A "Two-in-One" Pyrrolopyrrole Cyanine Fluorescent Probe for Discriminative Detection of Hydrazine and Hydrogen Sulfide in Real Samples

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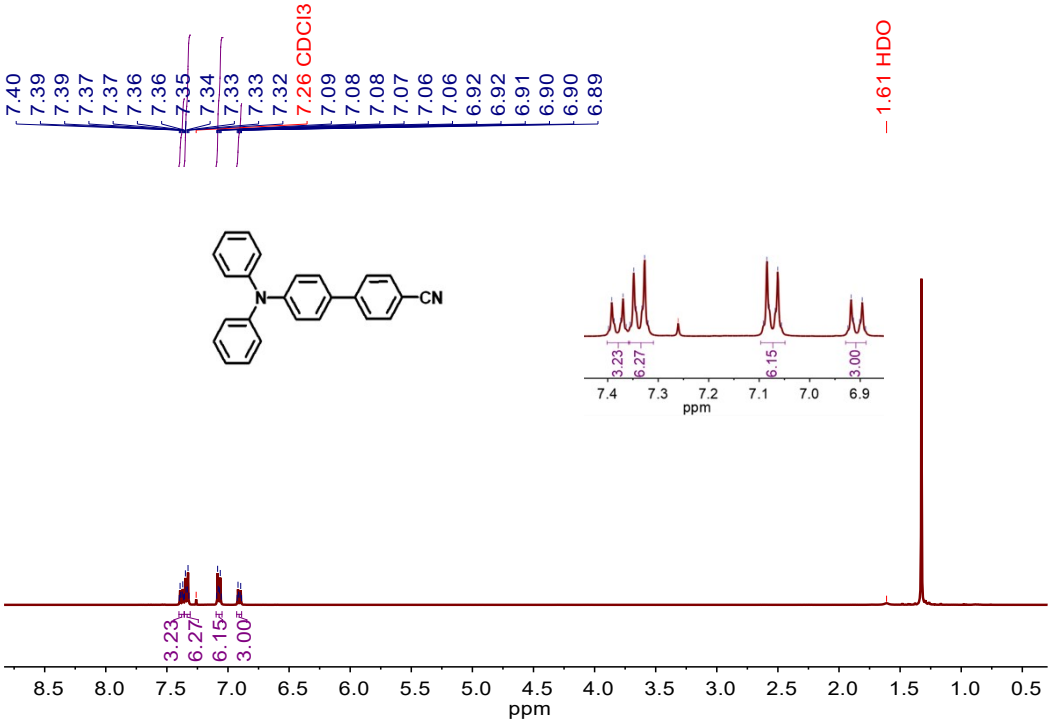

Figure S1. ^{1}H NMR spectrum of **1** in $CDCl_3$.

