Supporting information

A sensitive fluorescent sensor based on terpyridine@Zn^{2+} modified mesoporous silica for the detection of sulfonamide antibiotics

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Table S1 BET surface area (S_{BET}),Total pore volume (V_{total}) and average pore diameters (D_{BJH}) for ATpy@Zn–SBA–15 calculated from the N_2 adsorption–desorption isotherms

Sample	S_{BET} （m^2/g）	V_{total}(cm^3/g)	D_{BJH}（Å）
SBA–15[S1]	486	1.24	102.0
ATpy@Zn–SBA–15	332	0.96	110.5

Table S2 The fluorescence decay parameters of ATpy@Zn–SBA–15 in the absence and presence of STZ and SMT

Samples	T_1 (ns)	B_1	T_2 (ns)	B_2	τ (ns)
ATpy@Zn–SBA–15	1.97	0.2062	25.41	0.0020	2.20
ATpy@Zn–SBA–15@STZ	2.57	0.1582	127.21	0.0024	4.47
ATpy@Zn–SBA–15@SMT	2.41	0.1713	123.26	0.0028	4.32

Table S3 Energy of HOMO and LUMO of ATpy@Zn–SBA–15 and SAs

	ATpy@Zn^{2+}	STZ	SMT	SCP	SMR	SMP
pKa		2.0; 7.24	2.1; 5.3	1.87; 5.45	2.22; 6.80	2.2; 7.2
HOMO (eV)	-2.68	-5.99	-6.49	-6.29	-6.25	-6.08
LUMO (eV)	-1.51	-1.77	-2.34	-1.76	-1.21	-1.45
Eg (eV)	1.17	4.21	4.15	4.53	5.04	4.63

Table S4 Comparison of the sensing and adsorption performance for different sulfonamide antibiotics from water by different materials

Materials	Methods	SAs	LOD	pH range	Application	Refs.
ATpy@Zn-SBA-15	Fluorescence	STZ	0.17 μM	2.0-13.0	Tap water and milk	This work
		SMT	0.63 μM			
		SCP	0.52 μM			
		SMR	0.57 μM			
		SMP	0.54 μM			
N, B, F-CDs	Fluorescence	STZ	5.5 ng L^{-1}	3.0-10.0	Soil, river water, milk and egg	[S2]
FCS-1	Fluorescence	SCP STZ	NA	3.0-9.0	NA	[S3]
Cu NCs	Fluorescence	STZ	0.23 μg mL^{-1}	8.5	Honey and milk	[S4]
Microspheres	HPLC	SMR	NA	5.0	Milk and egg	[S5]
MIPs	HPLC	STZ, etc	0.013 μg L^{-1}	7.0	Lake water and well water	[S6]
PAN/Tp-BD	HPLC	SCP SMP	0.18 ng L^{-1} 0.10 ng L^{-1}	4.0	Chicken and fish	[S7]

LOD: Limit of detection; NA: Not available; NCs: Nanoclusters

References

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[S2]. Chen L, Liu Y, Cheng G, Fan Z, Yuan J, He S, Zhu G (2021) A novel fluorescent probe based on N, B, F co-doped carbon dots for highly selective and sensitive determination of sulfathiazole. Sci Total Environ 759: 143432.

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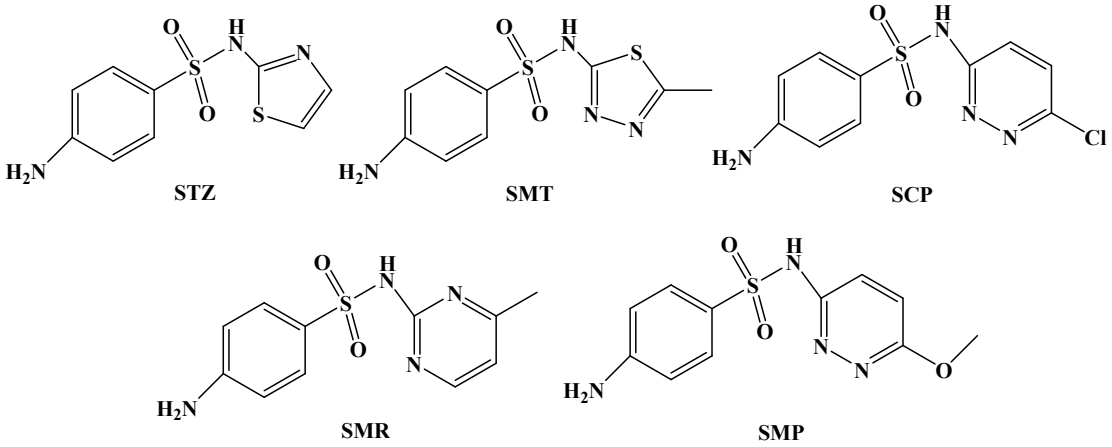

