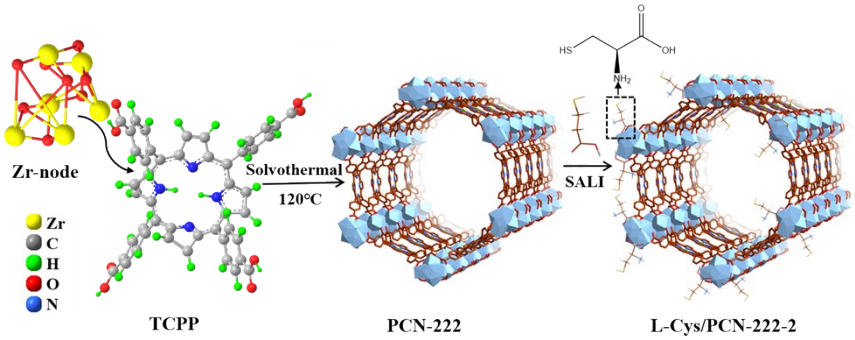


Fig. S1 Synthetic route of L-Cys/PCN-222-2 by SALI method

Tab. S1 Measurements of the fluorescence quantum yield of PCN-222 and L-Cys/PCN-2221, 2, 3

Types	F_s	A_s	QY_s
PCN-222	17116.5	0.030	6.94 %
L-Cys/PCN-222-1	15910.3	0.030	6.17 %
L-Cys/PCN-222-2	15200.4	0.030	5.71 %
L-Cys/PCN-222-3	14539.8	0.030	5.15 %

Tab. S2 Percentage of C, O, Zr and S elements in EDS of PCN-222 and L-Cys/PCN-222-2

Element Content	C (%)	O (%)	Zr (%)	S (%)
PCN-222	50.757	14.305	34.937	/
L-Cys/PCN-222-2	61.030	8.313	28.010	2.646

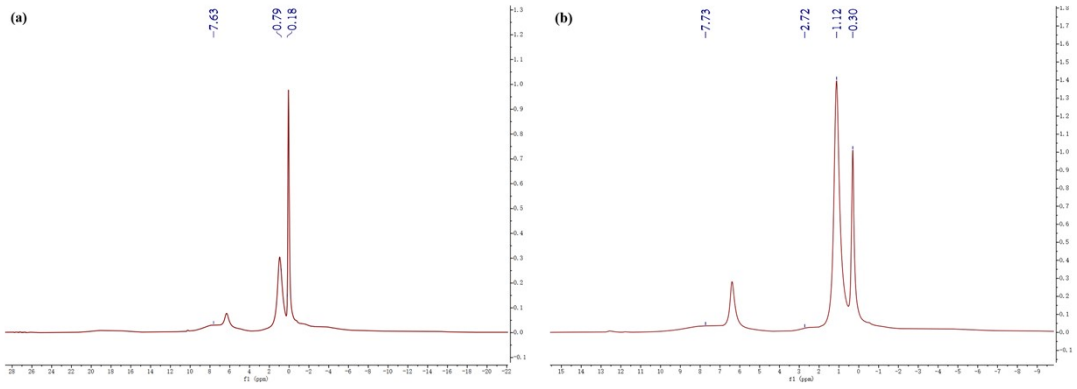


Fig. S2 Solid ^{1}H NMR spectra of PCN-222(a) and L-Cys/PCN-222(b)

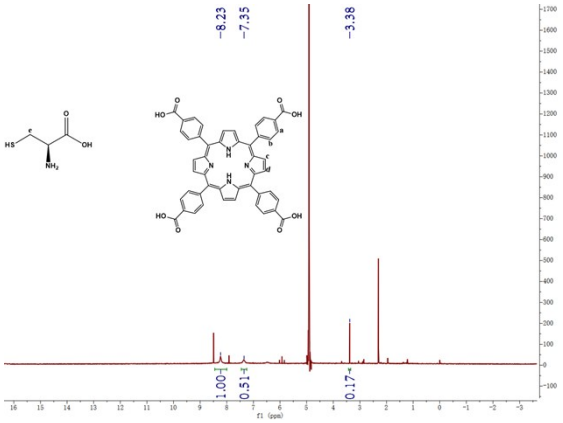


Fig. S3 Liquid ^{1}H NMR spectrum of digested L-Cys/PCN-222 with a 1:2.6 PCN-222:L-Cys loading

