Electronic Supplementary Material (ESI) for RSC Advances.

Naphthalimide-based fluorescent photoinduced electron transfer sensors for saccharides

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Supporting Information

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Experimental

Reagents

Unless otherwise specified, all the commercial reagents were of analytical grade and used without further purification. All the chemicals were purchased from Aladdin Corporation. Beverages were from Hangzhou Tinghsin Food Co., Ltd. Milk vetch honey was from Shanghai Guanshengyuan Food Co., Ltd. Ultra-pure water was prepared through Sartorius Arium 611DI system.

Characterization and measurement

NMR spectra were performed with a Bruker AV-400 spectrometer (400 M Hz). Mass spectra were recorded on a MA 1212 Instrument under standard condition (ESI, 70 eV). Absorption spectra were measured with an Evolution 220 UV–vis spectrophotometer (Thermo Scientific). Fluorescence spectra were carried out on a Lumina Fluorescence Spectrometer (Thermo Scientific), all the fluorescence spectra were uncorrected. The experiments were performed at 25 °C using nondegassed samples.

Absorbance and Fluorescence titration

Accurately weighted amount of compounds PET-S1 or PET-S2 were dissolved in DMF to obtain 1×10^{-3} M stock solutions. The stock solution was diluted with PBS to acquired 10 μM dye solutions.

Sugars were dissolved in phosphate buffer solution (PBS) to obtain stock solutions (6.0 M). 0–150 μL of sugar solutions were added into 3 mL of 1×10^{-5} M dye buffer solution (50 mM, pH 7.4) to make [sugar] = 0 ~ 300 mM. The pH was adjusted with HCl or NaOH aqueous solution.

Fluorescent detection of spiked fructose in beverages

Kangshifu sugar Sydney and Kangshifu honey grapefruit were respectively 30-fold and 50-fold diluted with PBS. Stock solutions of PET-S1 and a known concentration of fructose were added to 3 mL of the above diluted beverage solution to make [PET-S1] = 10 μM. The fructose concentrations were acquired by comparing the fluorescence intensity at 530 nm to the titration curve.

Determination of the detection limit

The detection limit (LOD) was obtained by $3S_b/k$, where S_b is the standard deviation of the blank measurements of 10 times, and k is the slope of the fitted line.

