Supporting Information

Synthesis of *N*-^{n}butyl-4-bromo-1,8-naphthalimide **(2)**

The mixture of 4-bromo-1,8-naphthalic anhydride **1** (1.8 mmol, 0.5 g) and n-butylamine (2.02 mmol, 0.2 ml) in ethanol (40 ml) was refluxed for 5 hrs under nitrogen atmosphere. After completion of reaction (TLC), the solvent was evaporated under reduced pressure. The solid obtained was recrystalized from methanol to get pure light yellow product, *N*-^{n}butyl-4-bromo-1,8-naphthalimide **(2)**. Light yellow solid; 80% yield; m.pt. (°C) = 202-204; ^{1}H NMR (500 MHz, $CDCl_3$, ppm): δ 8.64 (dd, 1H, Ar-H, J = 7.3 Hz), 8.55 (dd, 1H, Ar-H, J = 8.5 Hz), 8.40 (d, 1H, Ar-H, J = 7.85 Hz), 8.02 (d, 1H, Ar-H, J = 7.85 Hz), 7.83 (q, 1H, Ar-H, J_1 = 8.45 Hz, J_2 = 8.5 Hz), 4.17 (t, 2H, $-CH_2$, J_1 = 7.55 Hz, J_2 = 7.65 Hz), 1.74-1.68 (m, 2H, $-CH_2$), 1.47-1.42 (m, 2H, $-CH_2$), 0.98 (t, 3H, $-CH_3$, J_1 = 7.4 Hz, J_2 = 7.35 Hz); ^{13}C NMR (500 MHz, $CDCl_3$, ppm): δ 163.62, 163.60, 133.19, 131.99, 131.19, 131.08, 130.63, 130.16, 129.01, 128.07, 123.18, 122.32, 40.38, 30.17, 20.37, 13.83; LC-MS: m/z calculated for $C_{16}H_{14}BrNO_2$ [M^+] = 332.20, found = 332.03 [M^+].

Synthesis of Synthesis of 6-((2-aminoethyl)amino)-2-butyl-1*H*-benzo[*de*]isoquinoline-1,3(2*H*)-dione **(3)**

10 ml ethylene diamine was taken in a round bottom flask and left to heat for 1 hr. To this, *N*-^{n}butyl-4-bromo-1,8-naphthalimide (1.50 mmol, 0.5 g) **2** was added and the mixture was refluxed for 4 hrs. After completion of reaction (TLC), the resulting mixture was poured over crushed ice. The resulting precipitates were filtered off and given repeated washing with water to form pure product, **3**. Yellow solid; 85% yield; m.pt. (°C) = 395-397; ^{1}H NMR (500 MHz, DMSO-d_6, ppm): δ 8.70 (d, 1H, Ar-H, J = 8.30 Hz), 8.42 (d, 1H, Ar-H, J = 7.15 Hz), 8.24 (d, 1H, Ar-H, J = 8.55 Hz), 7.80 (br-s, 1H, -NH), 7.67 (t, 1H, Ar-H, J_1 = 7.75 Hz, J_2 = 7.95 Hz), 6.80 (d, 1H, Ar-H, J = 8.60 Hz), 4.01 (t, 2H, $-CH_2$, J_1 = 7.35 Hz, J_2 = 7.40 Hz), 3.37 (t, 2H, $-CH_2$, $J_1 = J_2$ = 6.45 Hz), 2.87 (t, 2H, $-CH_2$, $J_1 = J_2$ = 6.45 Hz), 1.96 (br-s, 2H, $-NH_2$), 1.59-1.56 (m, 2H, $-CH_2$), 1.35-1.31 (m, 2H, $-CH_2$), 0.91 (t, 3H, $-CH_3$, $J_1 = J_2$ = 7.35 Hz); ^{13}C NMR (500 MHz, DMSO-d_6) (ppm): δ 163.62, 162.78, 150.73, 134.09, 130.50, 129.29, 128.48, 124.06, 121.73, 120.00, 107.47, 103.72, 79.05, 46.34, 29.71, 19.71, 13.62; LC-MS: m/z calculated for $C_{18}H_{21}N_3O_2$ [M^+] = 311.39, found = 312.16 [$M + H^+$].

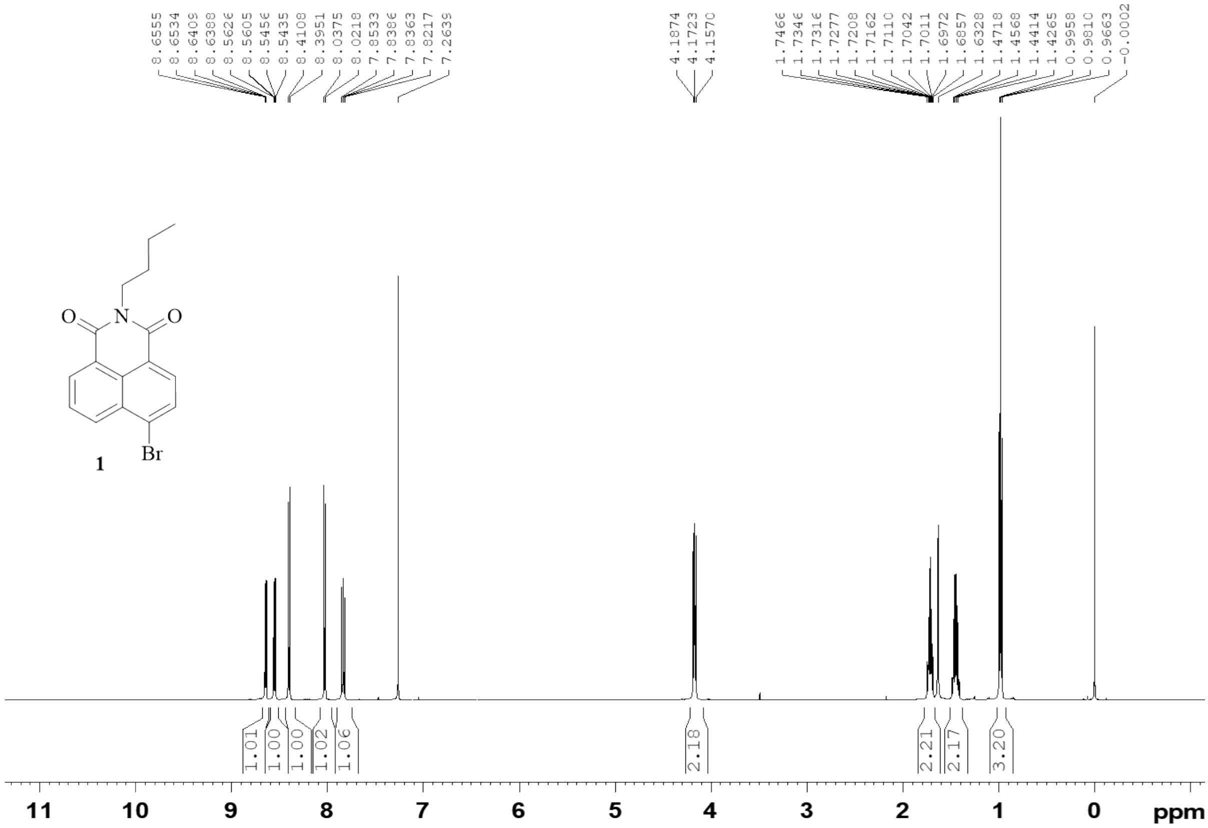


Fig. S1 ^{1}H NMR spectrum of **2**.

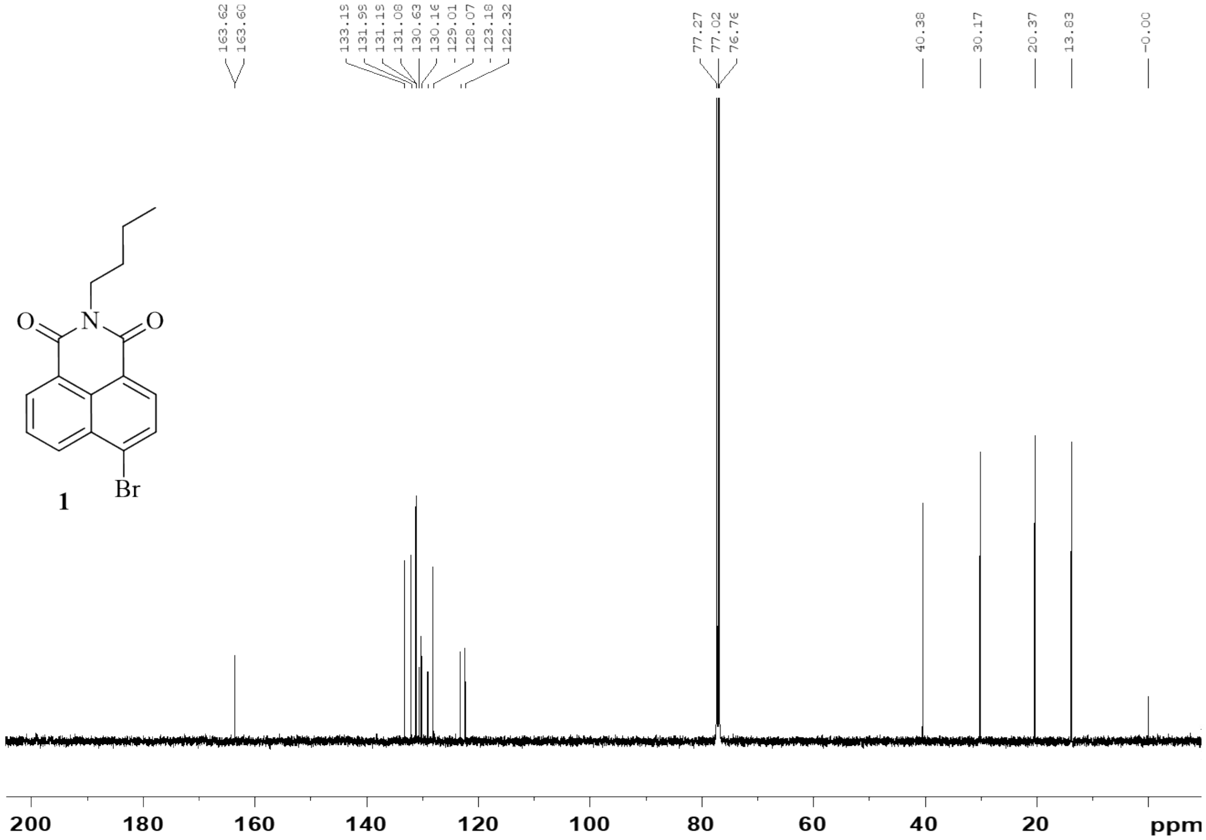


Fig. S2 ^{13}C NMR spectrum of **2**.