Fig. S1 Molecular structures of SAs

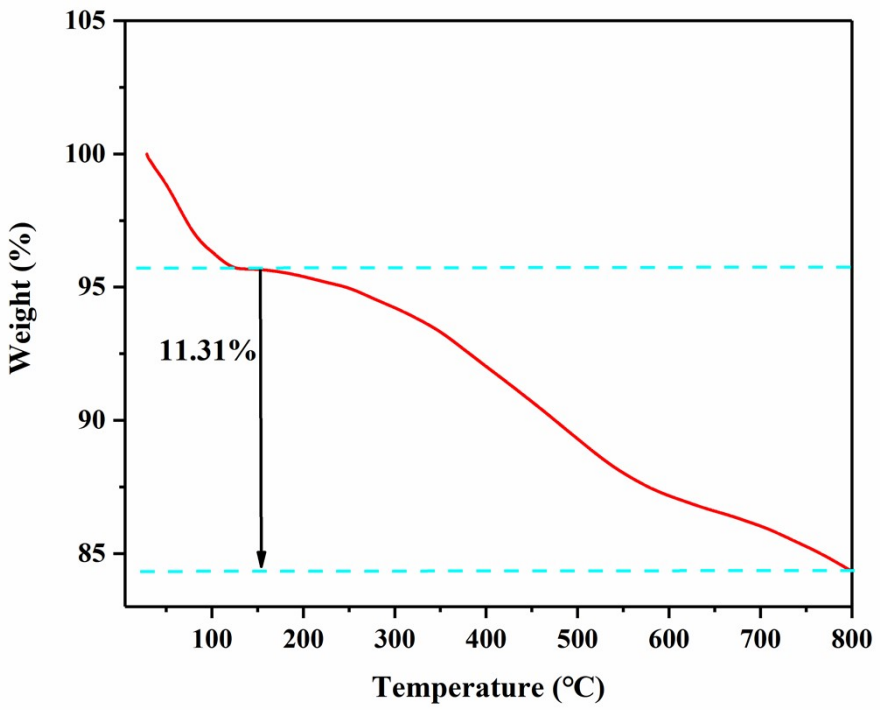

Fig. S2 The TGA curve of ATpy@Zn–SBA–15

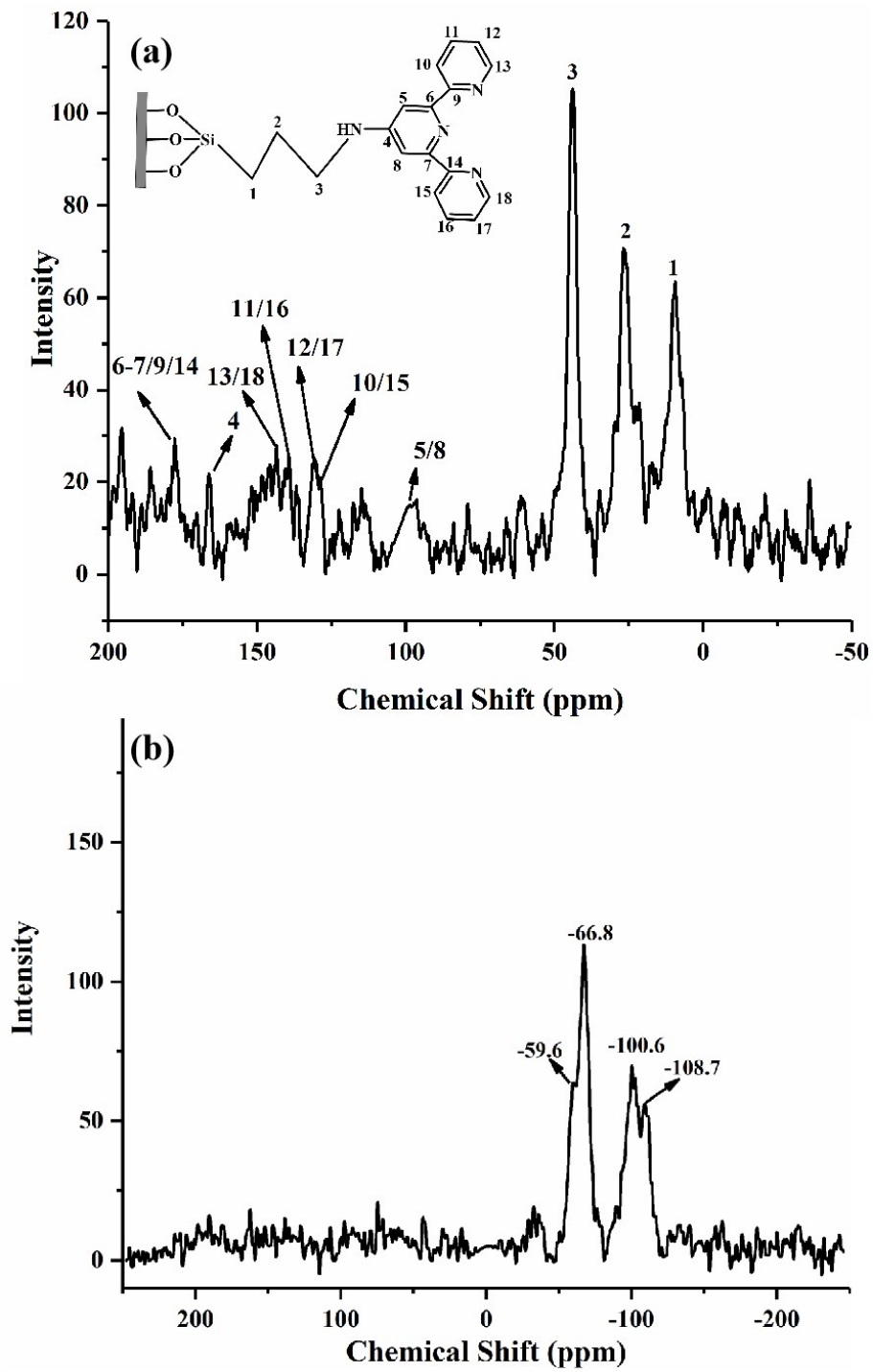

Fig. S3 (a) ^{13}C CP MAS NMR and (b)^{29}Si CP MAS NMR spectra of CTY@SBA.