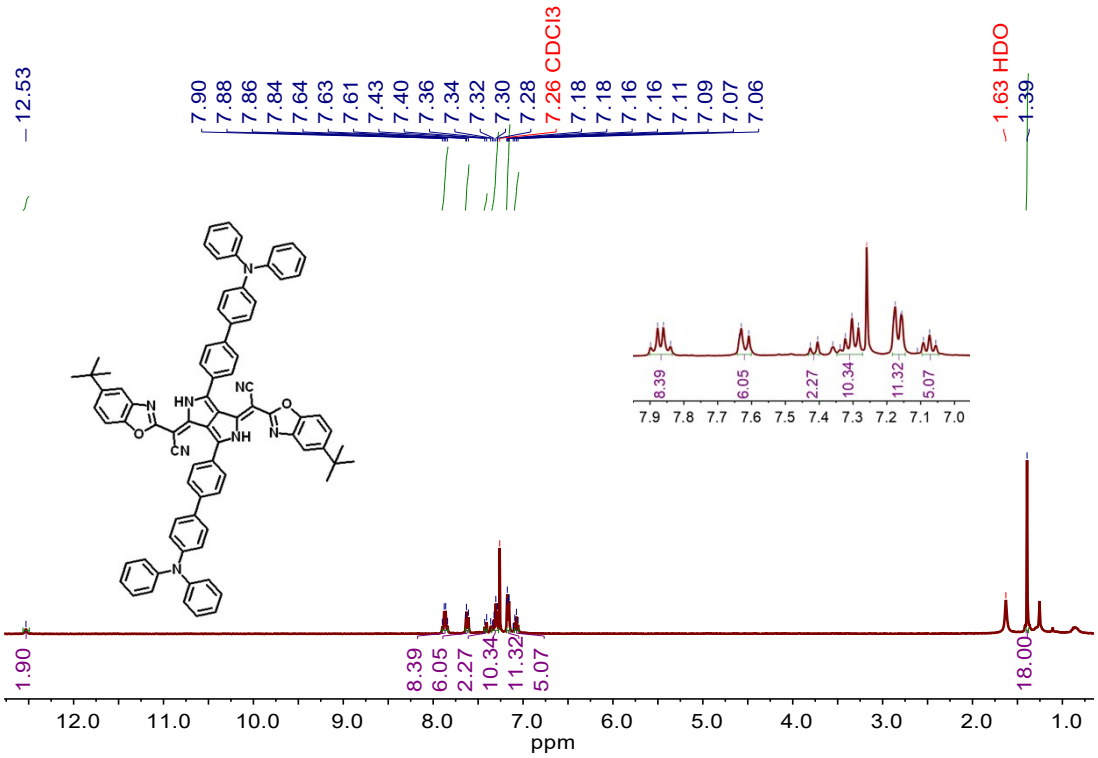

Figure S2. ^{1}H NMR spectrum of **PPCy-Ph-H** in $CDCl_3$.

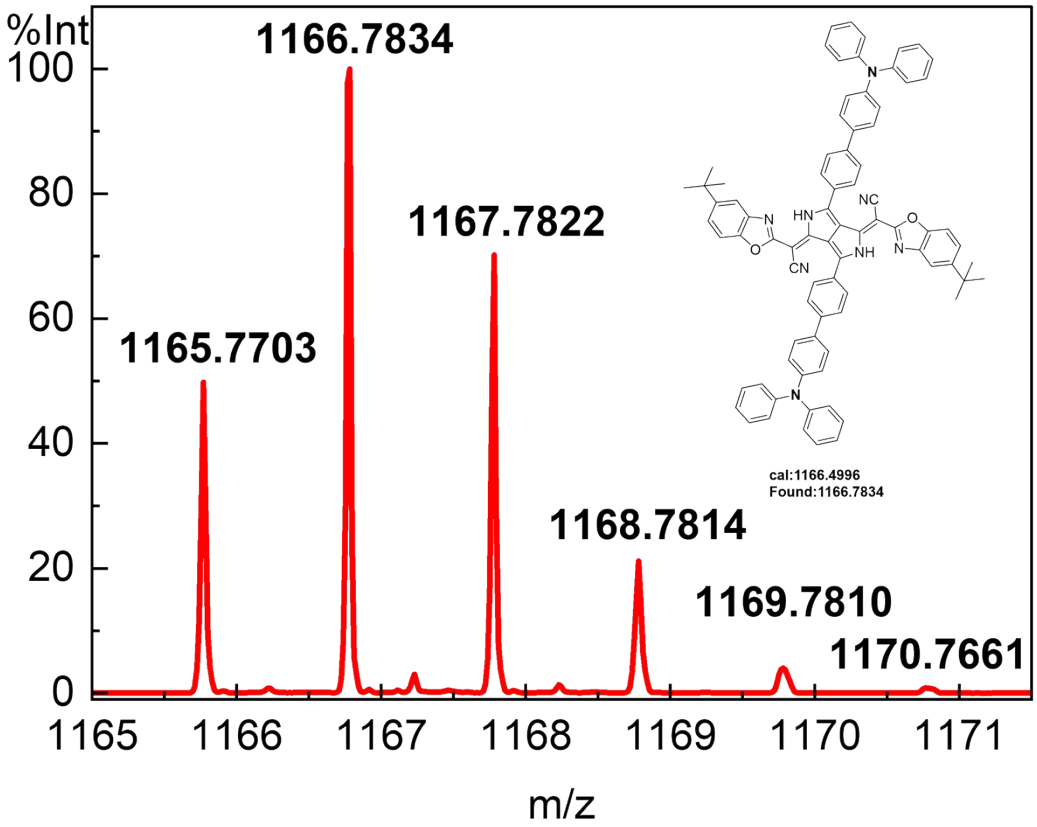

Figure S3. MALDI-TOF-MS of **PPCy-Ph-H**.