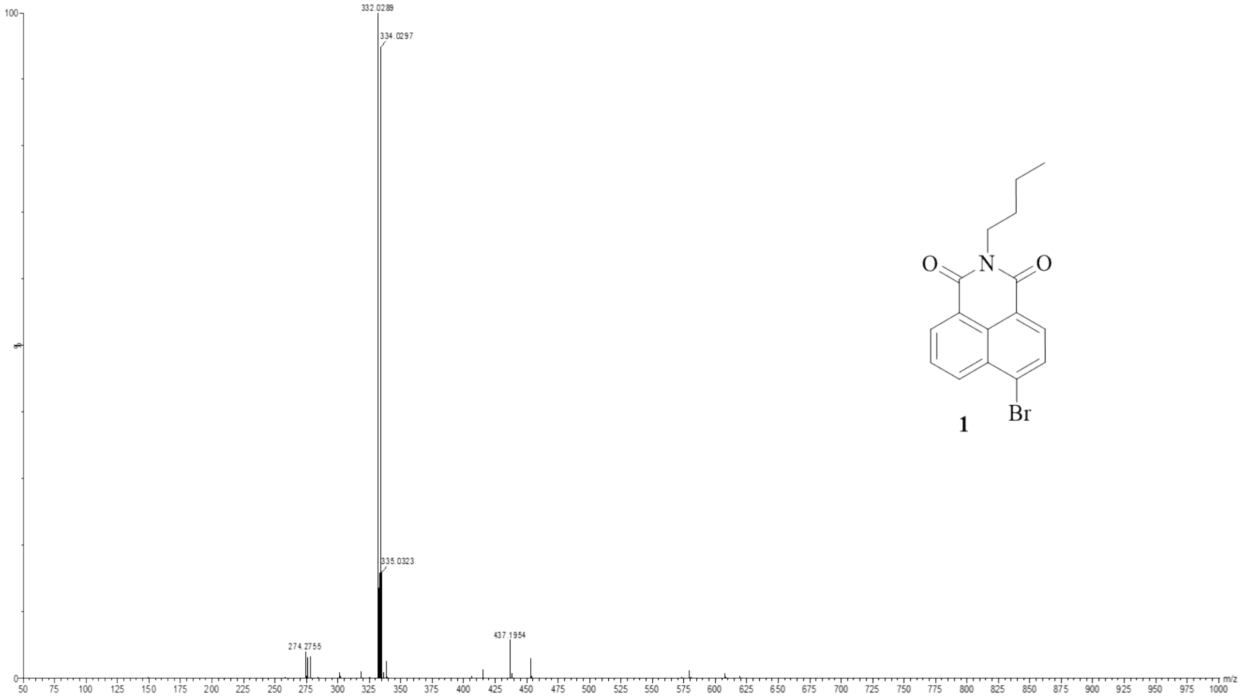


Fig. S3 LC-MS spectrum of **2**.

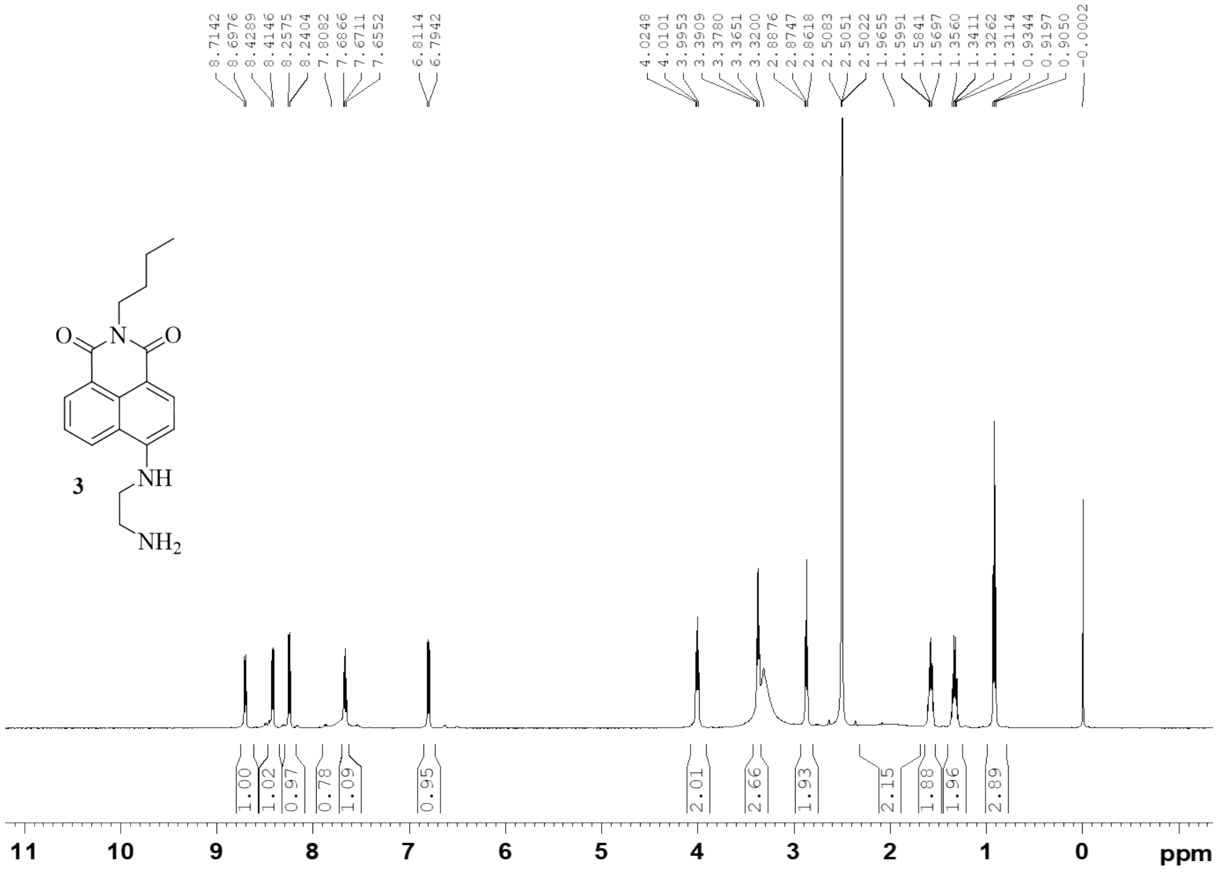


Fig. S4 ^{1}H NMR spectrum of **3**.