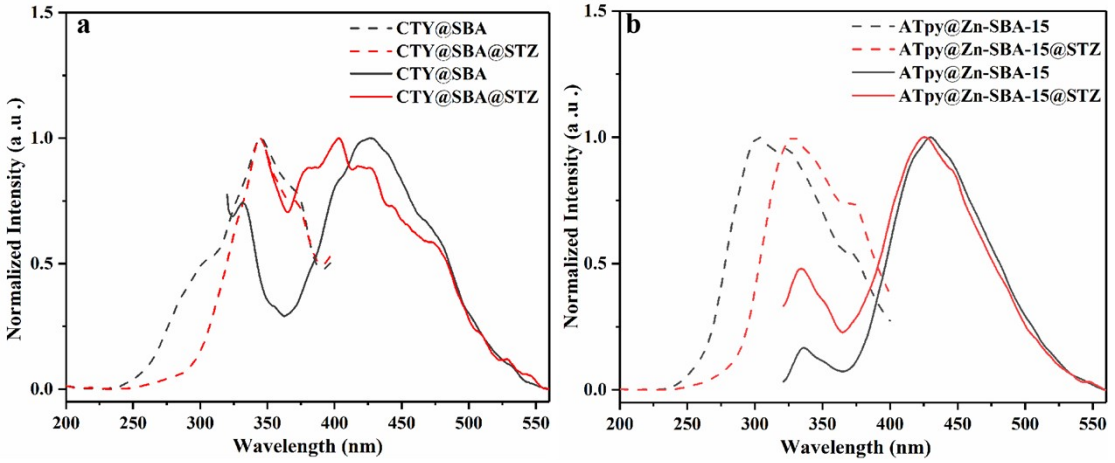

Fig. S4 The normalized excitation and emission spectra of (a) CTY@SBA (0.05 g L^{-1}) and CTY@SBA@STZ (0.05 g L^{-1}–2.0×10^{-4} M); (b) ATpy@Zn–SBA–15 (0.05 g L^{-1}) and ATpy@Zn–SBA–15@STZ (0.05 g L^{-1}–2.0×10^{-4} M) in aqueous solution (20 mM HEPES buffer, pH = 7.0)

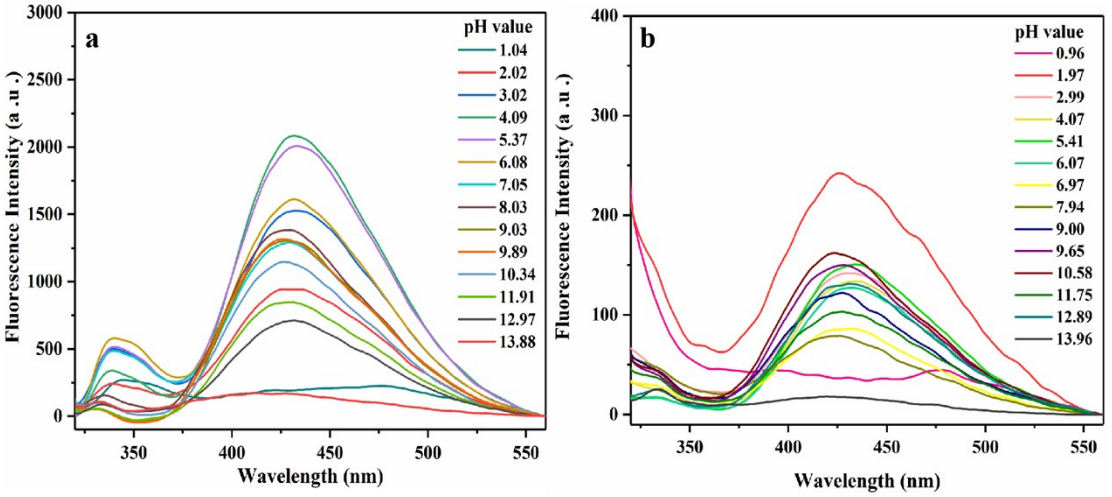

Fig. S5 Fluorescence spectra of ATpy@Zn–SBA–15 (0.05 g/L) in the absence (a) and presence (b) of STZ (2.0×10^{-4} M) at different pH values.