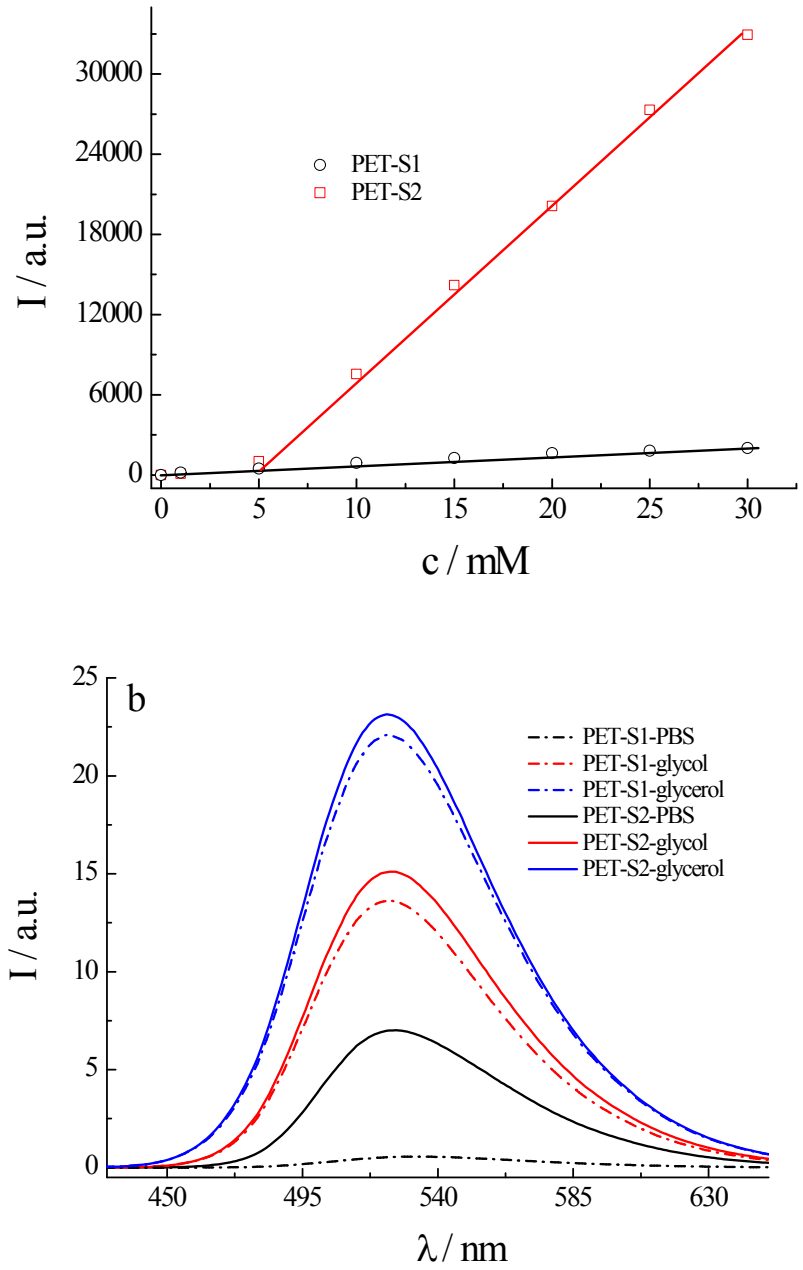


Fig. S1 The curves of I_{530} ~ c for PET-S1 and PET-S2 (a) and emission spectra (b) of PET-S1 and PET-S2 in various media, [PET-S1] = [PET-S2] = 10 μM, λ_{ex} = 400 nm.

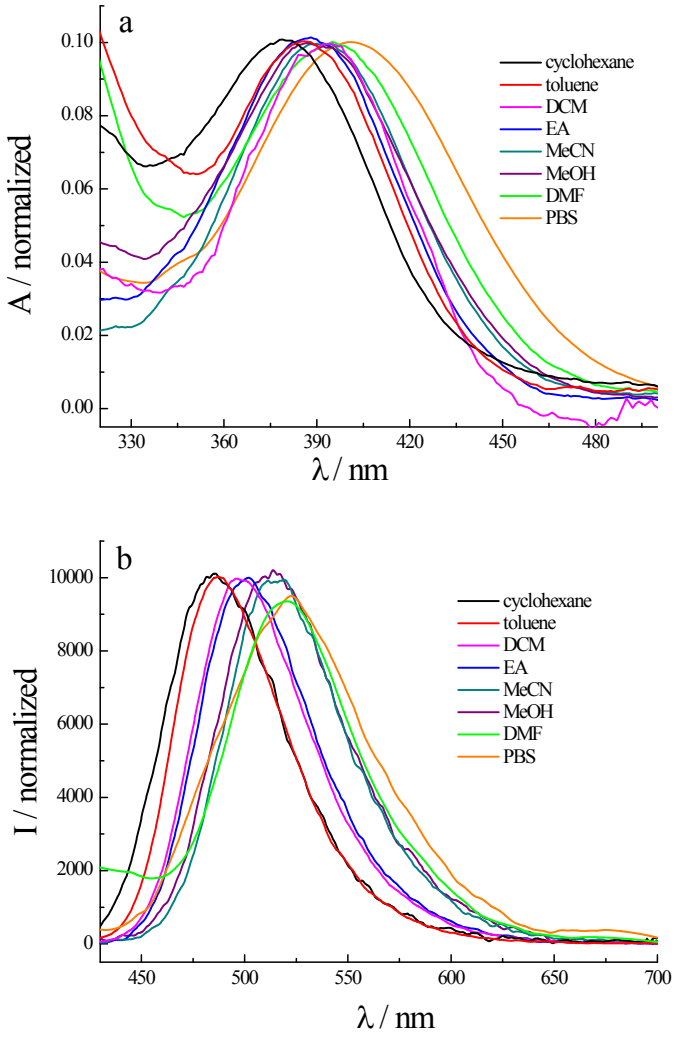


Fig. S2 Normalized absorption (a) and emission (b) spectra of PET-S2 in various solvents.