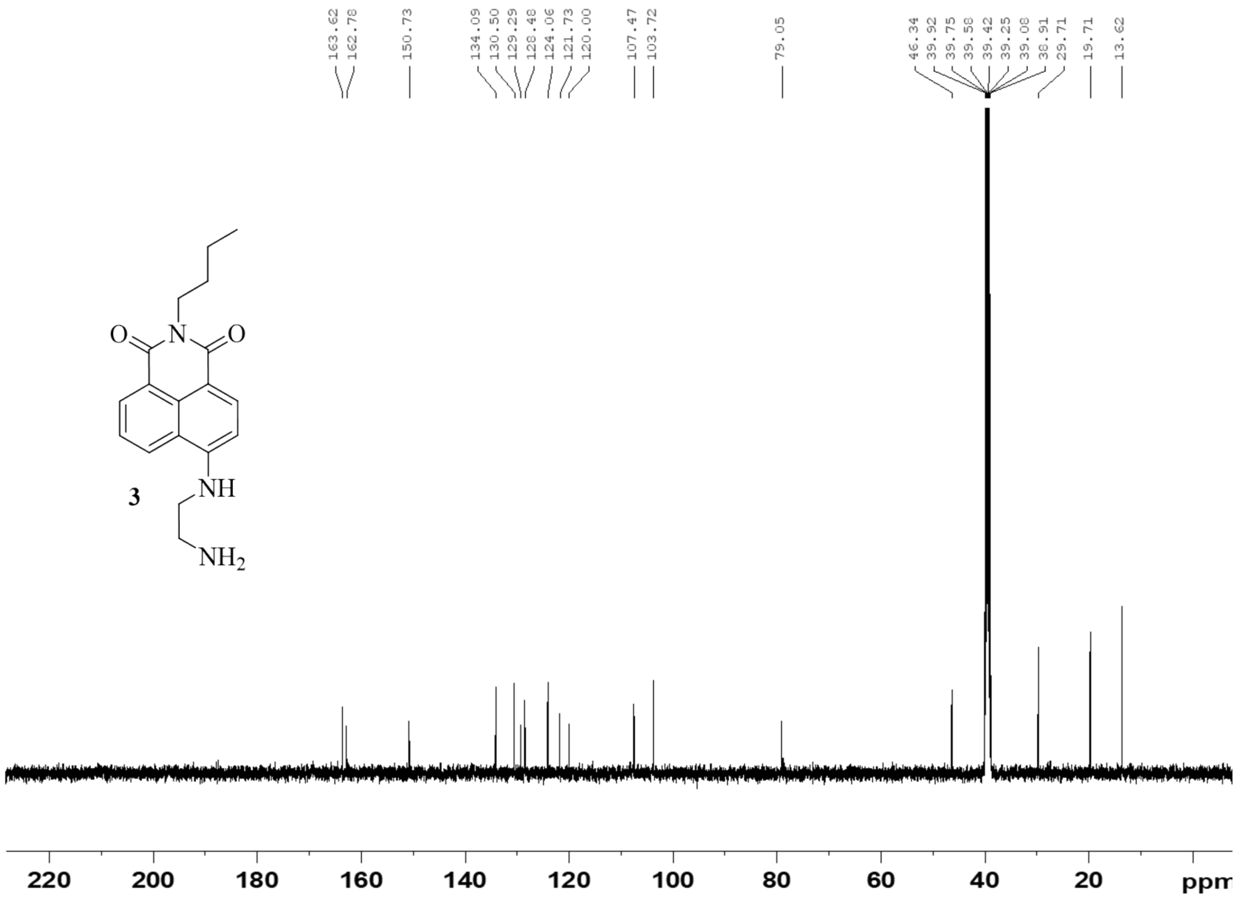


Fig. S5 ^{13}C NMR spectrum of **3**.

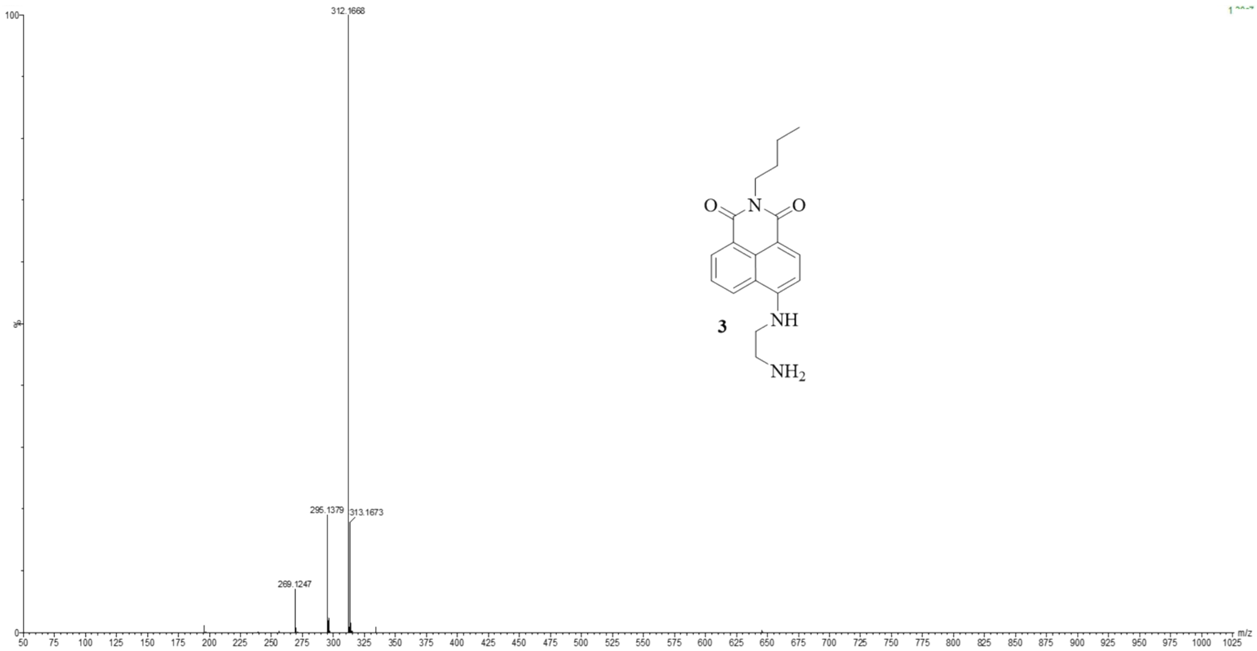


Fig. S6 LC-MS spectrum of **3**.

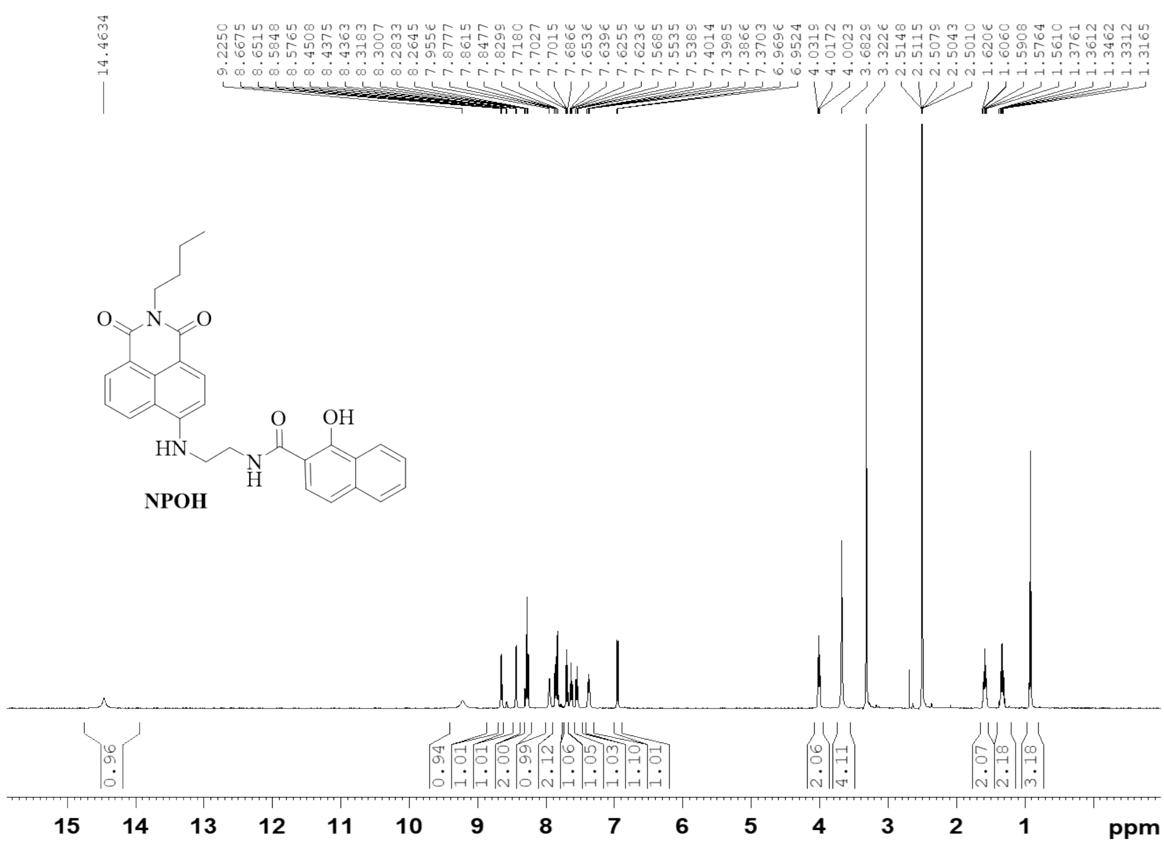


Fig. S7 ^{1}H NMR spectrum of **NPOH**.