Tab. S3 The specific surface area, average pore size and pore volume of PCN-222 and L-Cys/PCN-222-2

Sample	BET (m^2 g^{-1})	D (nm)	V (cm^3 g^{-1})
PCN-222	1736	2.77	1.012
L-Cys/PCN-222-2	1720	2.53	0.969

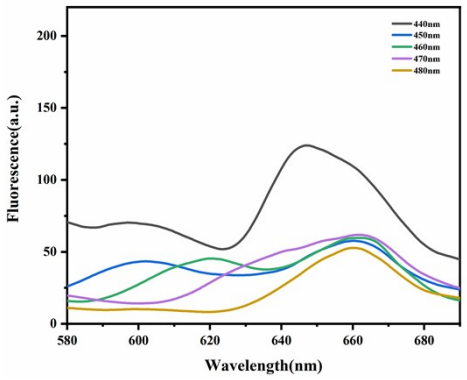


Fig. S4 The effects of excitation wavelengths on the fluorescence performance of TCPP

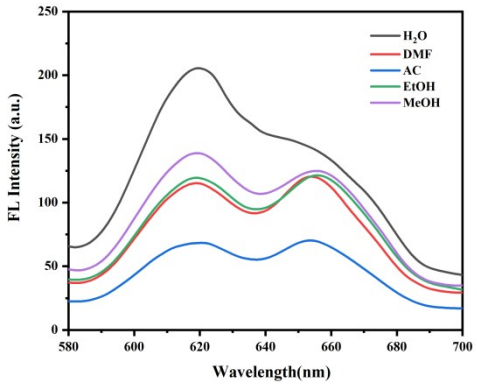
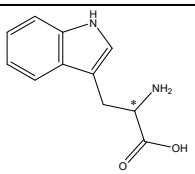
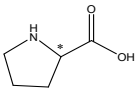
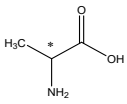
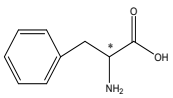
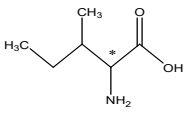
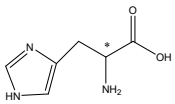
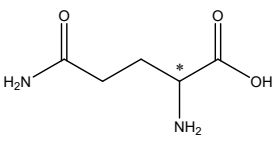
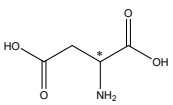
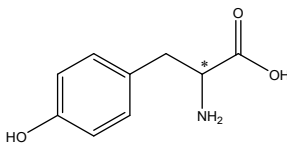
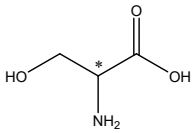
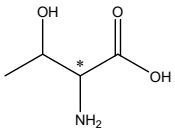
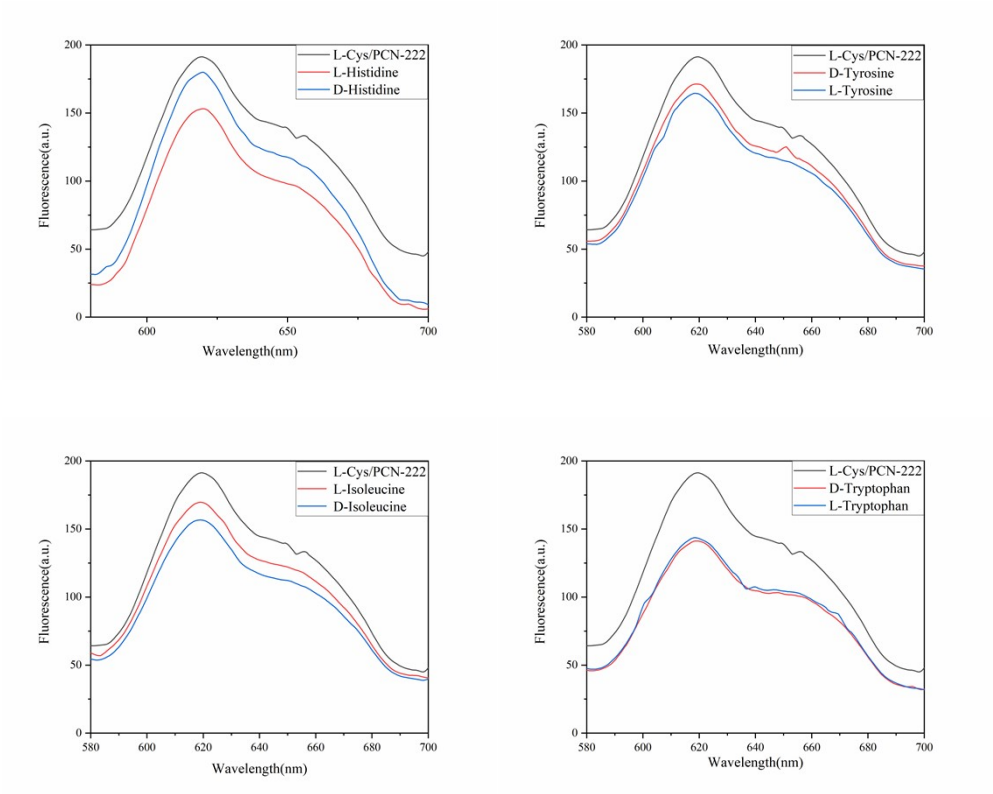