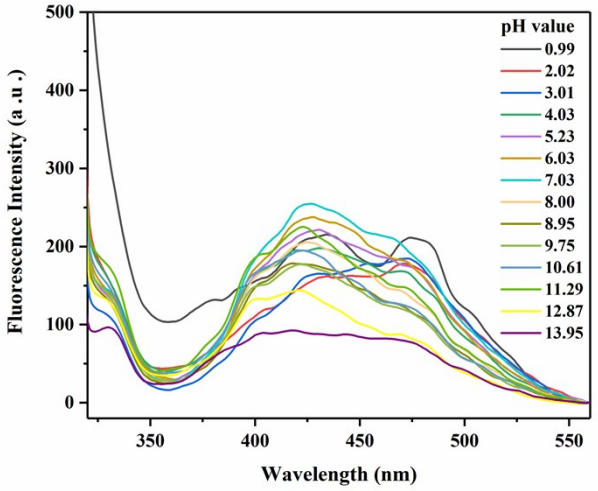

Fig. S6 Fluorescence spectra of CTY@SBA (0.05 g/L) at different pH values.

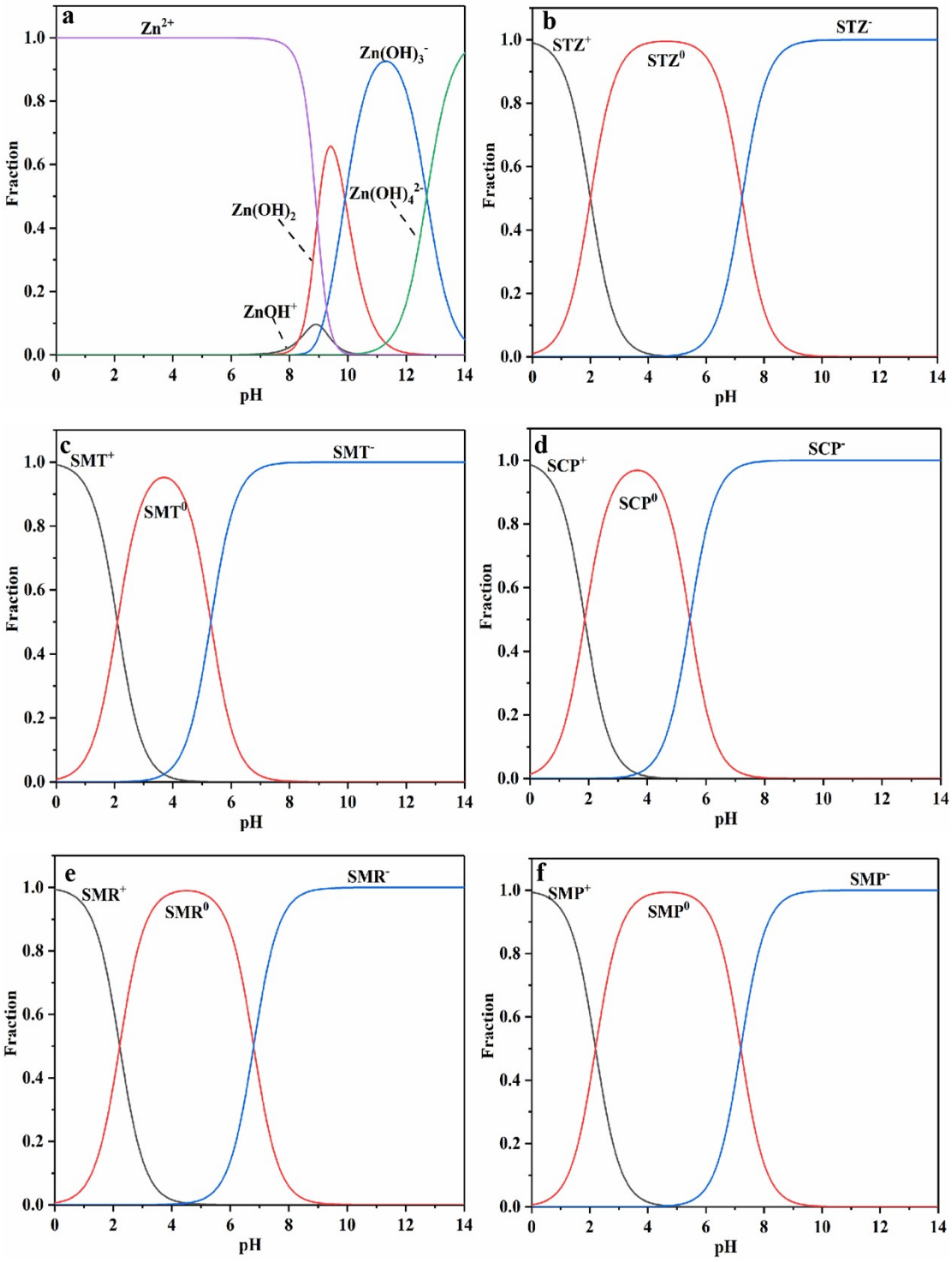

Fig. S7 Distribution coefficient plot of Zn (a), STZ (b), SMT (c), SCP (d), SMR (e) and SMP (f) as a function of solution pH.