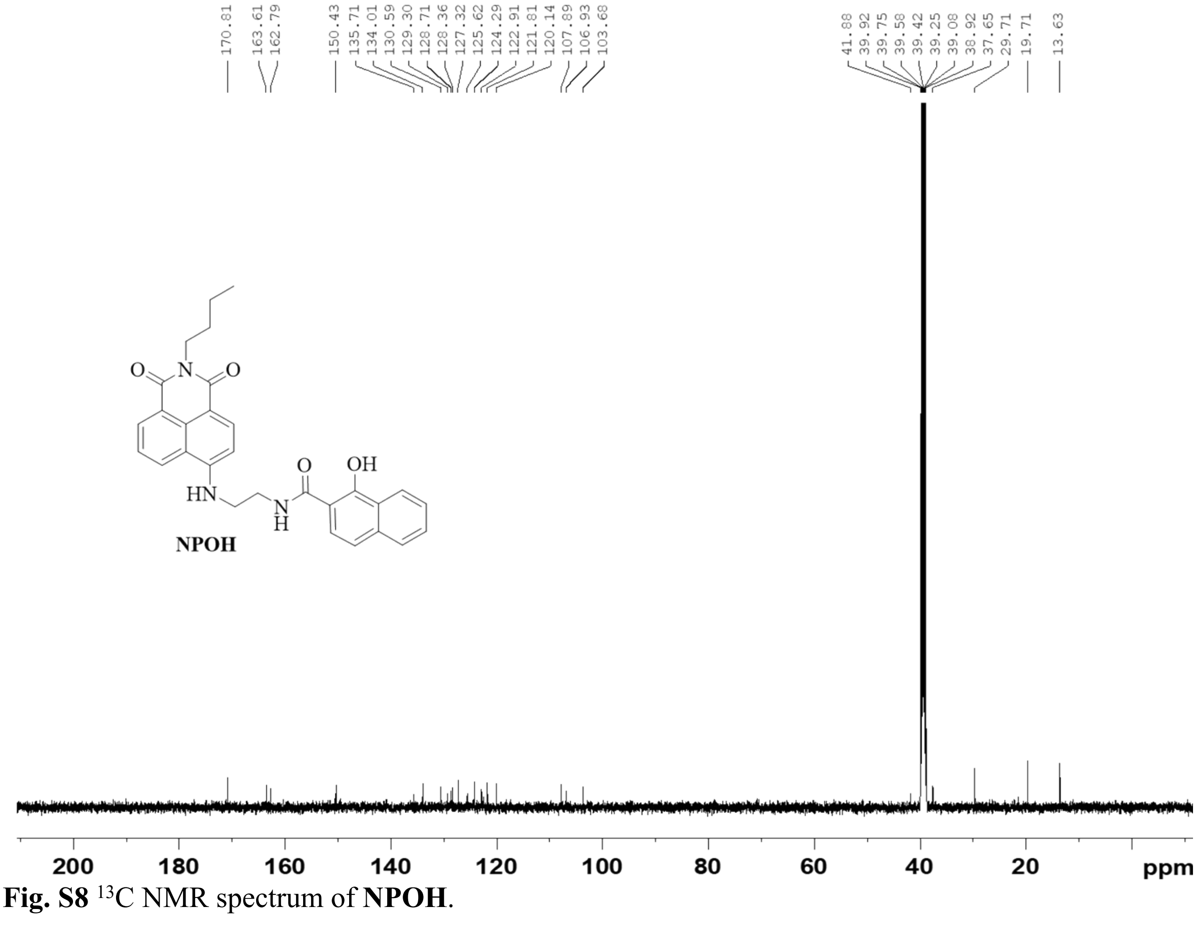


Fig. S8 ^{13}C NMR spectrum of **NPOH**.

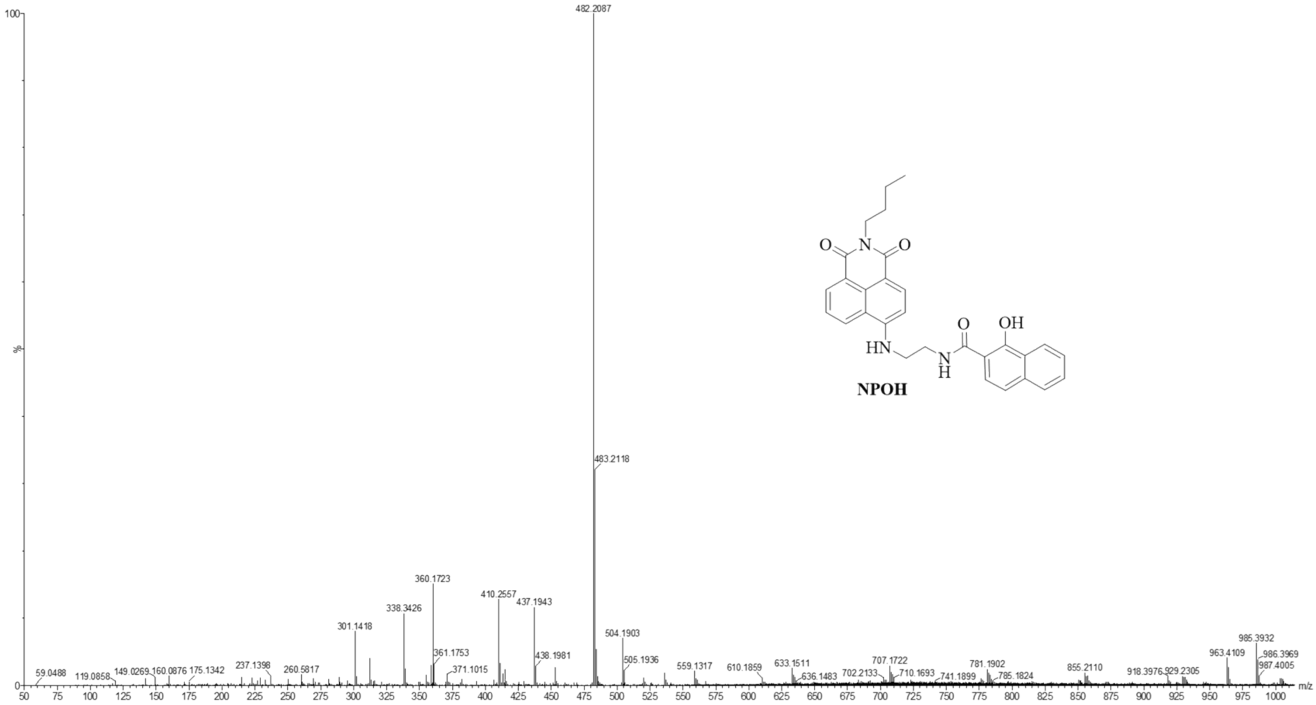


Fig. S9 HRMS spectrum of **NPOH**.

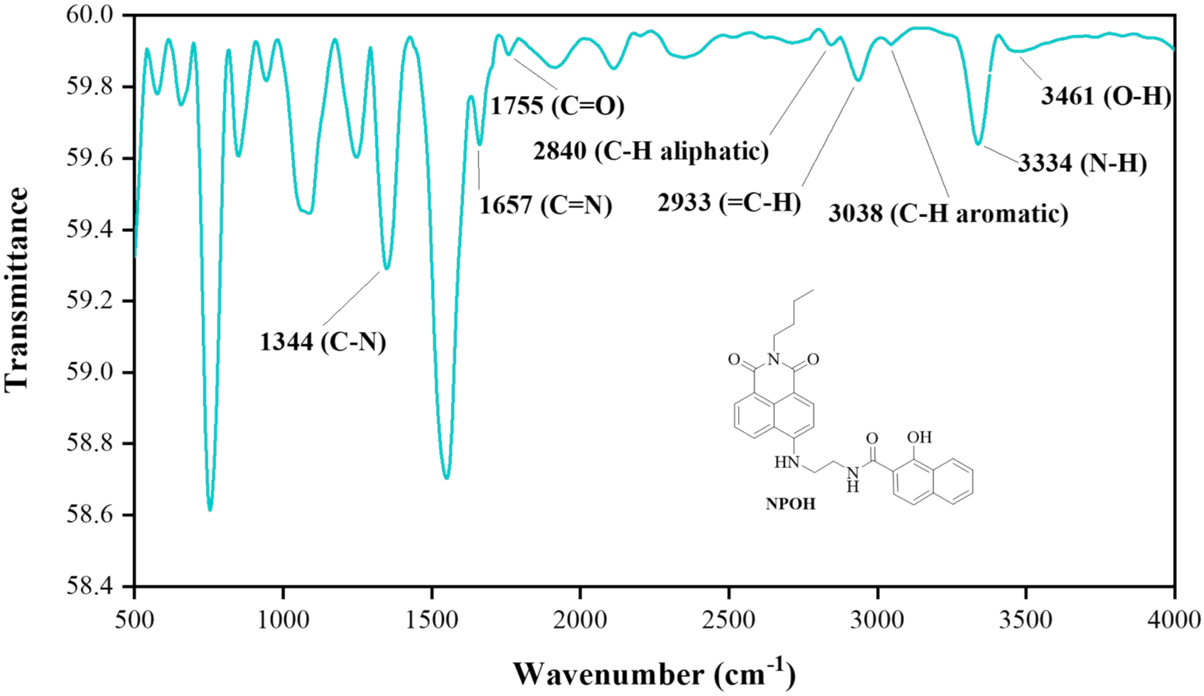


Fig. S10 FT-IR spectrum of **NPOH**.