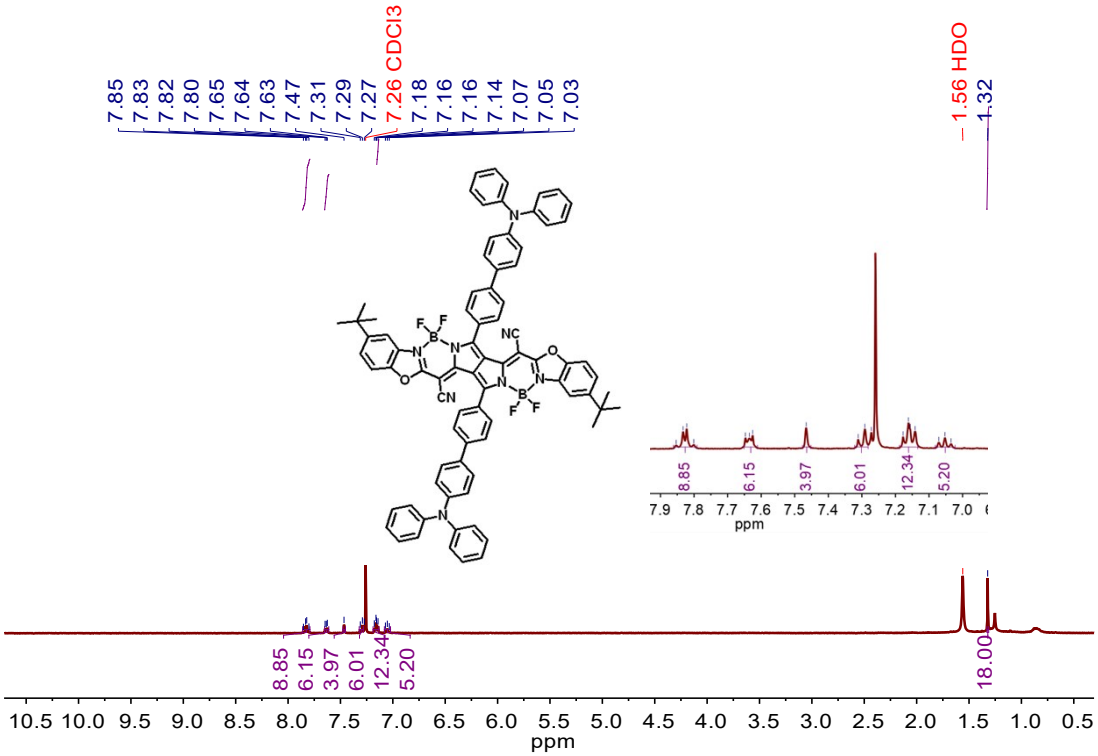

Figure S4. ^{1}H NMR spectrum of **PPCy-Ph-BF2** in $CDCl_3$.