Fig. S5 The effects of solvent type on the fluorescence intensity of L-Cys/PCN-222-2 under the excitation wavelength at 460 nm

Tab.S4 The molecular structure，isoelectric point，Log P，molecular size (Å) and Q_R of 11 chiral amino acids

Category	Compound name	Molecular structure	Isoelectric point	*Log P*	Molecular size (Å)	Q_R	F_L/F_0 F_D/F_0
Hydrophobic amino acids	Tryptophan		5.89	-0.9	12.5×7.8×6.9	1.01	0.75 0.74
	Proline		6.30	0.15	8.3×5.5×5.5	1.01	0.86 0.85
	α-Alanine		6.00	1.8	7.1×6.2×4.5	1.00	0.86 0.86
	Phenylalanine		5.48	2.8	7.0×7.0×10.7	1.02	0.88 0.86
	Isoleucine		6.02	4.5	8.4×7.5×5.8	1.02	0.84 0.82
	Histidine		7.59	-3.2	5.7×7.0×6.9	1.10	0.97 0.88
	Glutamine		5.65	-3.5	9.8×7.0×5.6	1.02	0.84 0.82
Hydrophilic	Aspartic acid		2.97	-3.5	8.9×6.9×5.1	0.94	0.60

						0.64
Tyrosine		5.66	-1.3	11.8×6.1×6.1	0.96	0.86 0.90
Serine		5.68	-0.8	4.9×6.4×7.5	1.01	0.81 0.80
Threonine		5.60	-0.7	5.3×6.0×7.6	1.03	0.82 0.80