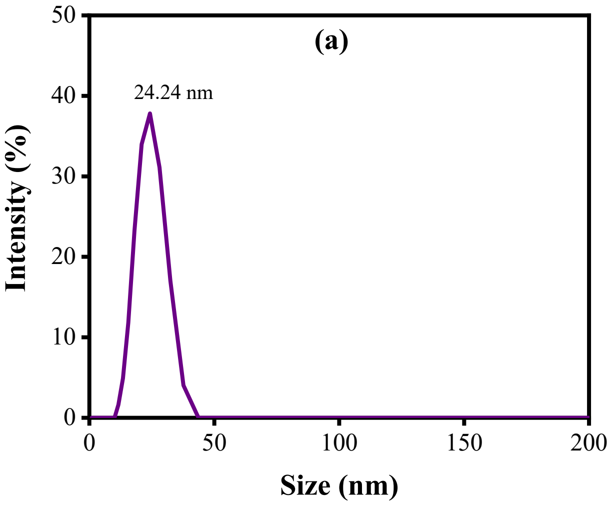


Fig. S11 DLS graph of **NPOH@PF127**

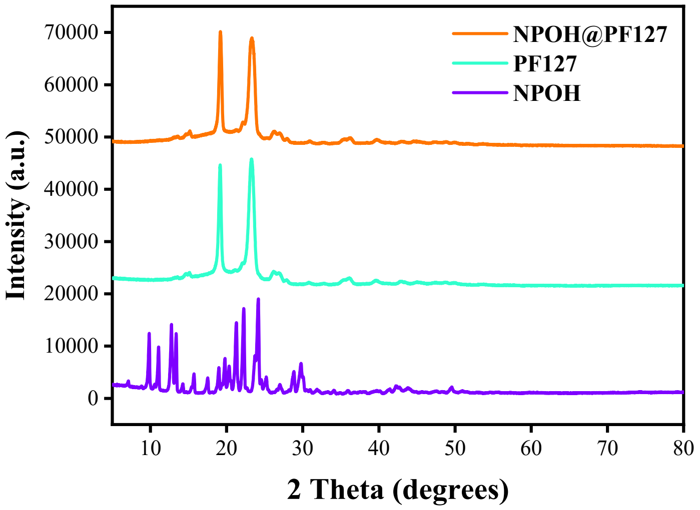


Fig. S12 XRD diffraction pattern of **NPOH, PF127** and **NPOH@PF127**

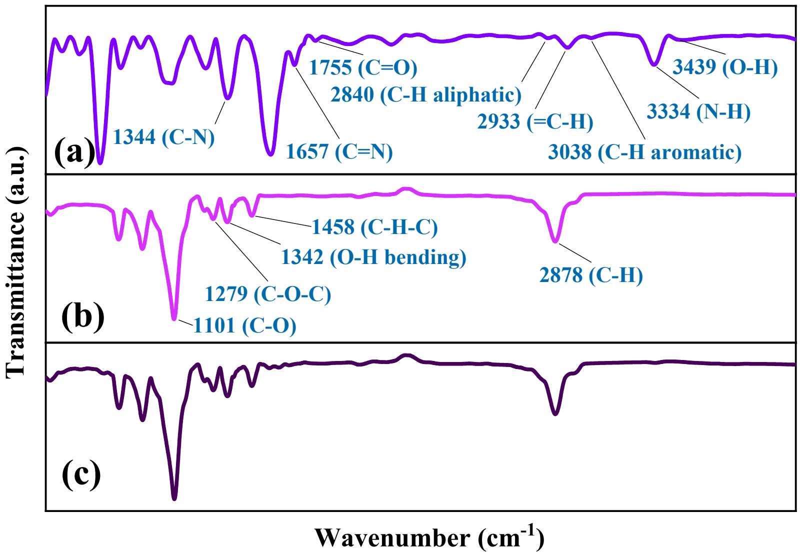


Fig. S13 FT-IR spectra of (a) **NPOH** (b) PF127 (c) **NPOH@PF127**

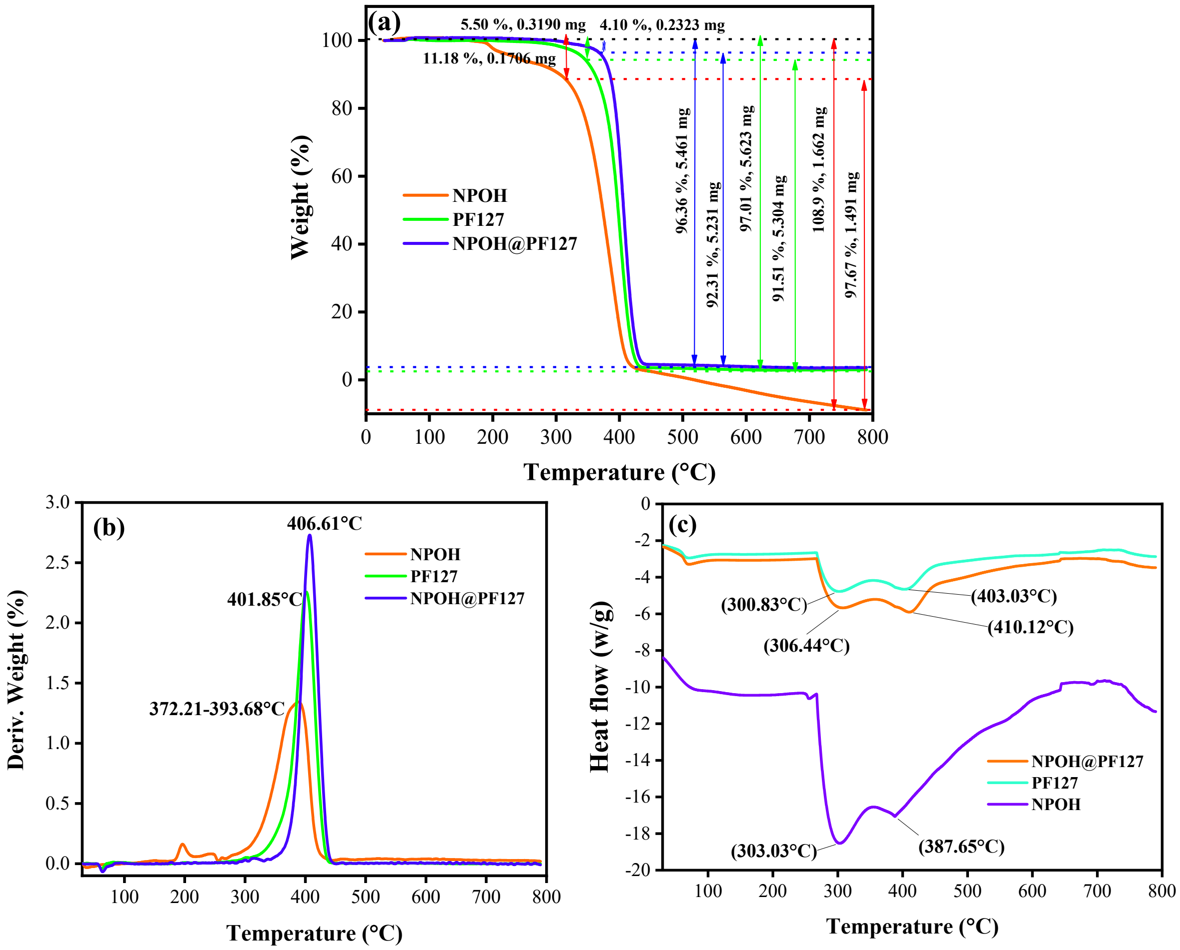


Fig. S14 (a) TGA (b) DTG and (c) DSC plot of **NPOH, PF127** and **NPOH@PF127**

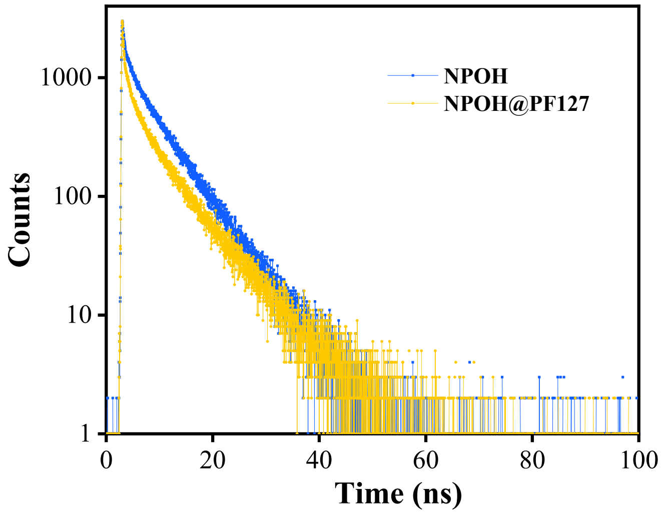


Fig. S15 Fluorescence decay curves of **NPOH** and its binary ensemble **NPOH@PF127**

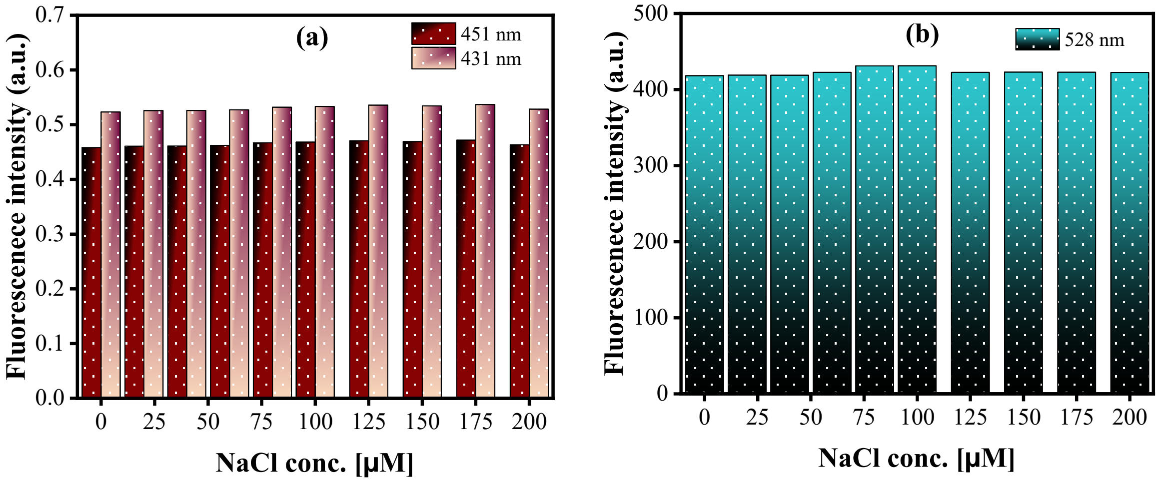


Fig. S16 (a) UV-vis (b) Fluorescence spectra of **NPOH@PF127** at different NaCl concentrations