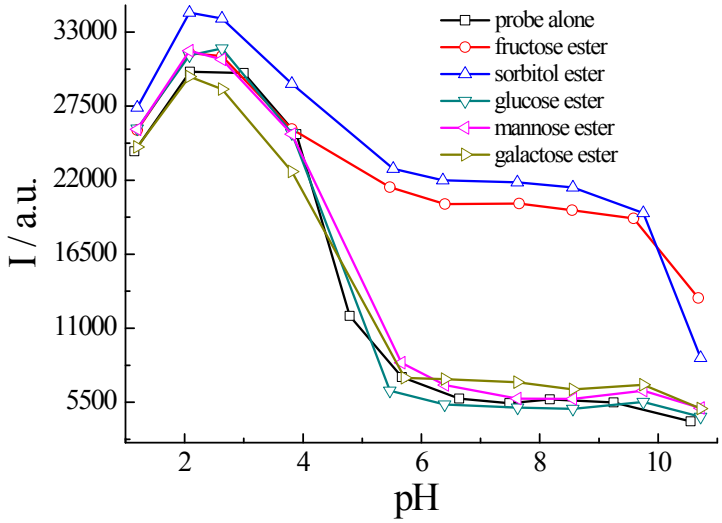


Fig. S3 The fluorescence intensity pH profiles of PET-S2 in the absence and presence sugars.

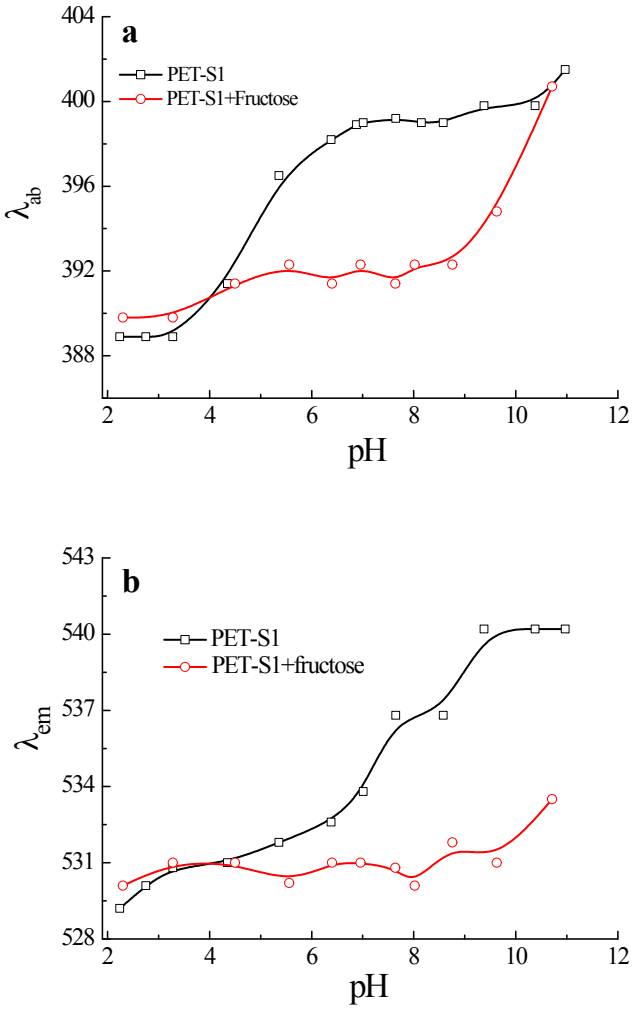


Fig. S4 pH effect on absorption (a) and emission (b) maxima of PET-S1 in the absence and presence of D-fructose. [PET-S1] = 10 μM, [D-fructose] = 100 mM, 50 mM PBS, pH 7.4.