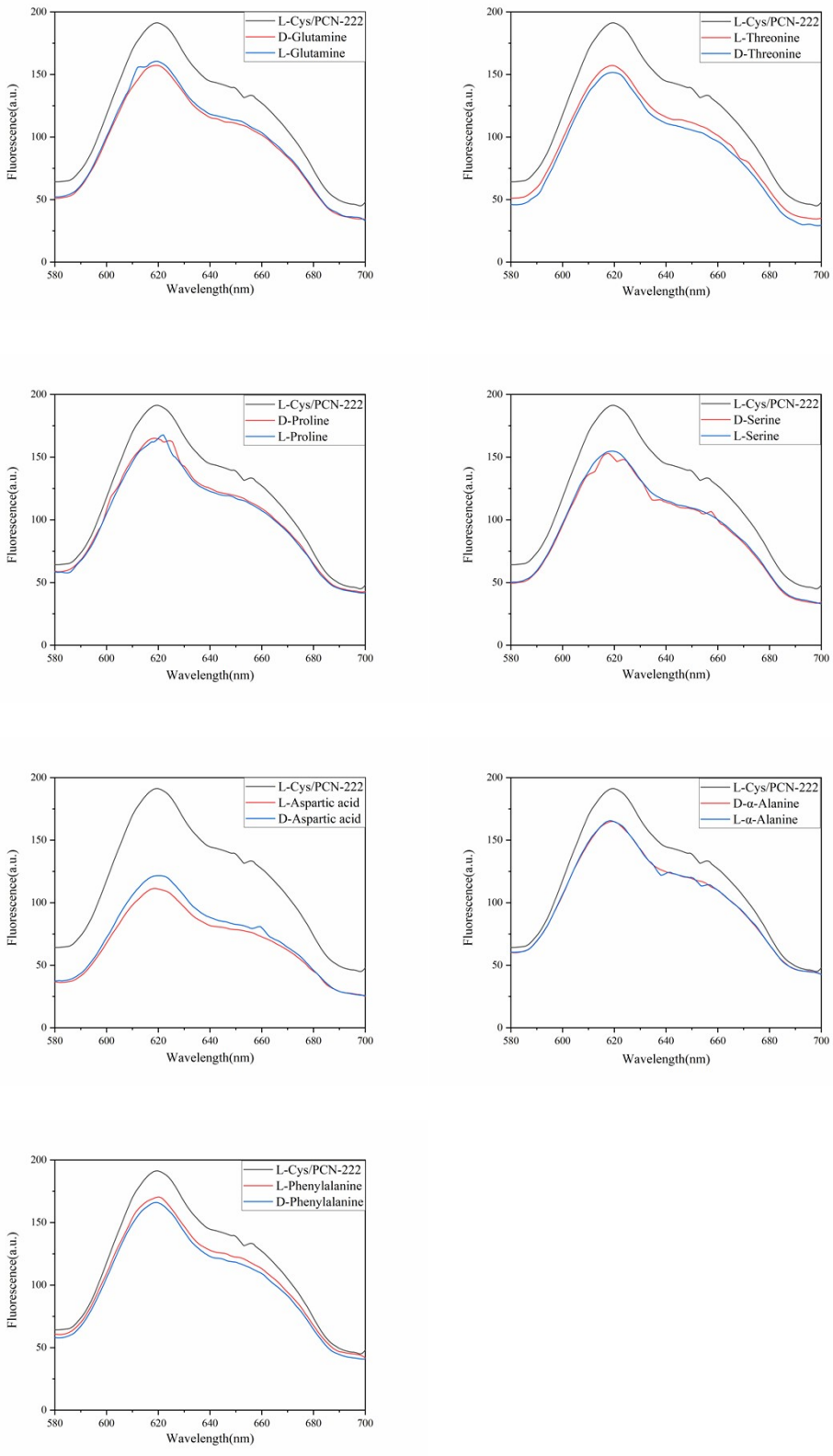


Fig. S6 The fluorescent spectra of L-Cys/PCN-222-2 quenched by 11 amino acids enantiomers

Tab. S5 The recoveries of D-/L-histidine under weak acidic or alkaline conditions

Sample	pH value	Spiked concentration (μmol L^{-1})	Measured concentration (μmol L^{-1})	Recovery (%)	RSD (%)
D-histidine	pH=4.0	5.00	3.21	67.51	6.38
L-histidine			3.38	64.11	6.44
D-histidine		10.00	6.54	65.35	5.85
L-histidine			6.65	66.45	5.73
D-histidine		40.00	28.53	71.33	3.86
L-histidine			29.52	73.80	3.51
D-histidine	pH=5.0	5.00	3.71	74.13	5.83
L-histidine			3.82	76.49	5.90
D-histidine		10.00	7.71	77.10	5.55
L-histidine			7.84	78.44	5.58
D-histidine		40.00	31.81	79.53	5.31
L-histidine			31.92	79.81	5.43
D-histidine	pH=6.0	5.00	4.26	85.12	7.10
L-histidine			4.27	85.43	7.03
D-histidine		10.00	8.71	87.14	6.82
L-histidine			8.73	87.33	6.88
D-histidine		40.00	35.32	88.31	6.31
L-histidine			35.60	89.01	6.21
D-histidine	pH=7.0	5.00	5.03	100.51	4.11
L-histidine			5.05	100.90	4.20
D-histidine		10.00	9.95	99.48	3.91
L-histidine			9.98	99.79	3.43
D-histidine		40.00	38.92	97.31	2.23
L-histidine			39.14	97.85	2.45
D-histidine	pH=8.0	5.00	4.17	83.47	4.14
L-histidine			4.21	84.21	4.10

D-histidine	10.00	8.23	82.33	3.74
L-histidine		8.38	83.81	3.50
D-histidine	40.00	32.40	80.99	2.63
L-histidine		32.45	81.12	2.41