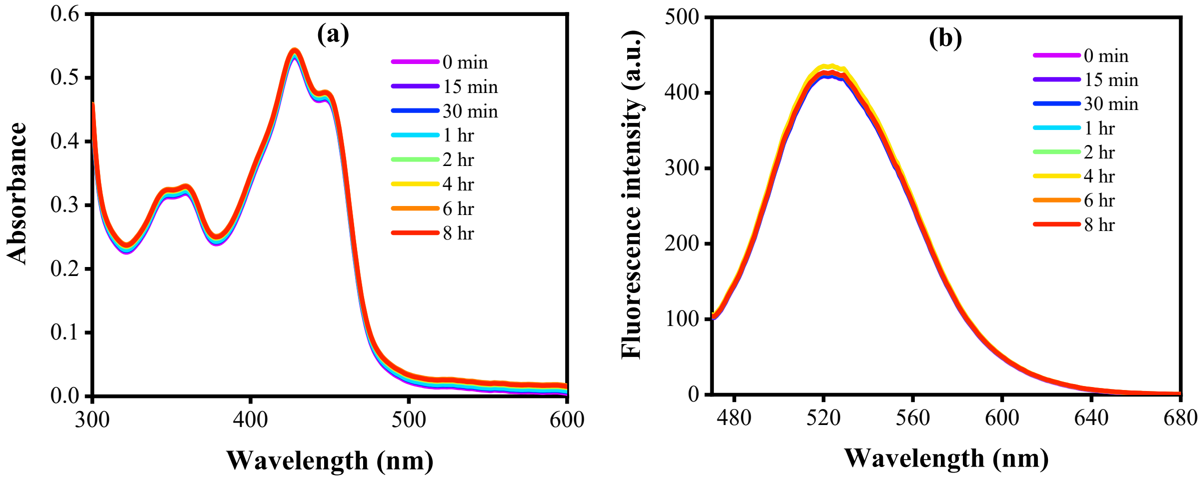


Fig. S17 (a) UV-vis absorption (b) Fluorescence spectra of **NPOH@PF127** at different time intervals

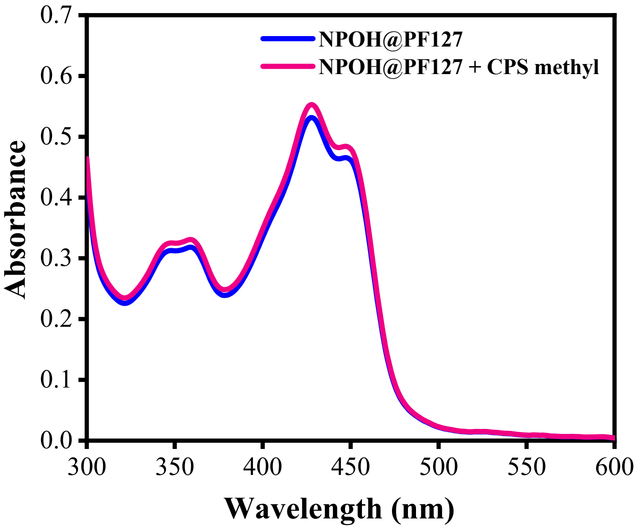


Fig. S18 UV–Vis absorption spectra of **NPOH@PF127** in the presence of CPS methyl

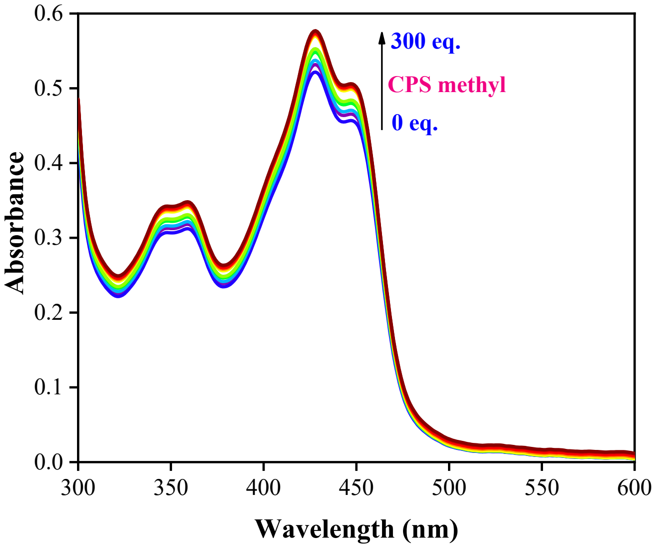


Fig. S19 UV–Vis absorption spectra of **NPOH@PF127** with various concentrations of CPS methyl

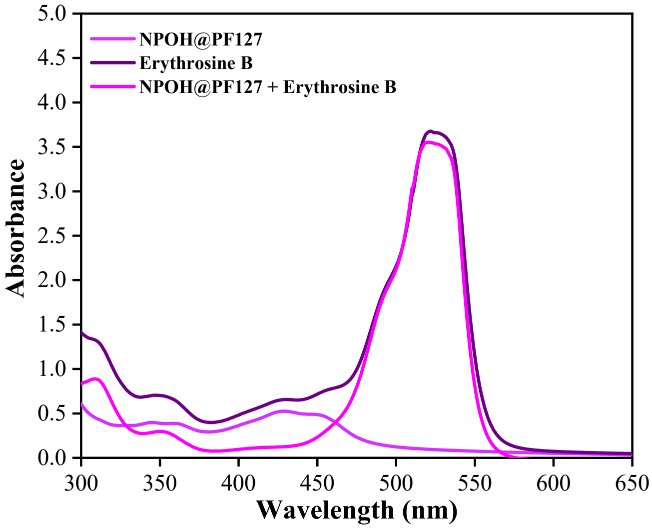


Fig. S20 UV–Vis absorption spectra of **NPOH@PF127**, erythrosine B and **NPOH@PF127** + erythrosine B

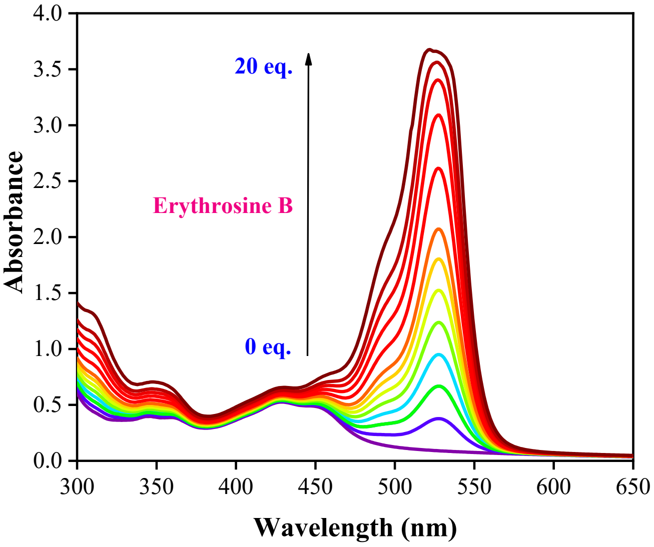


Fig. S21 UV–Vis absorption spectra of **NPOH@PF127** with various concentrations of erythrosine B

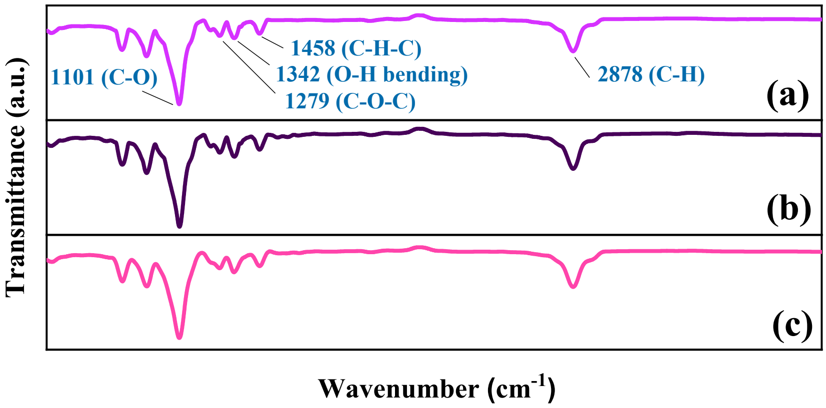


Fig. S22 FT-IR spectra of (a) **NPOH@PF127** (b) **NPOH@PF127** + CPS methyl (c) **NPOH@PF127** + erythrosine B