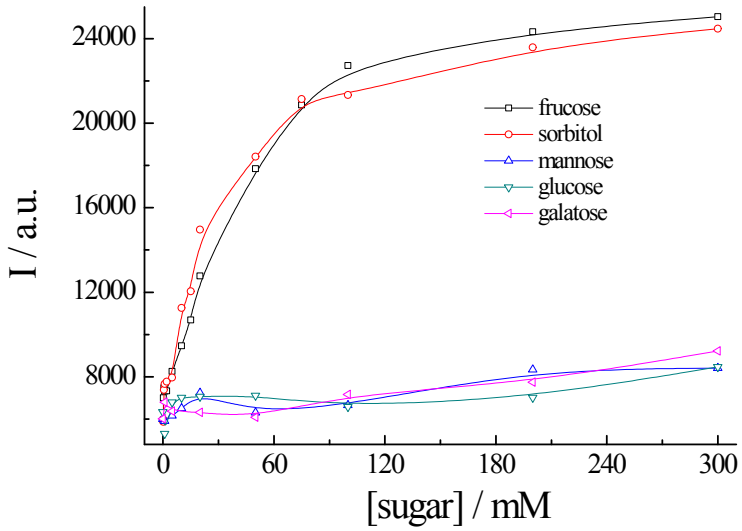


Fig. S5 The fluorescence intensity changes of PET-S2 as a function of sugar concentration. [PET-S2] = 10 μM, 50 mM PBS, pH 7.4.

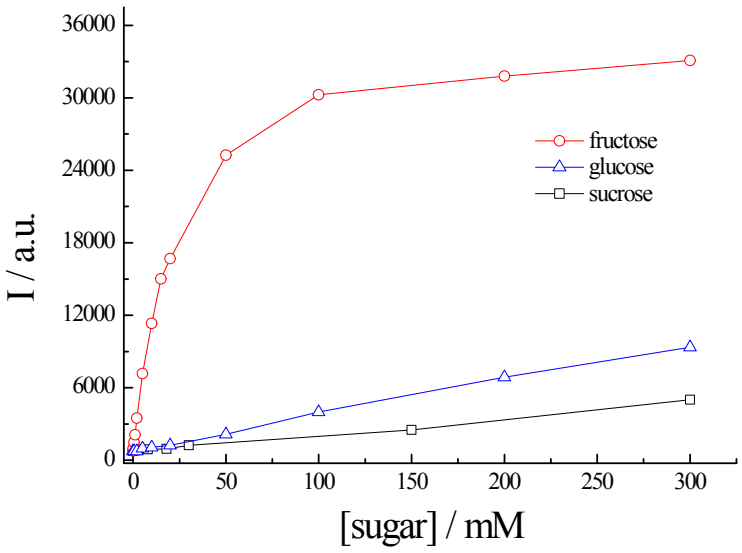


Fig. S6 The fluorescence intensity changes of PET-S1 as a function of sugar concentration. [PET-S1] = 10 μM, 50 mM PBS, pH 7.4.