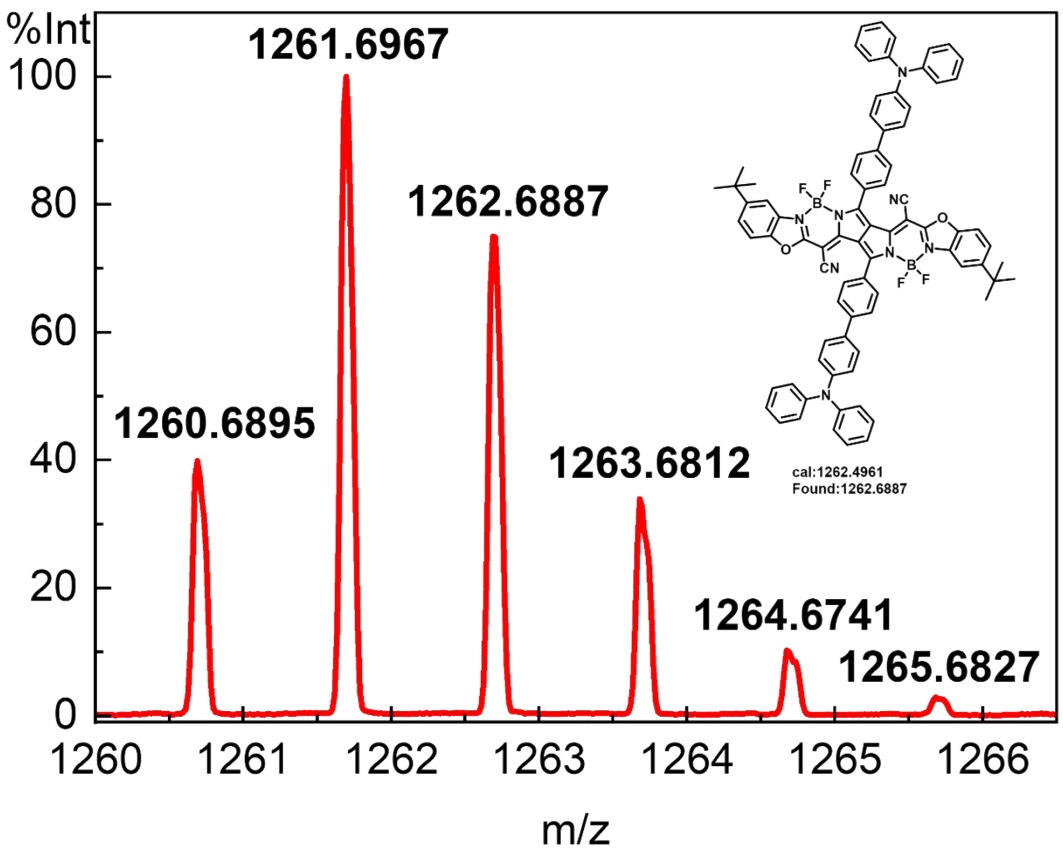

Figure S5. MALDI-TOF-MS of **PPCy-Ph-BF2**.

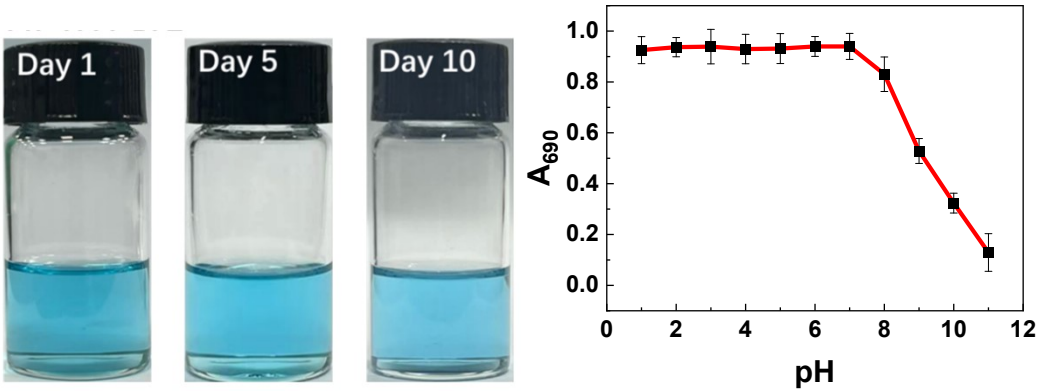

Figure S6. The photos of **PPCy-Ph-BF2** in CH_2Cl_2 (a) after exposure of daylight in air for 10 days and (b) absorption maximum at 690 nm at different pH.