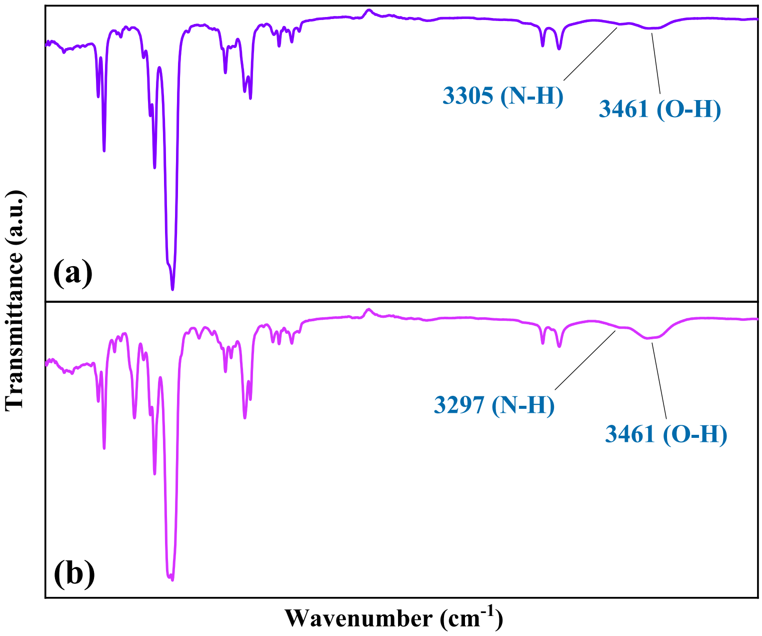


Fig. S23 FT-IR spectra of (a) **NPOH** (b) **NPOH** + CPS methyl in DMSO

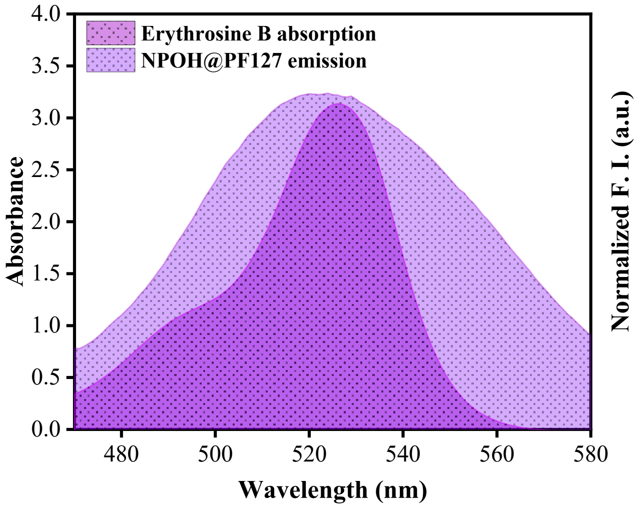


Fig. S24 Spectral overlap of normalized emission sepctrum of **NPOH@PF127** with UV-Vis absorption spectrum of erythrosine B

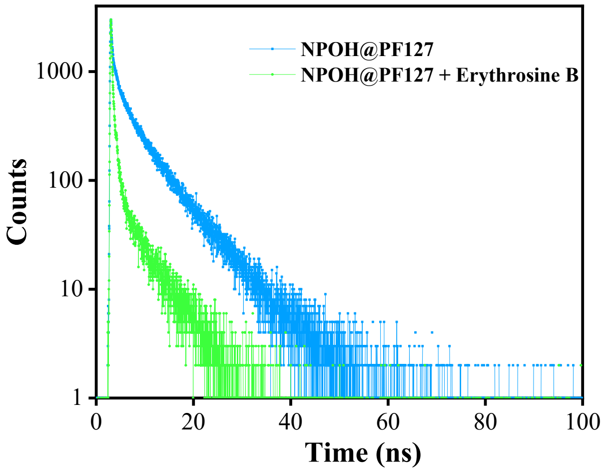
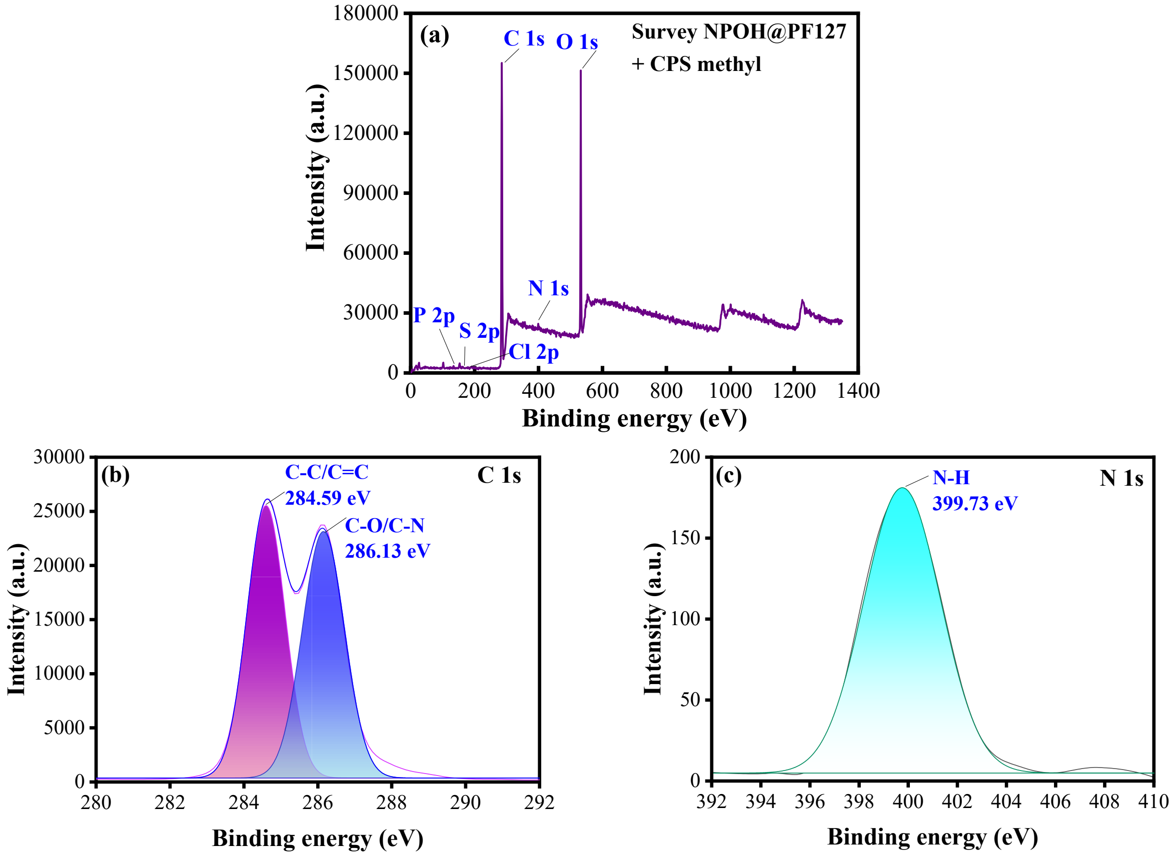


Fig. S25 Fluorescence decay curves of **NPOH@PF127** and **NPOH@PF127** + Erythrosine B