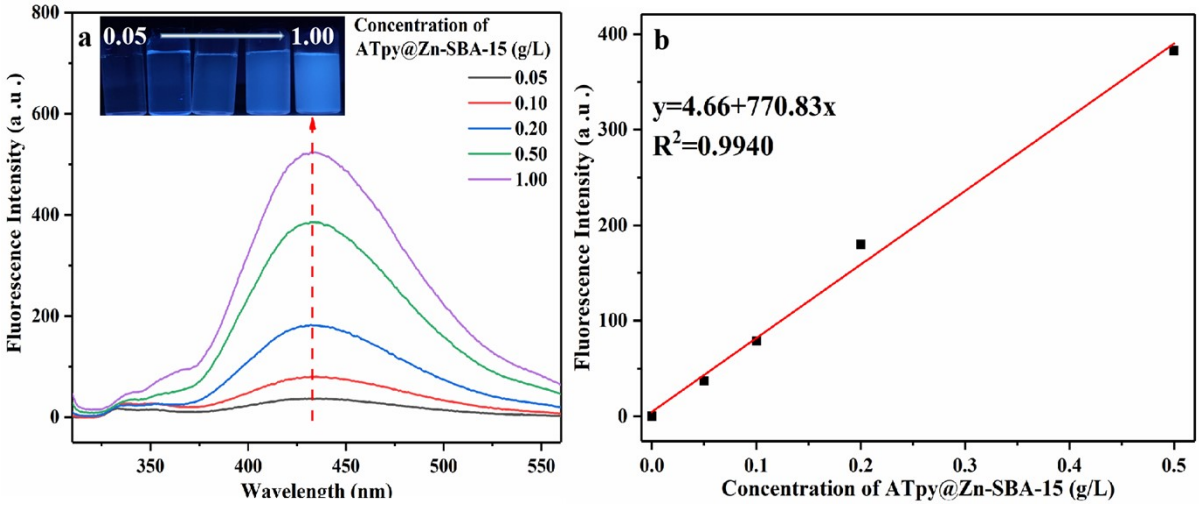

Fig. S8 (a) The fluorescence spectra of ATpy@Zn–SBA–15 (0.05–1.00 g/L) in aqueous solution (20 mM HEPES buffer, pH = 7.0) (λ_{ex} = 298 nm; slit: 3/5 nm); Inset: fluorescence images of different concentrations of ATpy@Zn–SBA–15 under 365 nm UV irradiation; (b) fluorescence intensity at 429 nm versus the concentration of ATpy@Zn–SBA–15

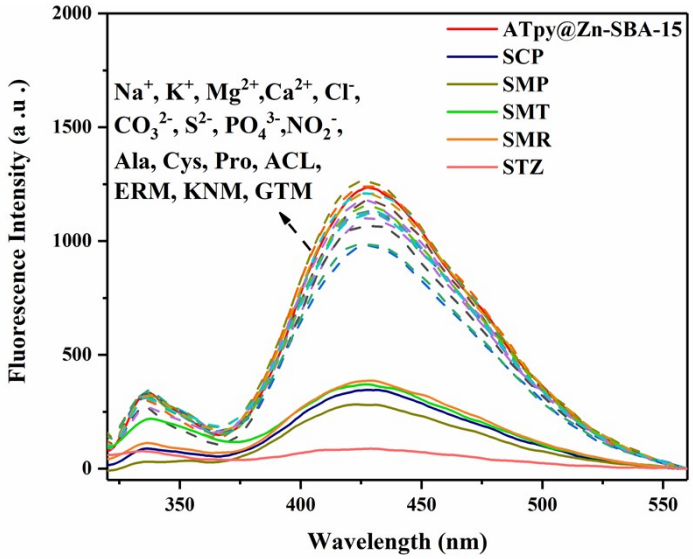

Fig. S9 Fluorescence emission spectra of ATpy@Zn–SBA–15 (0.05 g/L) in the presence of various metal cations, anions, amino acid and antibiotics (2.0×10^{-4} M) (20 mM HEPES buffer, pH = 7.0).

