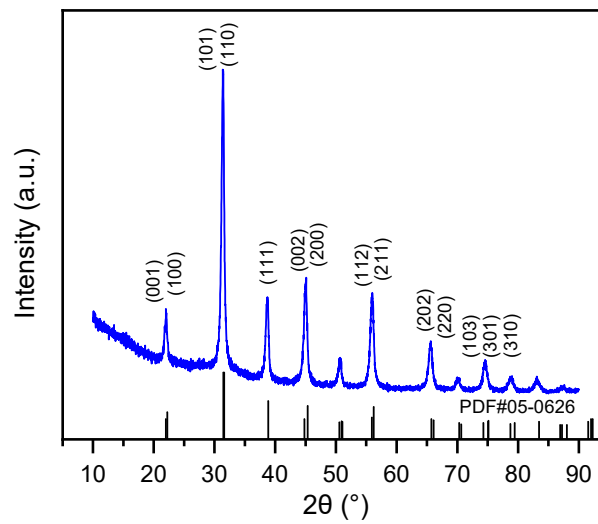**Figure S1.** Zeta potential of BTO nanoparticles as a function of pH.

Figure S2. XRD patterns (the inserted lines correspond to the JCPDS data of No. 05-0626) of BTO nanoparticles after recycling experiments.
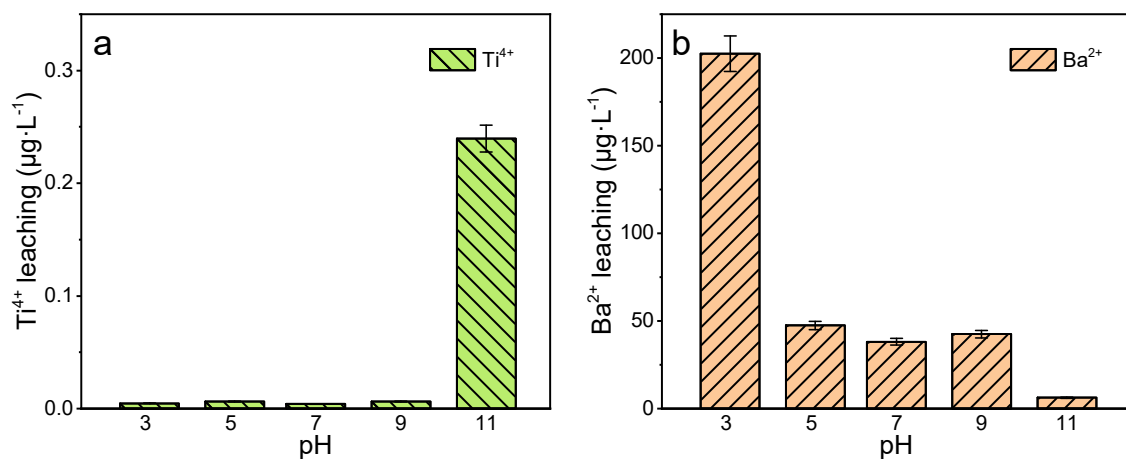

Figure S3. The leached concentration of Ti^{4+} ions (a) and Ba^{2+} ions (b) during the piezoelectric catalytic degradation of SMX. (Conditions: ultrasonic frequency: 45 kHz, ultrasonic power 300 W, reaction volume: 20 ml, initial SMX concentration: 1 mg·L^{-1}, BTO dosage: 0.05 g, and the reaction time is 15 min.)
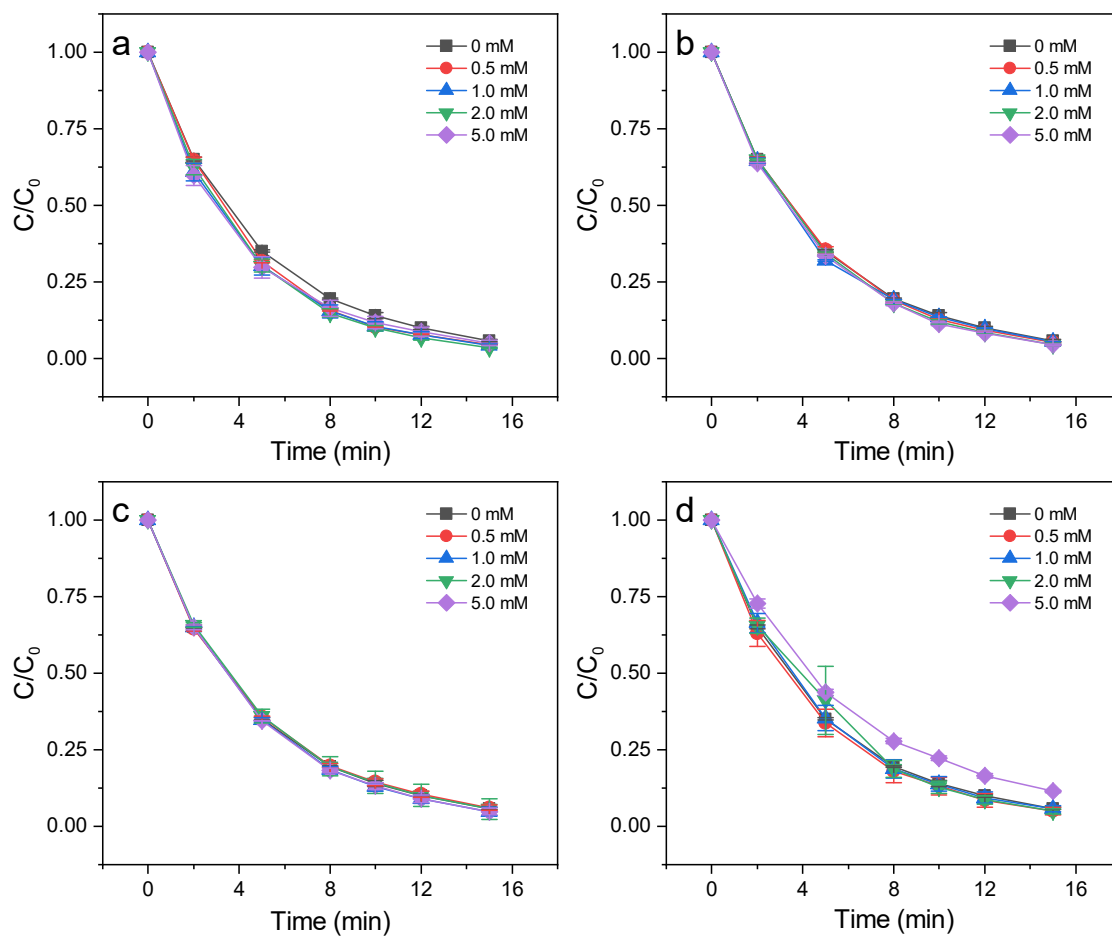
Figure S4. Effect of initial concentration of Cl⁻ (a), initial concentration of NO_3^- (b), initial concentration of Ca^{2+} (c), and initial concentration of Mg^{2+} (d) on the piezoelectric catalytic degradation of SMX as a function of reaction time. (Conditions: ultrasonic frequency: 45 kHz, ultrasonic power 300 W, reaction volume: 20 ml, initial SMX concentration: 1 mg·L⁻¹, BTO dosage: 0.05 g.)