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Supplementary Information for

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Cobalt doped graphitic carbon nitride as an effective catalyst for

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peracetic acid to degrade sulfamethoxazole

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7 **Text S1. Chemicals**

8 Peracetic acid (15% PAA and $\text{H}_2\text{O}_2/\text{PAA}$ molar ratio = 1.4), hydrogen peroxide
9 solution (30wt% H_2O_2), ethanol (EtOH, 99.5%), urea, cobalt nitrate hexahydrate
10 ($\text{Co}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$), sodium thiosulfate ($\text{Na}_2\text{S}_2\text{O}_3$), sodium hydroxide (NaOH), sulfuric
11 acid (H_2SO_4), methanol (MeOH) and tert-butanol (TBA) were purchased from
12 Chengdu Kelong Chemical Reagent Co. Ltd, China. Sulfamethoxazole (SMX) was
13 purchased from Aladdin Reagent Company, China. All chemicals were used as received
14 without further purification. All solutions were prepared using deionized water.

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16 **Text S2. Catalysts synthesis**

17 Cobalt doped g- C_3N_4 (Co-CN) was synthesized by a facile calcination method.¹
18 The detailed synthesis processes are as follows: 10 g urea and 0.2 g $\text{Co}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$
19 were mixed into 20 mL deionized water, and then the mixed solution was heated at 80
20 °C in a water bath until all the water was evaporated. Subsequently, the obtained
21 product was dried overnight in an oven and then transferred into a crucible with cover
22 to calcine at 500 °C for 4 h with a heating rate of 2.3 °C min^{-1} in a muffle furnace. After
23 cooling down to room temperature, the prepared product was ground into powder in an
24 agate mortar and washed with deionized water and ethanol for several times. Finally, it
25 was dried in vacuum at 80 °C for 6 h, as shown in Fig. S1.

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27 **Text S3. Characterization**

28 The prepared pure g- C_3N_4 , cobalt oxide, fresh Co-CN and used Co-CN were
29 characterized by several methods. The X-ray diffraction (XRD) patterns were collected
30 from a Panalytical Empyrean powder X-ray diffractometer (Ultima IV, PANalytical,
31 Holland) with a Cu $\text{K}\alpha$ radiation ($\lambda = 1.5406$ nm) in the 2θ range from 10° to 80°. The
32 surface morphology and element mapping of samples were analyzed by a scanning

33 electron microscope (SEM, ZEISS Gemini 300, Carl Zeiss, Germany) coupled with an
34 energy diffraction spectrum (EDS, OXFORD Xplore, OXFORD, UK). The specific
35 surface areas of samples were calculated by Brunauer–Emmett–Teller (BET) method
36 based on the N₂ adsorption-desorption measurement using a physisorption analyzer
37 (ASAP2460, Micromeritics, USA). X-ray photoelectron spectroscopy (XPS, Thermo
38 Scientific K-Alpha, Thermo, USA) was used to investigate the elemental composition
39 of samples.

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41 **Text S4. Analysis**

42 SMX concentration was analyzed using a high performance liquid chromatograph
43 (HPLC, LC-2030, Shimadzu, Japan). The mobile phase was methanol and 0.1% acetic
44 acid water solution (v/v = 35/65) at a flow rate of 1 mL min⁻¹. The column temperature
45 and the wavelength of UV detector were set at 30 °C and 270 nm, respectively, with
46 the injection volume of 20 μL. The degradation products of SMX were determined by
47 an ultra performance liquid chromatograph coupled with a quadrupole time-of-flight
48 mass spectrometer (UPLC-Q-TOF-MS, Quattro Premier XE, Waters, USA) with a C18
49 reversed-phase column (50 × 2.1 mm, 1.7 μm). The mobile phase contained A (0.1%
50 formic acid water solution) and B (acetonitrile) at a flow rate of 0.5 mL min⁻¹. The
51 gradient was 90% A and 10% B for 0.2 min, linearly increasing to 5% A and 95% B in
52 4.3 min, maintaining for 0.5 min, and then decreasing back to 90% A and 10% B in 2
53 min.