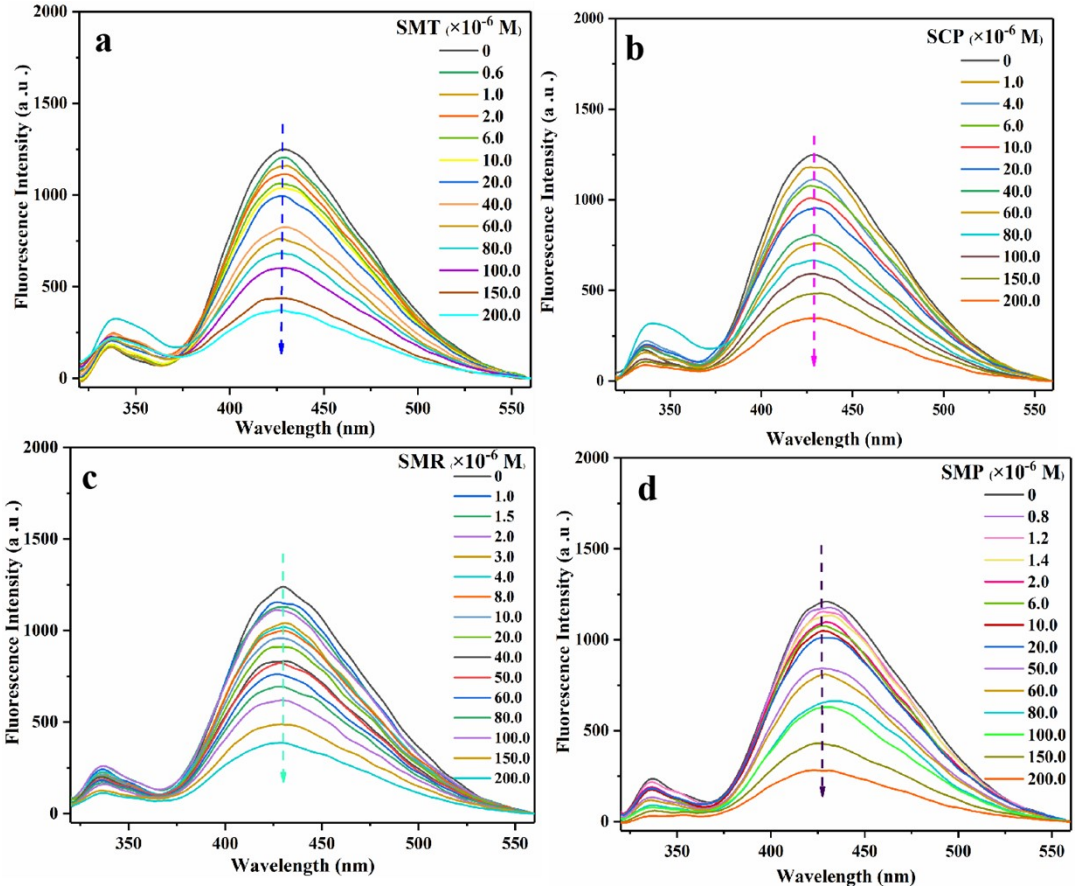

Fig. S10 The fluorescence spectra of ATpy@Zn–SBA–15 (0.05 g/L) in the presence of different concentrations of (a) SMT (0–2.0×10^{-4} M), (b) SCP (0–2.0×10^{-4} M), (c) SMR (0–2.0×10^{-4} M) and (d) SMP (0–2.0×10^{-4} M) (20 mM HEPES buffer, pH = 7.0).

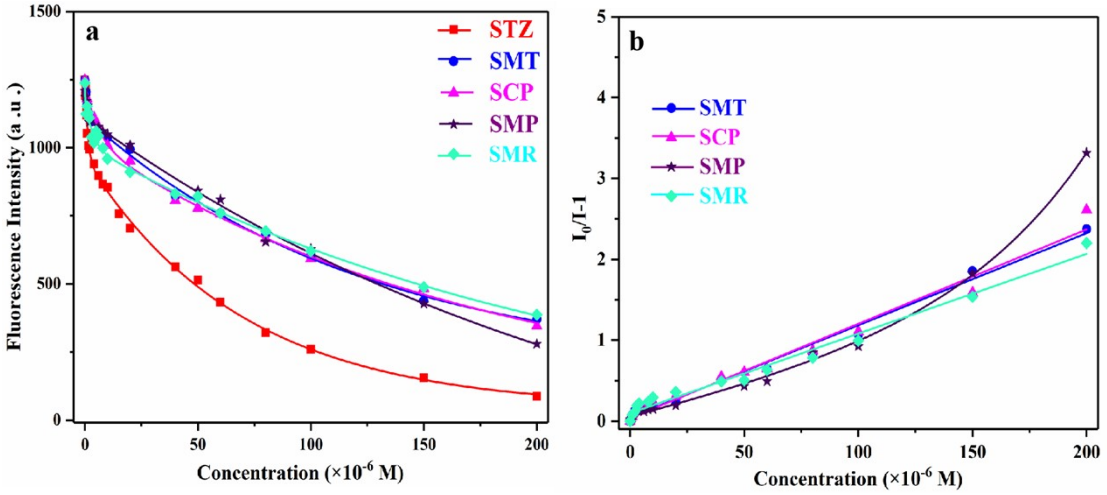

Fig. S11 (a) The fluorescence intensity of ATpy@Zn–SBA–15 (0.05 g L^{-1}) and (b) the Stern–Volmer curve towards SAs at 429 nm in aqueous solution (20 mM HEPES buffer, pH = 7.0)

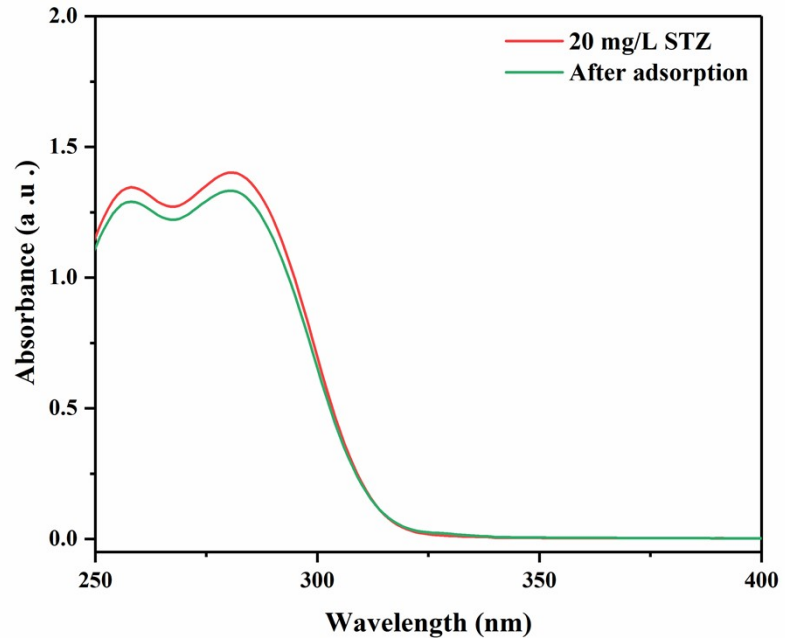

Fig. S12 UV–Vis spectra for the adsorption of ATpy@Zn–SBA–15 toward STZ (W= 5 mg; V = 10 mL; C_0 = 20 mg/L) after 6 h.

