Supporting information for

The determination of 11 sulfonamide antibiotics in water and foods by developing N-rich structure magnetic covalent organic framework combined with ultra-high performance liquid chromatography-tandem mass spectrometry

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Table S1. The basic properties of 11 sulfonamides antibiotics.

Sulfonamides antibiotics	CAS	Molecular formula	Molecular mass	Purity (%)
Sulfamethoxypyridazine	80-35-3	$C_{11}H_{12}N_4O_3S$	280.30	99.7
Sulfameter	651-06-9	$C_{11}H_{12}N_4O_3S$	280.30	99.0
Sulfamonomethoxine	1220-83-3	$C_{11}H_{12}N_4O_3S$	280.30	97.9
Sulfachlorpyridazine	80-32-0	$C_{10}H_9ClN_4O_2S$	284.72	99.1
Sulfadoxine	2447-57-6	$C_{12}H_{14}N_4O_4S$	310.33	99.1
Sulfamethoxazole	723-46-6	$C_{10}H_{11}N_3O_3S$	253.28	99.5
Sulfisoxazole	127-69-5	$C_{11}H_{13}N_3O_3S$	267.30	99.8
Sulfabenzamide	127-71-9	$C_{13}H_{12}N_2O_3S$	276.31	99.2
Sulfadimethoxine	122-11-2	$C_{12}H_{14}N_4O_4S$	310.33	99.4
Sulfaquinoxaline	59-40-5	$C_{14}H_{12}N_4O_2S$	300.34	98.9
Sulfanitran	122-16-7	$C_{14}H_{13}N_3O_5S$	335.34	98.9

Table S2. The mass conditions of 11 sulfonamides antibiotics.

Compounds	Retention time (min)	Precursor ion (m/z)	Declustering potential (V)	Product ion (m/z)	Collision energy (eV)
Sulfamethoxypyridazine	3.20	281.0	83.2/77.9	156.2*/92.1	24.0/37.9
Sulfameter	3.44	281.1	55.0/61.1	156.1*/108.2	24.9/33.2
Sulfamonomethoxine	3.92	281.1	56.9/18.1	156.2*/108.2	24.2/35.1
Sulfachlorpyridazine	4.53	285.1	82.0/83.1	156.2*/108.1	21.6/34.0
Sulfadoxine	5.15	311.1	82.1/73.1	156.0*/108.1	24.1/33.0
Sulfamethoxazole	5.24	254.1	106.9/84.9	156.1*/108.2	22.3/31.8
Sulfisoxazole	5.97	268.0	87.7/100.2	156.2*/113.0	19.6/21.8
Sulfabenzamide	7.30	277.1	72.9/76.9	156.1*/92.0	17.8/38.8
Sulfadimethoxine	7.68	311.2	55.0/39.8	156.2*/108.1	27.4/37.9
Sulfaquinoxaline	7.72	301.1	38.0/47.9	156.0*/92.1	23.2/39.7
Sulfanitran	8.51	336.3	155.2/153.8	156.2*/294.0	17.1/16.9

* Quantitative ion.

Table S3 Matrix effects of the sulfonamide antibiotics in eggs.

Compounds	ME (%)	
	Surface waters	Eggs
Sulfamethoxypyridazine	110.04	84.39
Sulfameter	109.11	82.70
Sulfamonomethoxine	110.94	81.18
Sulfachloropyridazine	105.97	94.49
Sulfadoxine	112.35	95.22
Sulfamethoxazole	106.72	101.29
Sulfisoxazole	98.88	106.01
Sulfabenzamide	103.41	109.08
Sulfadimethoxine	98.82	115.57
Sulfaquinoxaline	106.68	112.07
Sulfanitran	91.36	98.36

Table S4 The recoveries and RSDs of 11 kinds of SAs in surface waters (n=7).

Compounds	Spike level 2 μg·L^{-1}		Spike level 4 μg·L^{-1}		Spike level 20 μg·L^{-1}	
	Recovery (%)	RSD (%)	Recovery (%)	RSD (%)	Recovery (%)	RSD (%)
Sulfamethoxypyridazine	89.4	4.07	96.6	2.18	81.5	1.59
Sulfameter	80.4	3.66	91.0	3.12	83.6	1.55
Sulfamonomethoxine	85.4	3.90	92.9	2.49	79.2	2.10
Sulfachloropyridazine	86.8	4.04	99.4	3.19	92.6	2.27
Sulfadoxine	82.4	4.22	93.1	3.48	84.5	2.01
Sulfamethoxazole	78.5	3.78	87.1	3.30	76.3	2.87
Sulfisoxazole	79.2	3.14	82.2	2.55	76.6	4.39
Sulfabenzamide	74.3	3.24	82.2	1.86	78.1	2.96
Sulfadimethoxine	87.6	4.43	96.6	2.05	94.4	3.25
Sulfaquinoxaline	89.4	5.01	102.6	3.08	94.3	3.68
Sulfanitran	93.3	3.65	105.0	8.17	107.2	4.70

Table S5 The recoveries and RSDs of 11 kinds of SAs in eggs (n=7).