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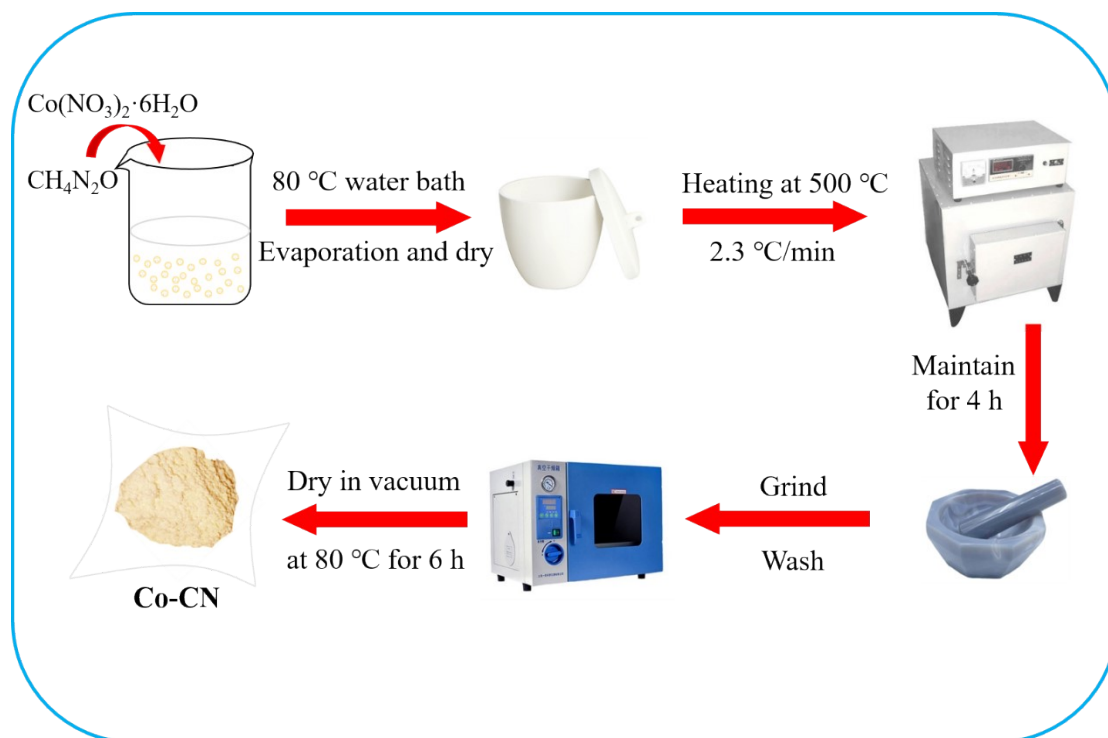
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58 Table S1. The weight percentages of C, N and Co in g-C₃N₄ and Co-CN