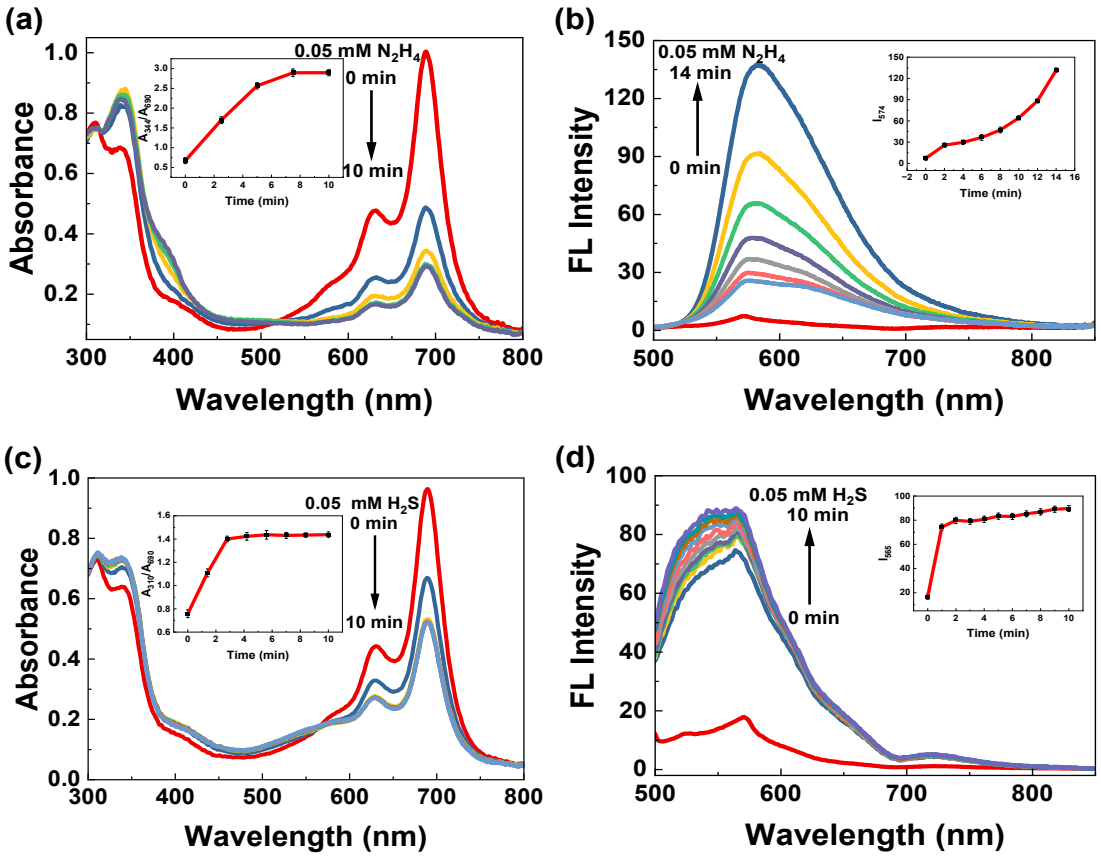

Figure S7. Time-dependent UV-vis absorption of **PPCy-Ph-BF2** (10 μM) towards (a) N_2H_4 and (c) H_2S (0.05 mM). Time-dependent emission spectra of **PPCy-Ph-BF2** towards (b) N_2H_4 and (d) H_2S.

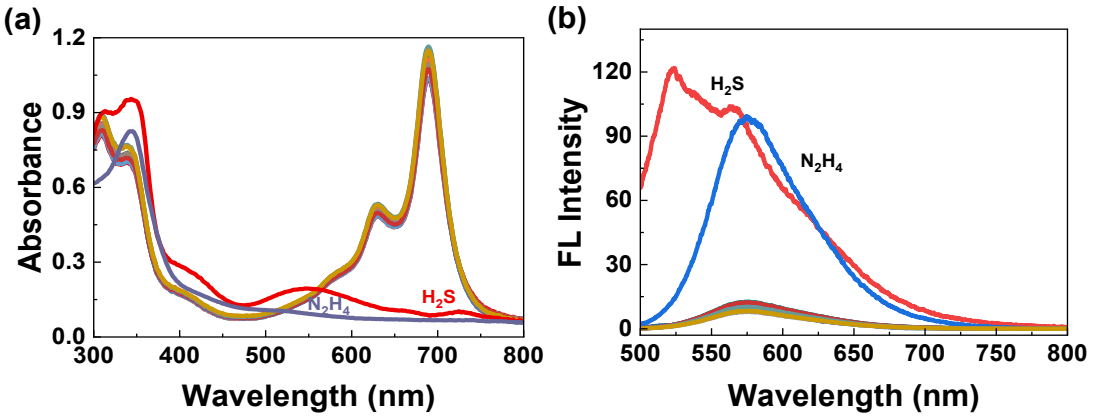

Figure S8. (a) UV-vis absorption and (b) emission spectra of **PPCy-Ph-BF2** (10 μM) in the presence of different analytes (Na^+, K^+, Mg^{2+}, Ca^{2+}, Cr^{3+}, Mn^{2+}, Fe^{2+}, Fe^{3+}, Co^{2+}, Ni^{2+}, Cu^{2+}, Zn^{2+}, Cd^{2+}, Hg^{2+}, Pb^{2+}, NH_4^+, F^-, Cl^-, Br^-, I^-, CO_3^{2-}, NO_3^-, NO_2^-, AcO^-, SO_4^{2-}, SO_3^{2-}, HSO_3^-, CN^-) at room temperature for 2 min.