Compounds	Spike level 10 μg·kg^{-1}		Spike level 20 μg·kg^{-1}		Spike level 100 μg·kg^{-1}	
	Recovery (%)	RSD (%)	Recovery (%)	RSD (%)	Recovery (%)	RSD (%)
Sulfamethoxypyridazine	77.8	4.62	76.4	5.21	79.4	3.50
Sulfameter	75.6	2.59	77.1	6.56	78.7	2.50
Sulfamonomethoxine	75.5	3.20	80.1	5.10	77.2	3.29
Sulfachloropyridazine	78.8	4.26	79.6	2.57	75.1	6.76
Sulfadoxine	89.2	2.50	84.2	3.65	78.2	7.12
Sulfamethoxazole	78.0	5.82	76.6	6.36	75.9	3.91
Sulfisoxazole	85.1	8.05	79.4	6.67	76.2	6.46
Sulfabenzamide	83.9	3.82	78.2	7.82	79.6	9.56
Sulfadimethoxine	97.5	2.68	101.3	4.76	84.6	4.76
Sulfaquinoxaline	95.6	6.37	94.0	3.45	80.7	2.18
Sulfanitran	97.7	5.93	93.8	7.85	102.5	4.65

Fig. S1. Effects of the main parameters for MSPE and extraction performance of the Fe_3O_4@SiO_2@PDE-TATP-COF on the recovery for sulfonamide antibiotics. Note: Error bar shows the standard deviation (n=3). (A) Sample solution pH; (B) Salt concentration; (C) extraction time; (D) the type of the desorption solvents; (E) volume of the desorption solvent; (F) desorption time.

Sulfamethoxypyridazine Sulfameter Sulfamonomethoxine Sulfachloropyridazine Sulfadoxine Sulfamethoxazole Sulfisoxazole Sulfabenzamide Sulfadimethoxine Sulfaquinoxaline Sulfanitran

Table S6 Adsorption of different types of analytes with Fe_3O_4@SiO_2@PDE-TATP-COF

Analytes		Log K_{ow}[a]	Recovery (%)
Sulfonamide antibiotics	Sulfamethoxypyridazine	0.32	84.4
	Sulfameter	0.42	84.7
	Sulfamonomethoxine	-0.04	81.9
	Sulfachloropyridazine	3.25	89.8
	Sulfadoxine	0.34	90.5
	Sulfamethoxazole	0.89	78.8
	Sulfisoxazole	1.01	84.4
	Sulfabenzamide	1.19	83.1
	Sulfadimethoxine	1.48	98.5
	Sulfaquinoxaline	1.58	104.4
	Sulfanitran	4.10	108.7
Nitroimidazole antibiotics	Hydroxymetronidazole	-0.9	0.4
	2-Methyl-4-nitroimidazole	1.15	8.1
	2-Dimethyl-5-nitro-1H-imidazole-1-ethanol	0.33	9.5
Quinolone antibiotics	Pipemidic acid	-0.16	13.1
	Norfloxacin	0.82	11.3

[a]Log K_{ow}: octanol/water partition coefficient.

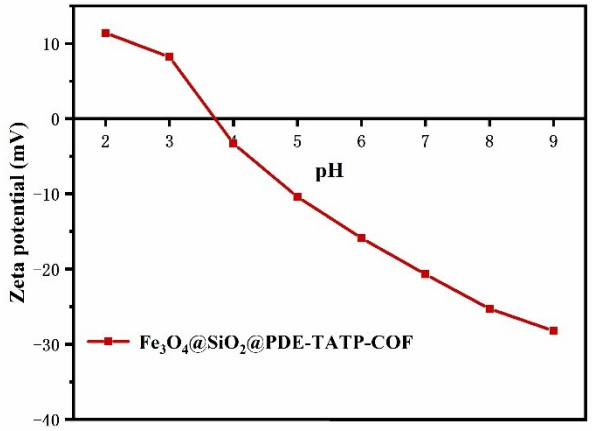

Fig.S2. Characterization of Zeta potential the Fe_3O_4@@SiO_2@PDE-TAPB-COF