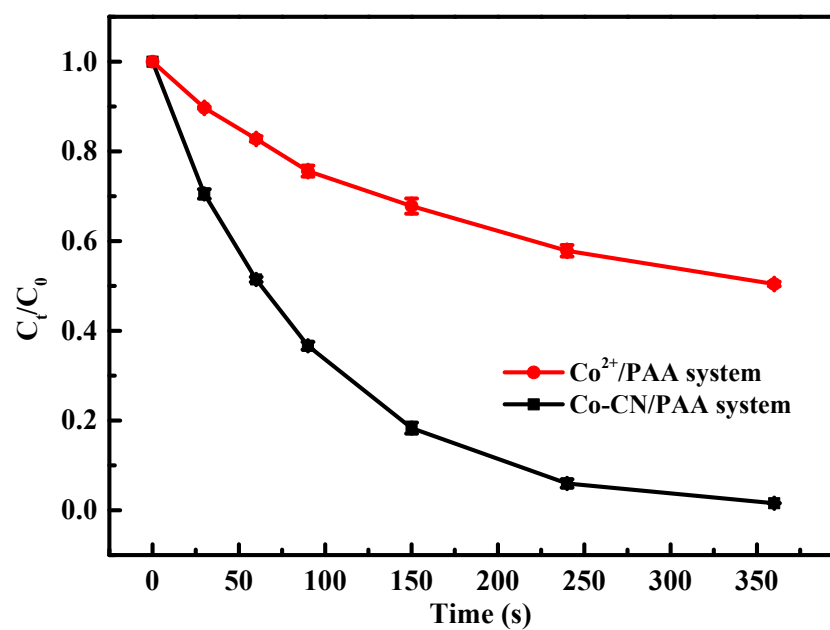
Product	Weight percentage (%)		
	C	N	Co
g-C ₃ N ₄	39.06	60.94	/
Co-CN-0.5	38.65	58.97	2.38
Co-CN-1	38.86	57.09	4.05
Co-CN-1.5	39.61	52.92	7.47
Co-CN-2	41.14	50.73	8.13
Co-CN-5	31.08	46.39	22.53



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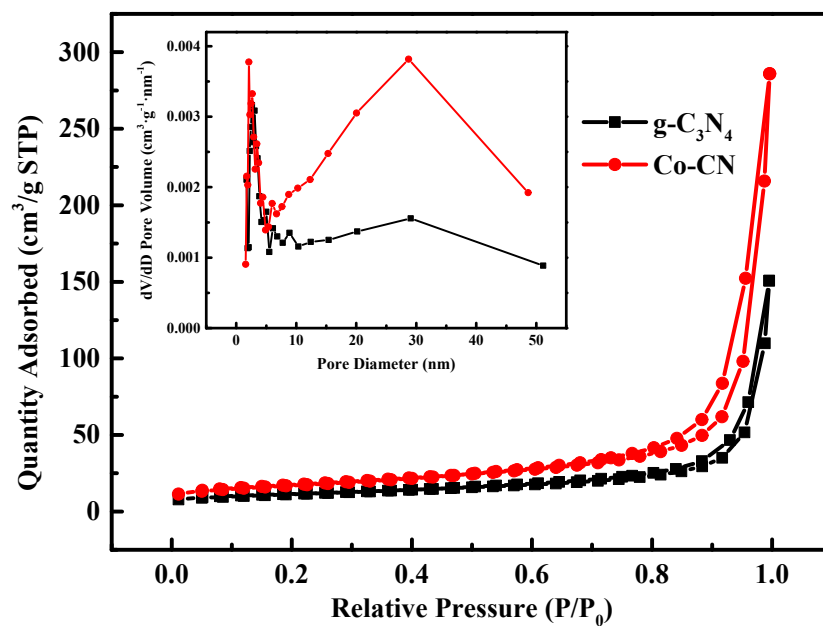
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Fig. S1 The synthesis procedure of Co-CN.