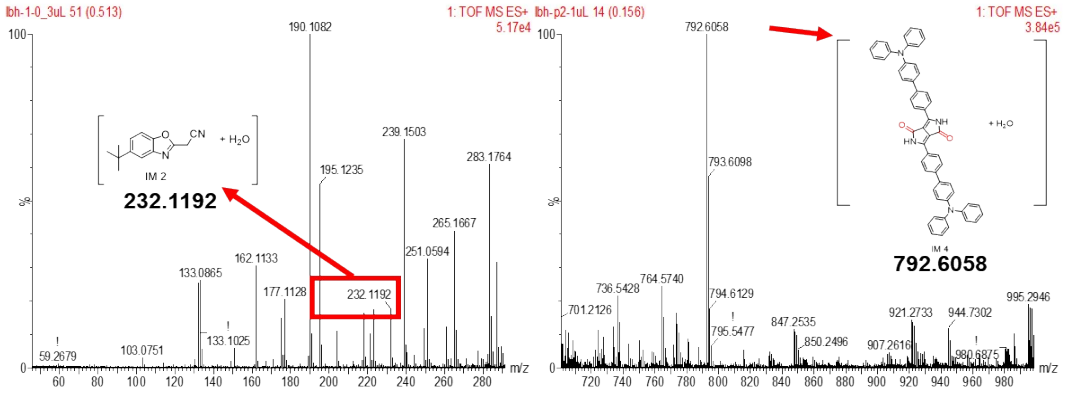

Figure S9. The HRMS spectra of **PPCy-Ph-BF2** (10 μM) in the presence of N_2H_4.

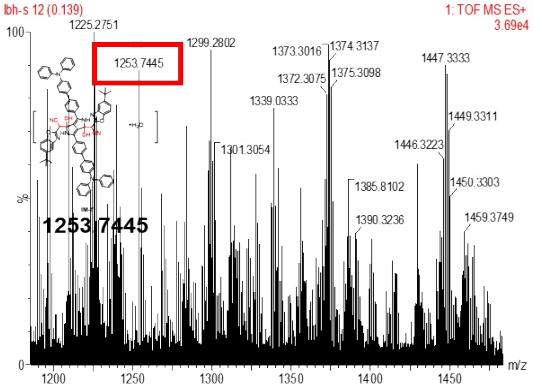

Figure S10. The HRMS spectrum of **PPCy-Ph-BF2** (10 μM) in the presence of H_2S.