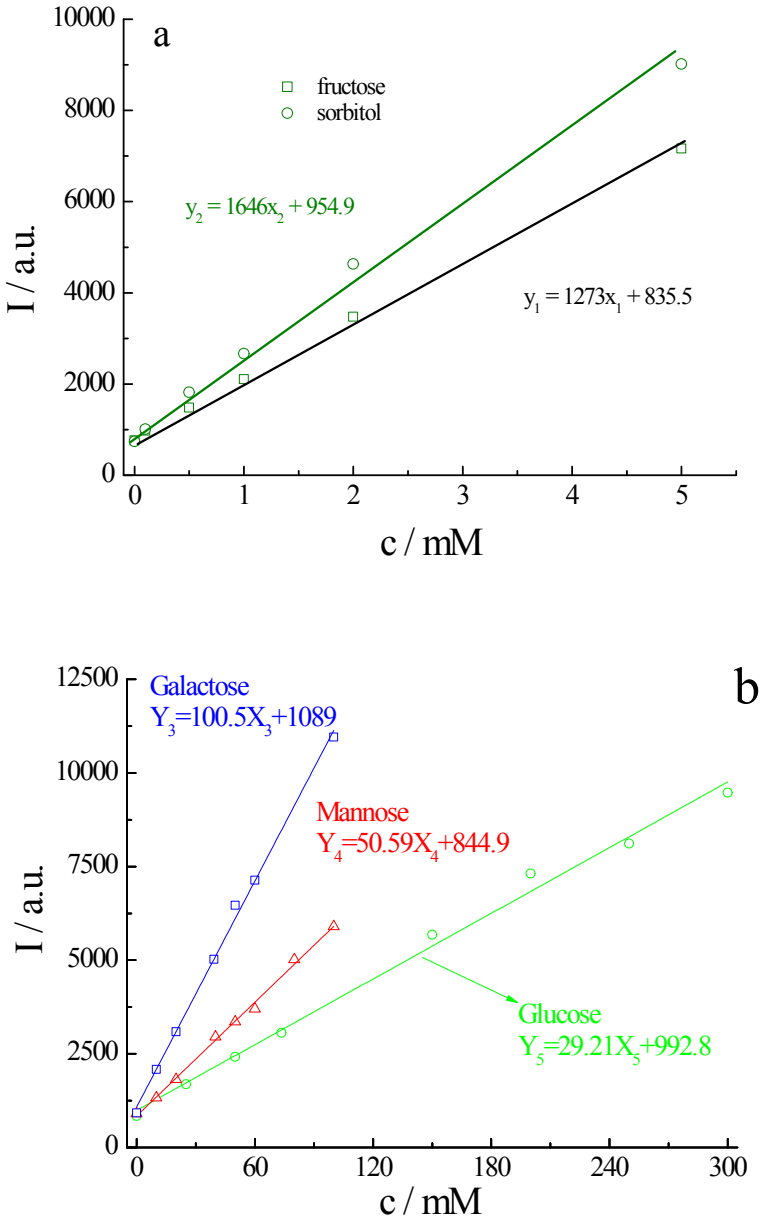


Fig. S7 The linear relationship between the fluorescence intensity (I_{530}) and the sugar concentration. [PET-S1] = 10 μM, 50 mM PBS, pH 7.4.