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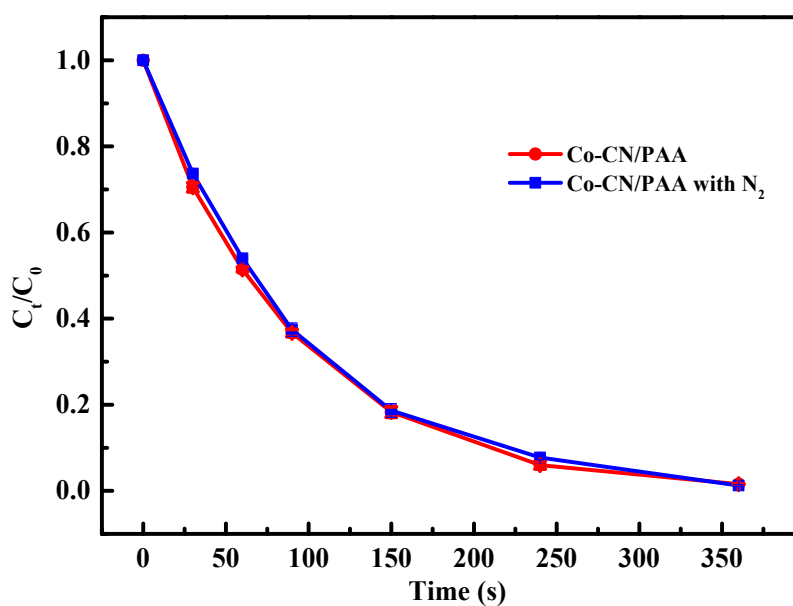
63 Fig. S2 SMX degradation by different systems. Experimental conditions: $[\text{PAA}]_0 = 0.1 \text{ mM}$,
 64 $[\text{Co}^{2+}]_0 = 20 \mu\text{g L}^{-1}$, $[\text{catalyst}]_0 = 50 \text{ mg L}^{-1}$, $[\text{SMX}]_0 = 5 \mu\text{M}$, $\text{pH}_0 = 6.5$, $T = 25 \text{ }^\circ\text{C}$.



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66 **Fig. S3** N_2 adsorption–desorption isotherm curves and the corresponding pore-size
 67 distribution curves obtained by the BJH method.

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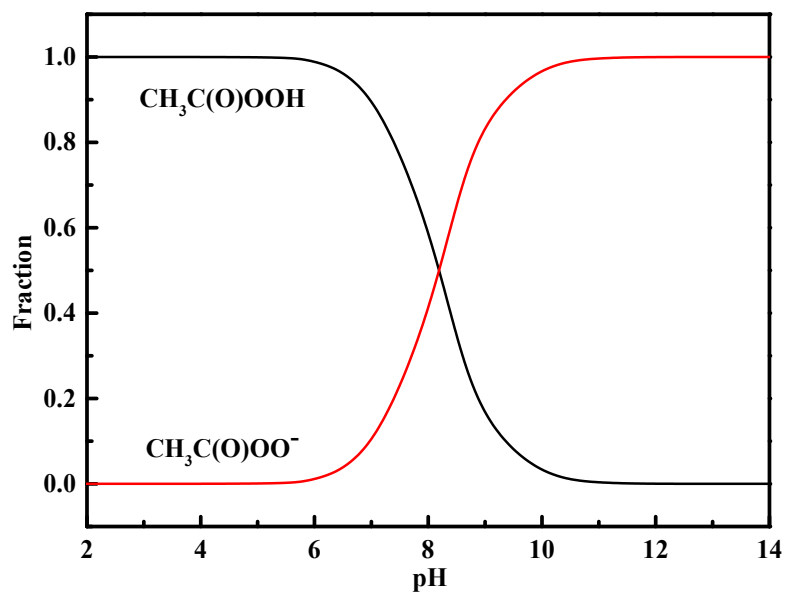


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70 **Fig. S4** Degradation of SMX in Co-CN/PAA system under N_2 atmosphere. Experimental
 71 conditions: $[\text{PAA}]_0 = 0.1 \text{ mM}$, $[\text{catalyst}]_0 = 50 \text{ mg L}^{-1}$, $[\text{SMX}]_0 = 5 \text{ }\mu\text{M}$, $\text{pH}_0 = 6.5$, $T = 25 \text{ }^\circ\text{C}$.

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Fig. S5 Speciation diagram of PAA.

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77 References

78 1 M. Xie, J. Tang, L. Kong, W. Lu, V. Natarajan, F. Zhu and J. Zhan, Cobalt doped g-
79 C_3N_4 activation of peroxymonosulfate for monochlorophenols degradation, *Chem.*
80 *Eng. J.*, 2019, **360**, 1213-1222.

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