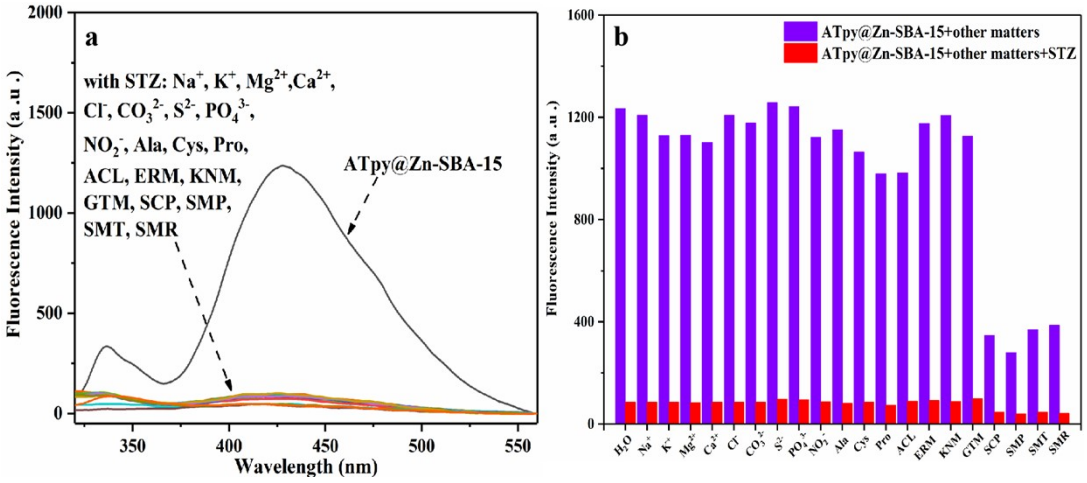

Fig. S13 (a) Fluorescence spectra and (b) the caomparison of fluorescence intensity of ATpy@Zn–SBA–15@STZ (0.05 g/L – 2.0×10^{-4} M) in the presence of metal ions, anions, amino acid and other antibiotics (2.0×10^{-4} M) at HEPES buffer (20 mM, pH=7.0)

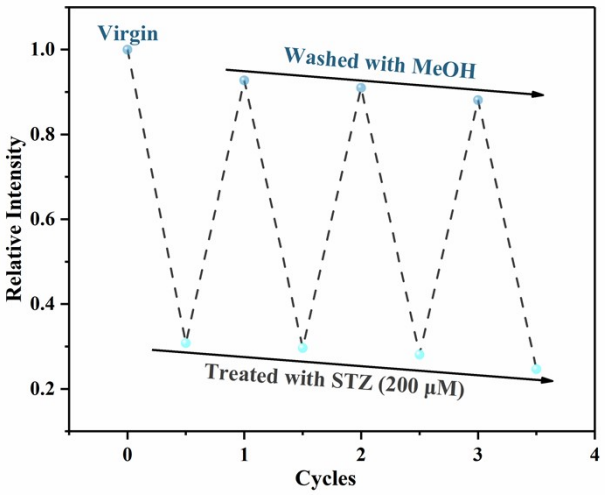

Fig. S14 Recycling performance of ATpy@Zn–SBA–15 aqueous suspension (1.0 g L^{-1}) for the fluorescence detection of STZ aqueous solution (200 μM) when excited at 298 nm.