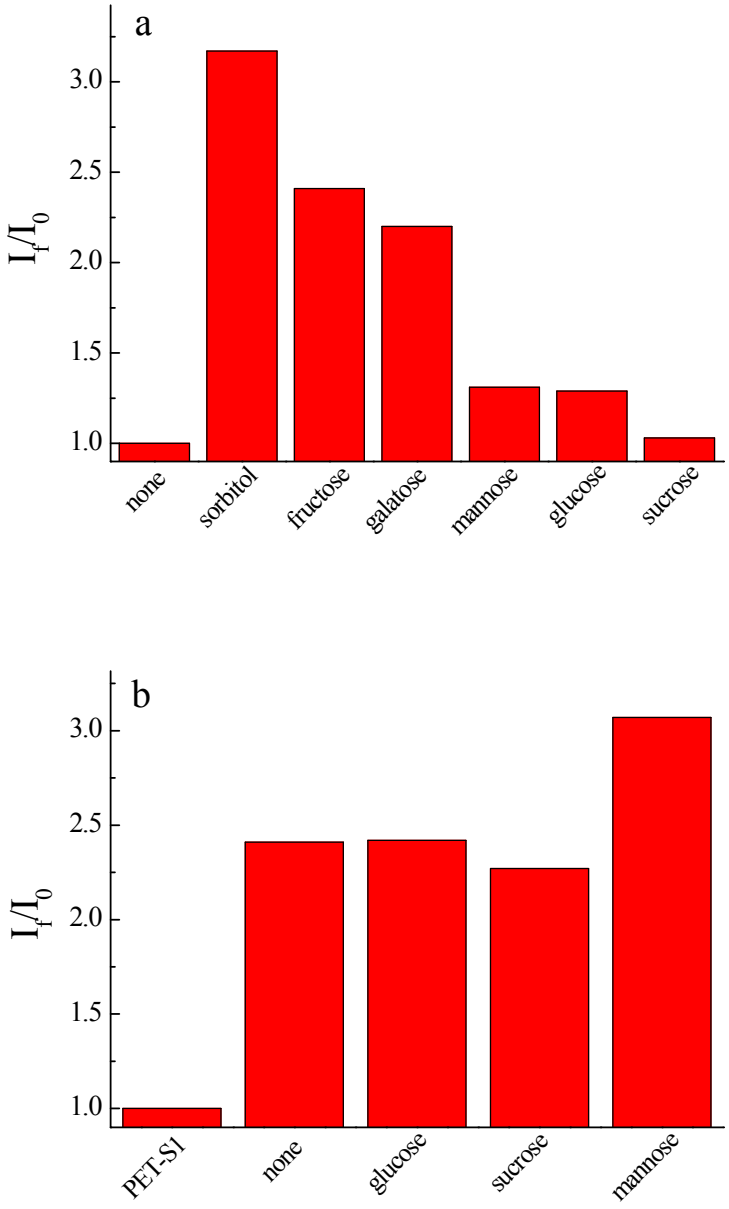
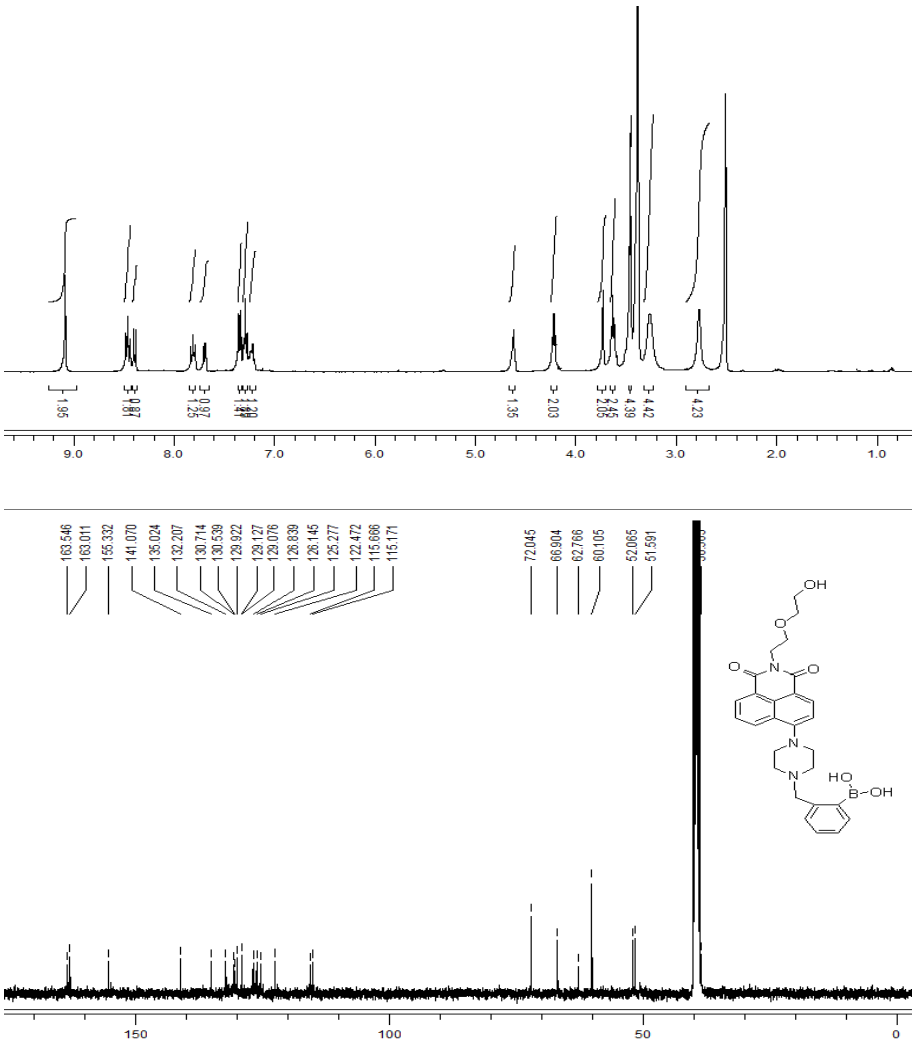
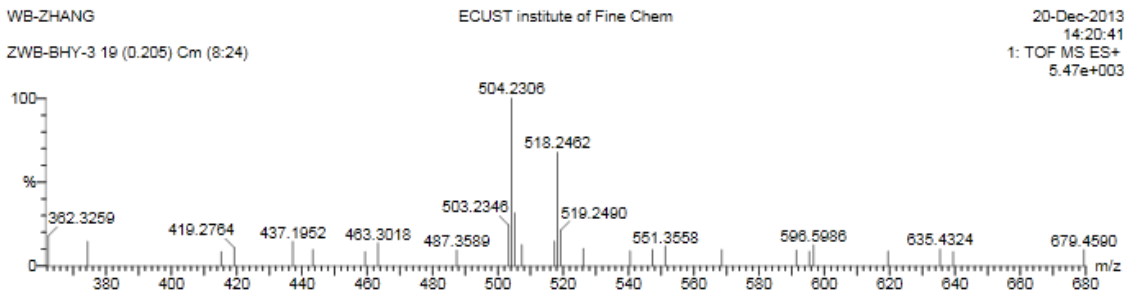