Tab. S6 The recoveries and RSDs of Lake water sample (n=5)

Actual sample	Analyte	Blank sample (μmol L^{-1})	Spiked volume (μmol L^{-1})	Measured value (μmol L^{-1})	Recovery (%)	RSD (%)
Lake water	Hg^{2+}	—	10.00	10.39	103.90	4.38
			25.00	24.87	99.48	3.95
			45.00	46.86	104.13	4.86

Tab. S7 The fluorescence lifetime of L-Cys/PCN-222-2 solution before and after L- and D-Histidine

System components	τ_1 (ns)	τ_2 (ns)	T_{av} (ns)	R^2
L-Cys/PCN-222-2	0.79988	0.7998	0.80	0.9927
L-Cys/PCN-222-2+L-Histidine	0.80386	0.80387	0.80	0.9975
L-Cys/PCN-222+D-Histidine	0.83711	0.83716	0.84	0.9950

Tab. S8 The fluorescence lifetime of L-Cys/PCN-222-2 solution before and after Hg^{2+} addition

System components	τ_1 (ns)	τ_2 (ns)	T_{av} (ns)	R^2
L-Cys/PCN-222-2	0.79988	0.7998	0.80	0.9927
L-Cys/PCN-222-2+Hg^{2+}	0.71326	0.71329	0.71	0.9916

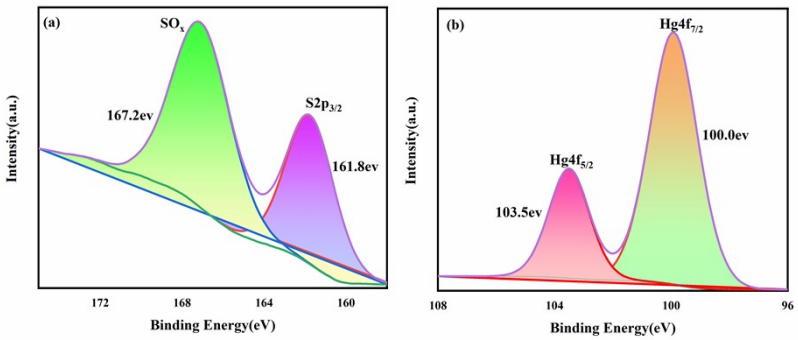


Fig. S7 XPS S2p spectrrum (a) and Hg 4f spectrum(b) of L-Cys/PCN-222-2+Hg^{2+}

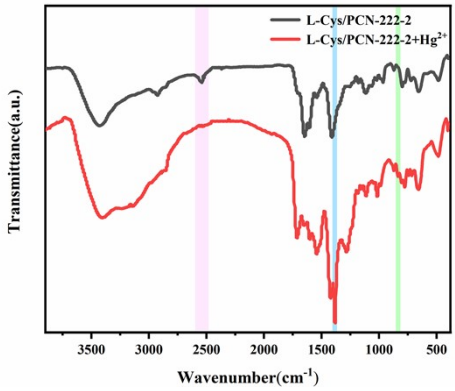


Fig. S8 The FT-IR spectra of L-Cys/PCN-222-2 and L-Cys/PCN-222-2+Hg^{2+}

Tab. S9 Comparisons of L-Cys/PCN-222-2 with other PCN-222 series

PCN-222 series	Metal source	Analytes	Concentration range (μmol L^{-1})	*LOD* (μmol L^{-1})	Post modification	Detected time (s)	Ref.
PCN-222	Zr	F^-	1 ~ 20	0.07	No	＜10	17
PCN-222	Zn	Pentachlorophenol	3 ~ 27	1.24	No	30	23
PCN-222	Zr	Phosphate	0.25 ~ 25	0.023	No	—[a]	24
PCN-222	Zr	Chloramphenicol	3.1×10^{-7} ~ 3.1×10^{-2}	2.50×10^{-7}	No	60	21
Fe@PCN-222	Fe	Glucose	10 ~ 300	2.41	Yes	—[a]	22
L-Cys/PCN-222-2	Zr	D-/L-Histidine	5~45	3.85/2.48	Yes	40	This work
		Hg^{2+}	10~500	2.79			

—[a] noted that there was no involvement of detected time in the references.