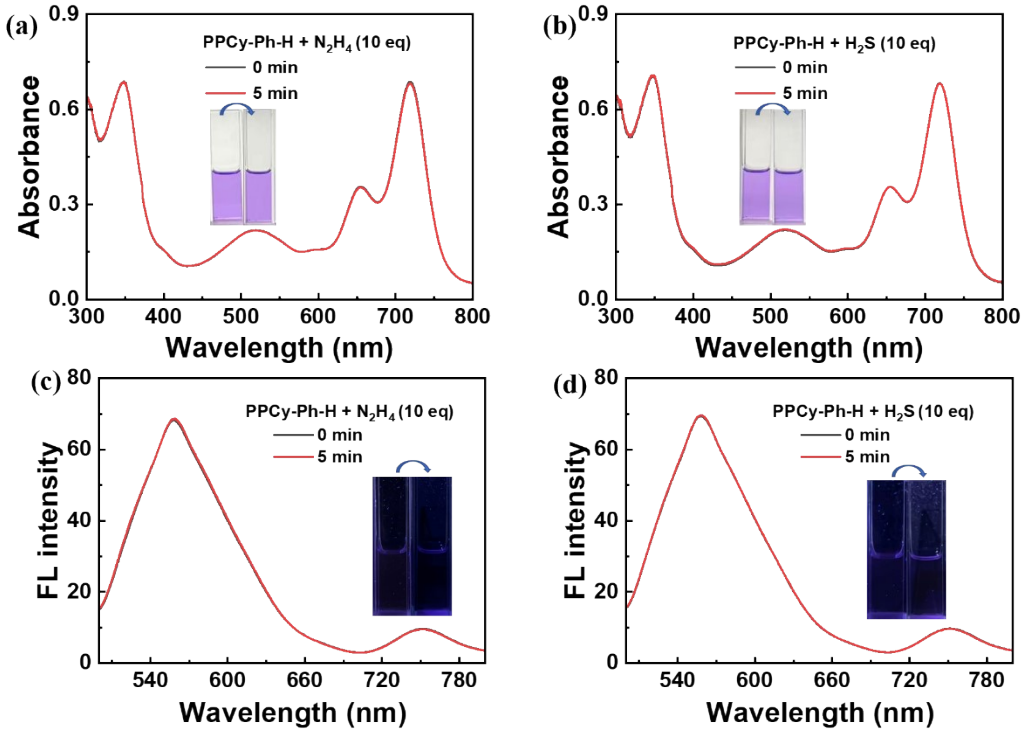

Figure S11 (a-d) The UV-vis and fluorescence spectra of model compound without BF_2 motif (**PPCy-Ph-H**) in presence of N_2H_4 or H_2S for 5 min.

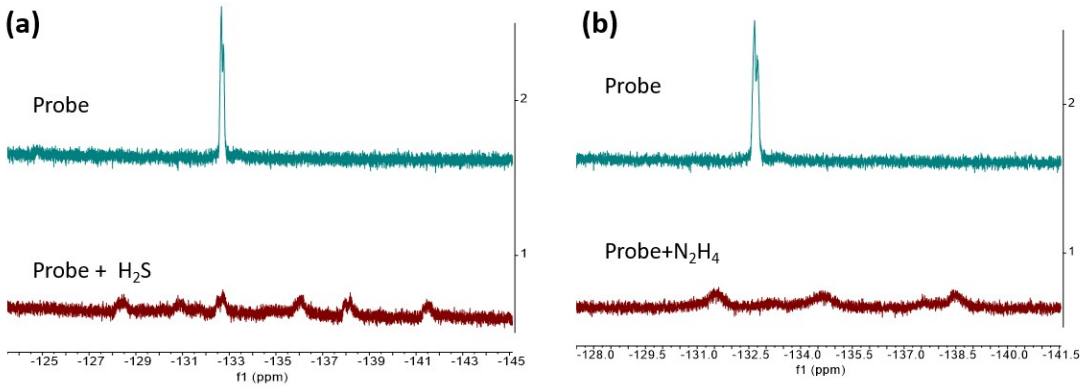

Figure S12 ^{19}F NMR spectra of **PPCy-Ph-BF2** (10 mM) in the presence of (a) N_2H_4 and (b) H_2S in $CDCl_3$ at room temperature.

Table S1 The comparison of solution LODs and solid-state LQD values in this work with WHO/OSHA limits for N_2H_4 and typical H_2S levels

Analytes	OSHA	This work
N_2H_4	0.048 ppm	(1) Detecting N_2H_4 solution: 9.11 nM and 2.38 nM (UV-vis and Fluorescence method with **PPCy-Ph-BF2** solution); 29.3 mM (with **PPCy-Ph-BF2**-loading polyamide thin film and Color APP) (2) Detecting N_2H_4 gas: 3.25 and 1.74 mM (with **PPCy-Ph-BF2**-loading sponge and Color APP)
H_2S	10 ppm (8-hour average); 15 ppm (15 minutes)	(1) Detecting H_2S solution: 1.70 nM and 0.64 nM (UV-vis and Fluorescence method with **PPCy-Ph-BF2** solution); 35.7 mM (with **PPCy-Ph-BF2**-loading polyamide thin film and Color APP) (2) Detecting H_2S gas: 2.56 and 2.63 mM (with **PPCy-Ph-BF2**-loading sponge and Color APP)

Table S2. Determination of N_2H_4 concentrations with **PPCy-Ph-BF2** and HPLC.

Sample	Spiked (μM)	Recovery (%) (by HPLC)	Recovery (%) (by probe)
Tap water	3.00	96.4	98.3
Lake water	3.00	97.8	99.6
Red wine	3.00	105.5	100.6
Beer	3.00	106.3	101.0