Fig. S8 The fluorescence intensity of PET-S1 without and with sugars (a) and the fluorescence intensity of PET-S1-fructose without and with other sugars (b). [PET-S1] = 10 μM, [fructose] = [sorbitol] = 1 mM, the concentrations of other sugars are 10 mM, 50 mM PBS, pH 7.4, λ_{em} = 530 nm.



Monoisotopic Mass, Even Electron Ions
360 formula(e) evaluated with 32 results within limits (up to 1 closest results for each mass)
Elements Used:
C: 0-40 H: 0-40 N: 0-3 O: 0-12 B: 0-1



Minimum:				-1.5			
Maximum:		30.0	50.0	100.0			
Mass	Calc. Mass	mDa	PPM	DBE	i-FIT	i-FIT (Norm)	Formula
504.2306	504.2306	0.0	0.0	14.5	22.8	0.0	C27 H31 N3 O6 B

Fig. S9 ^{1}H NMR, ^{13}C NMR and ESI spectra of PET-S1.

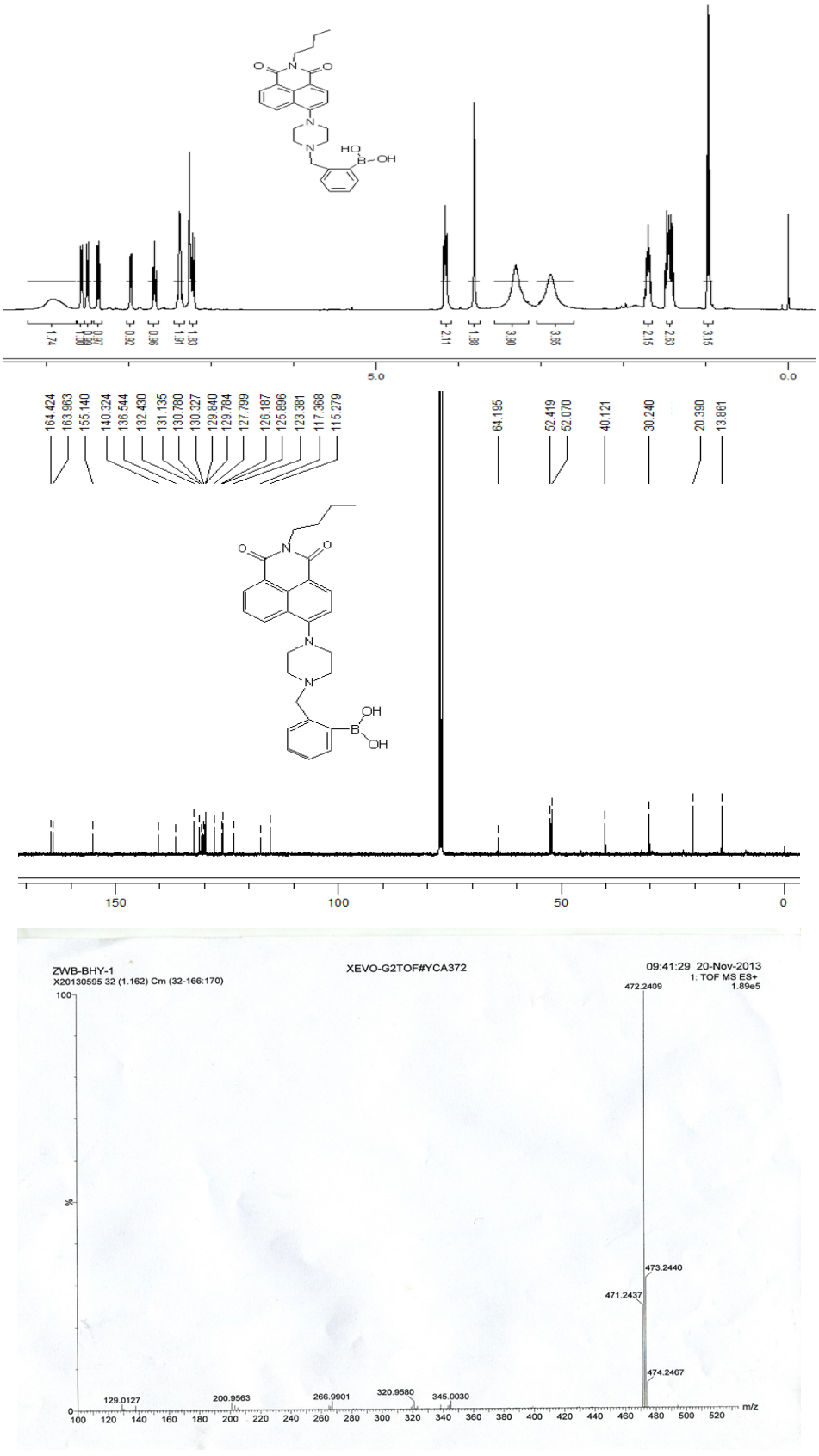


Fig. S10 [1] H NMR, [13]C NMR and ESI spectra of PET-S2.

Table S1 The absorption and emission wavelengths, Stokes shifts and fluorescence quantum yields[a] of PET-S1 and PET-S2 in various solvents[b].

compound		Cyclo-hexane	toluene	dichloro-methane	Ethyl-acetate	acetonitrile	DMF	methanol	PBS
PET-S1	λ_{ab} / nm	383	389	388	389	393	394	389	399
	λ_{em} / nm	486	492	500	503	520	518	520	540
	Stokes shift / nm	103	103	112	114	127	124	131	141
	Φ_{fl}	0.078	0.286	0.259	0.157	0.043	0.033	0.022	0.007
PET-S2	λ_{ab} / nm	380	386	394	388	391	395	394	401
	λ_{em} / nm	485	488	496	502	515	519	514	521
	Stokes shift / nm	105	102	102	114	124	124	120	120
	Φ_{fl}	0.117	0.526	0.510	0.347	0.199	0.047	0.105	0.065

[a] Coumarin 153 (Φ_f = 0.38 in ethanol) was used as the reference; [b] containing 1% DMF.