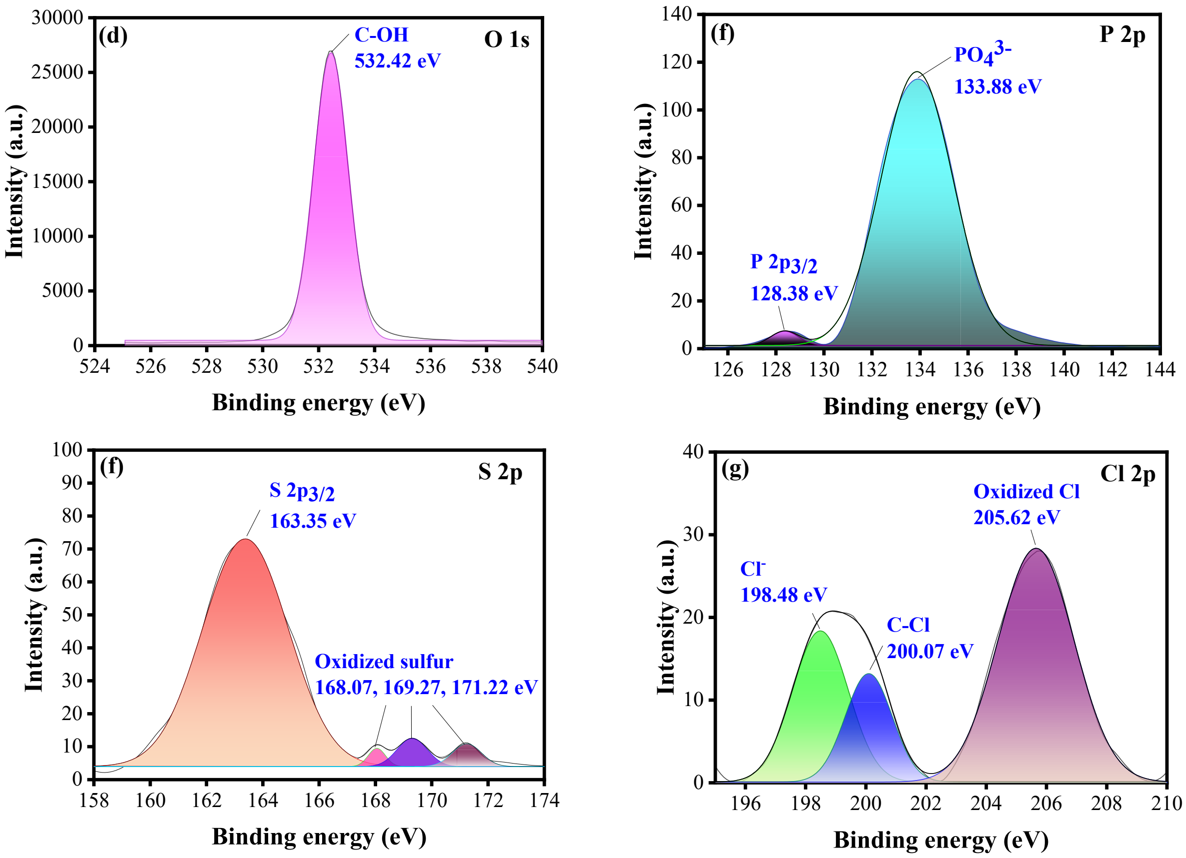
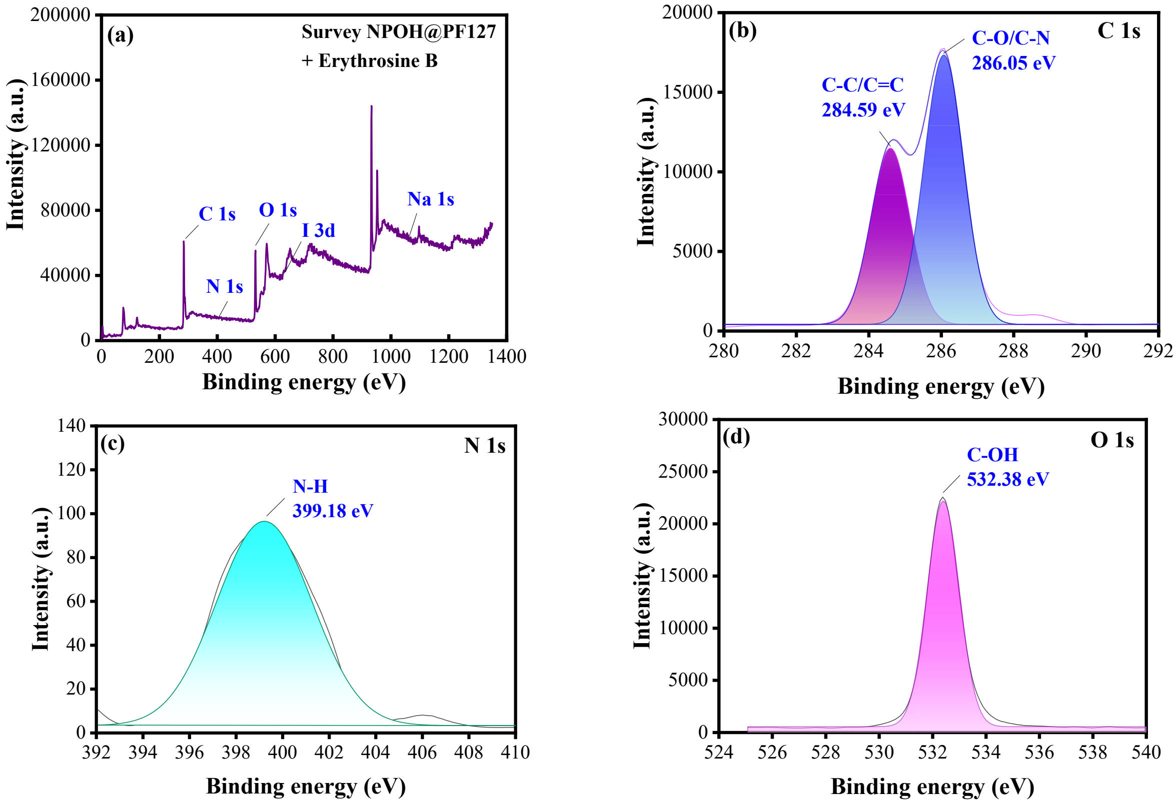


Fig. S26 XPS survey scan of (a) **NPOH@PF127** + CPS methyl, (b–g) deconvoluted spectra of C (1s), N (1s), O (1s), P (2p), S (2p) and Cl (2p)



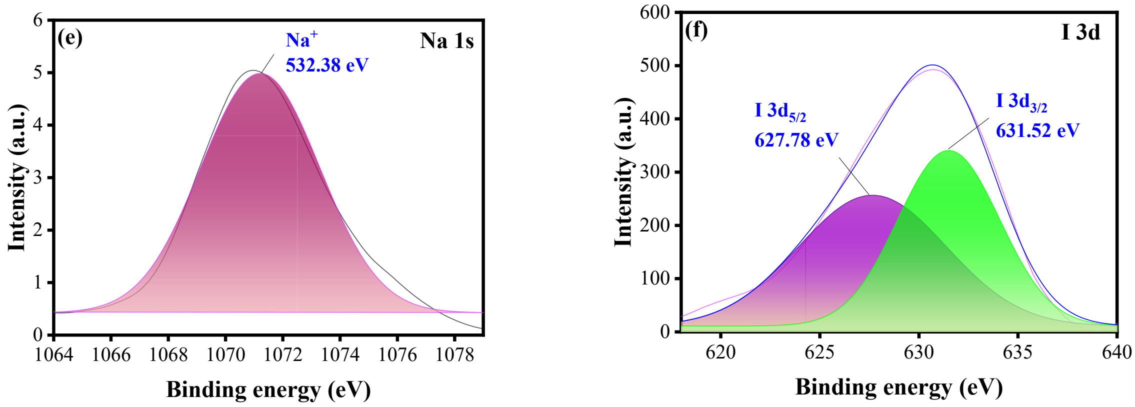
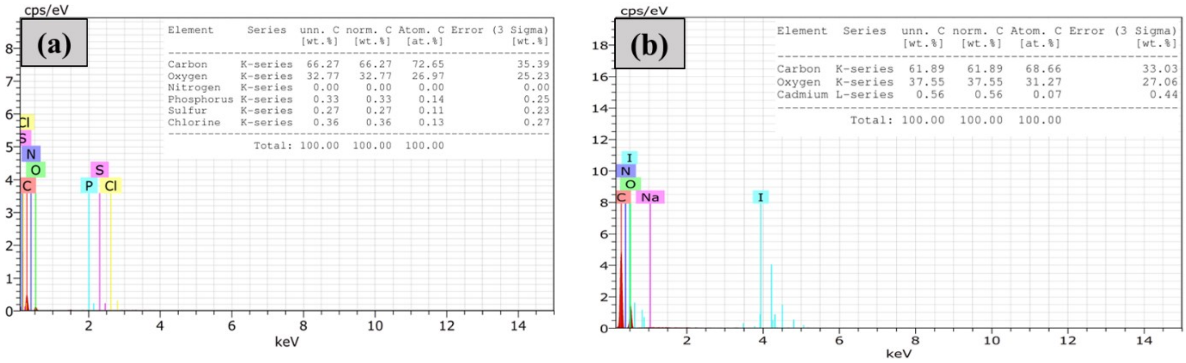


Fig. S27 XPS survey scan of (a) **NPOH@PF127** + erythrosine B, (b–f) deconvoluted spectra of C (1s), N (1s), O (1s), Na (1s) and I (3d)



```
Element      Series    unn. C norm. C Atom. C Error (3 Sigma)
                       [wt.%]  [wt.%]  [at.%]          [wt.%]
-------------------------------------------------------------
Carbon     K-series    66.27   66.27   72.65            35.39
Oxygen     K-series    32.77   32.77   26.97            25.23
Nitrogen   K-series     0.00    0.00    0.00             0.00
Phosphorus K-series     0.33    0.33    0.14             0.25
Sulfur     K-series     0.27    0.27    0.11             0.23
Chlorine   K-series     0.36    0.36    0.13             0.27
-------------------------------------------------------------
              Total:  100.00  100.00  100.00
```

```
Element  Series   unn. C norm. C Atom. C Error (3 Sigma)
                  [wt.%]  [wt.%]  [at.%]          [wt.%]
--------------------------------------------------------
Carbon  K-series   61.89   61.89   68.66           33.03
Oxygen  K-series   37.55   37.55   31.27           27.06
Cadmium L-series    0.56    0.56    0.07            0.44
--------------------------------------------------------
          Total:  100.00  100.00  100.00
```

Fig. S28 EDX spectra of (a) **NPOH@PF127** + CPS methyl (b) **NPOH@PF127** + erythrosine B

Table S1. Comparison of present sensor system **NPOH@PF127** with the earlier reported sensors for CPS methyl and erythrosine B detection

Sensor	**Method**	**Analyte**	**LOD (µM)**	**Conc. range (µM)**	**Ref.**
Terahertz nanomaterials	Terahertz time-domain spectroscopy	CPS methyl	0.63	0.62-3.10	1
Colloidal gold antibody probe	Immunochromatography	CPS methyl	0.41	0.155-37.7	2
Pre-treated glassy carbon electrode	Electrochemical	Erythrosine B	0.8	-	3
Nickel-ferrite/chitosan composite	Electrochemical	Erythrosine B	1.04	2.91-39.93	4
Binary ensemble **NPOH@PF127**	Optical	CPS methyl Erythrosine B	1.28 0.18	4.22-1500 0.59-138	This work

References:

1. W. Xu, L. Xie, J. Zhu, W. Wang, Z. Ye, Y. Ma, C.-Y. Tsai, S. Chen and Y. Ying, *Food Chem.*, 2017, **218**, 330-334.
2. X. Hua, G. Qian, J. Yang, B. Hu, J. Fan, N. Qin, G. Li, Y. Wang, F. Liu, *Biosens. Bioelectron.*, 2010, **26**, 189-194.
3. R. Yemmi, B. E. K. Swamy, *J. Food Compos. Anal.*, 2024, **133**, 106338.
4. G. E. Uwaya, K. Bisetty, *Inorg. Chem. Commun.*, 2025, **178**, 114512.