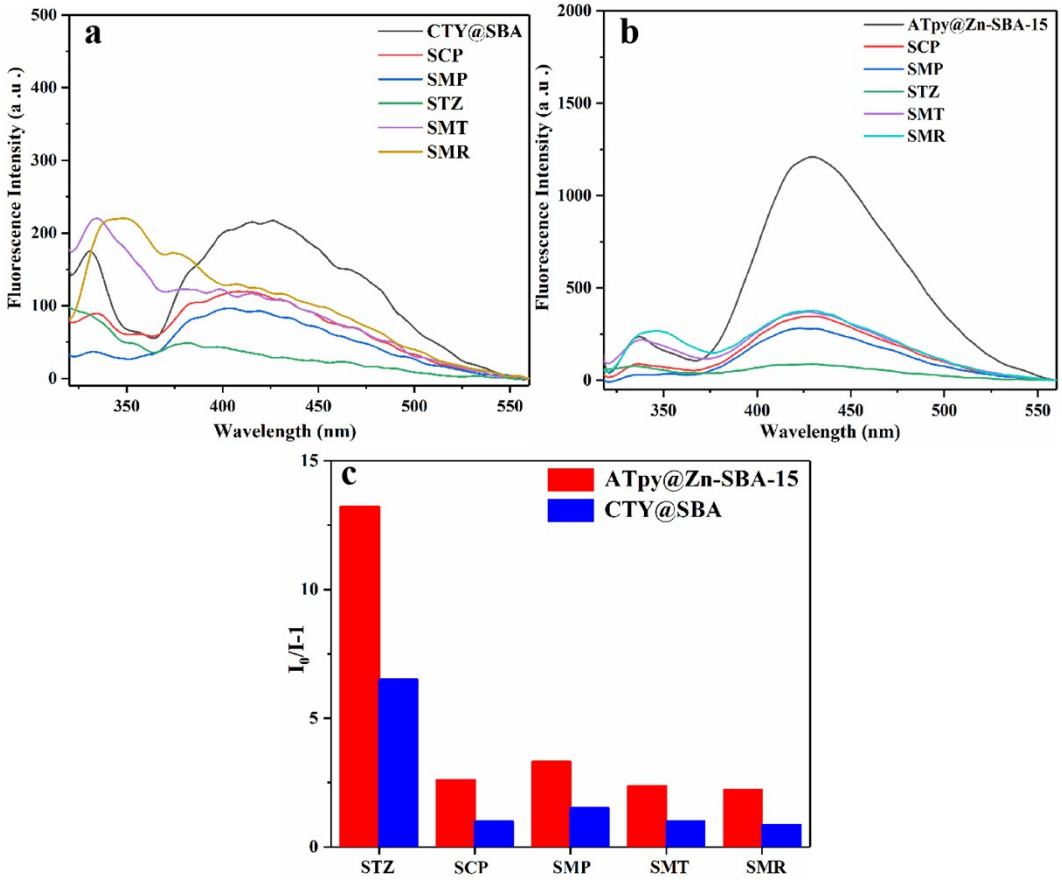

Fig. S15 (a) Fluorescence spectra of CTY@SBA (0.05 g/L) and (b) ATpy@Zn–SBA–15 (0.05 g/L) in the presence of SAs (2.0×10^{-4} M) in HEPES buffer (20 mM, pH=7.0); (c) response of CTY@SBA and ATpy@Zn–SBA–15 toward SAs (I_0 and I represent the fluorescence intensity at 429 nm in the absence and presence of each of SAs)

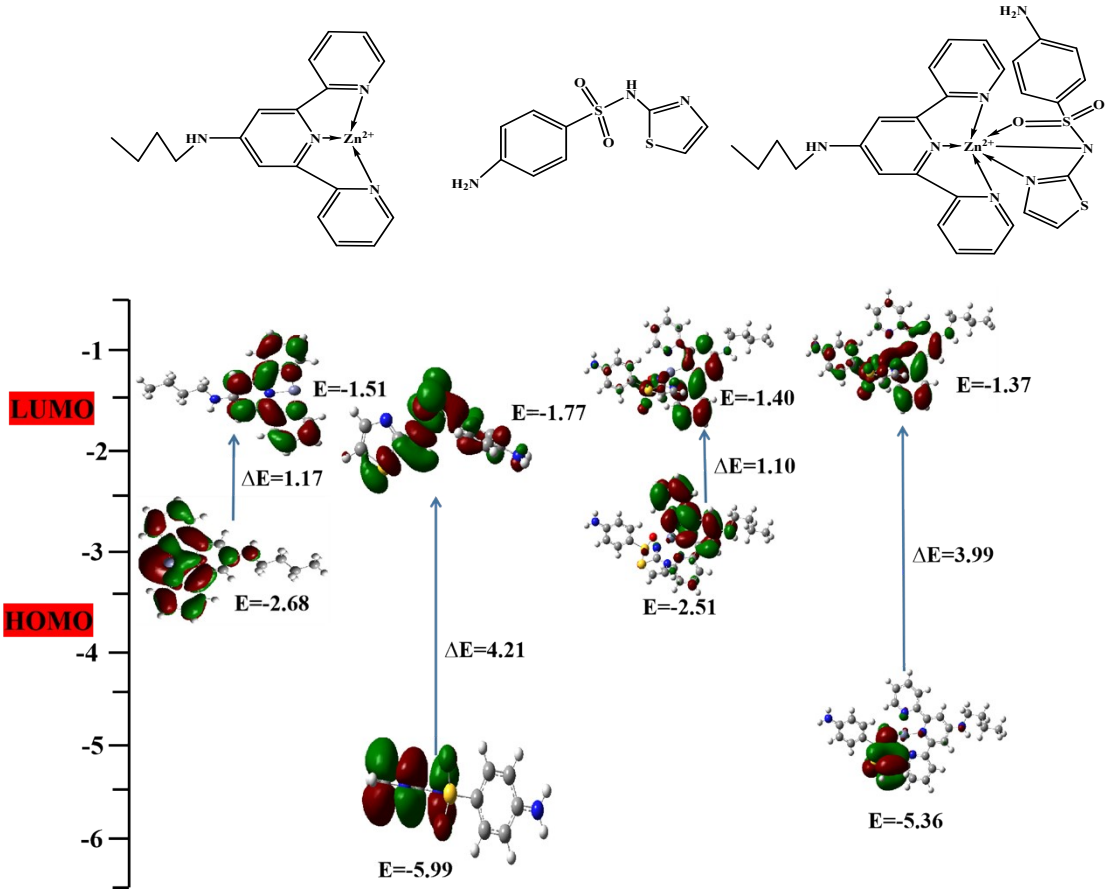

Fig. S16 Theoretical HOMO and LUMO energies for ATpy@Zn-SBA-15, STZ and ATpy@Zn-SBA-15@STZ