A dual-response fluorescence sensor for SO_2 derivatives and polarity, and the application in real water and food samples

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Table S1 Comparison of TLA with other sensors based on different mechanisms for SO_2 detection.

1. Energy transfer efficiency

$E=1-F_{DA}/F_D$

Herein, in the FRET process, E represents the efficiency of energy transfer. F_D indicates the fluorescence intensity of the donor when by itself. F_{DA} represents the fluorescence intensity of the donor when the acceptor is present.

2. Detection limit

Detection limit = $3\sigma/K$

σ represents the standard deviation of detection of 10 sensor blank solutions. K represents the slope of the linear relationship in the fluorescence emission spectrum of the sensor TLA.

3. The synthesis of donor

4-(1-methyl-1H-phenanthro[9,10-d]imidazol-2-yl)benzoic acid (0.5 mmol), dimethylamine (1.0 mmol), EDC (2.0 mmol) and DMAP (0.4 mmol) were added to dry DCM, and reacted 48 h in N_2 condition. Then, the products were separated though column chromatography (silica gel: 200-300 mesh, DCM/MeOH, V/V, 70/1). The product TLA was received with 33% yield, and the structure was characterized by ^{1}H NMR (400 MHz, DMSO-*d*$_6$): δ = 3.028 (d, J=16.0 Hz, 6H), 4.328 (s, 3H), 7.637-7.790 (m, 6H), 7.948 (d, J=8.4 Hz, 2H), 8.612 (dd, J=12.4 and 8.0 Hz, 2H), 8.872 (d, J=8.4 Hz, 1H), 8.879 (d, J=8.0 Hz, 1H).

Scheme S1 The synthesis route of donor.

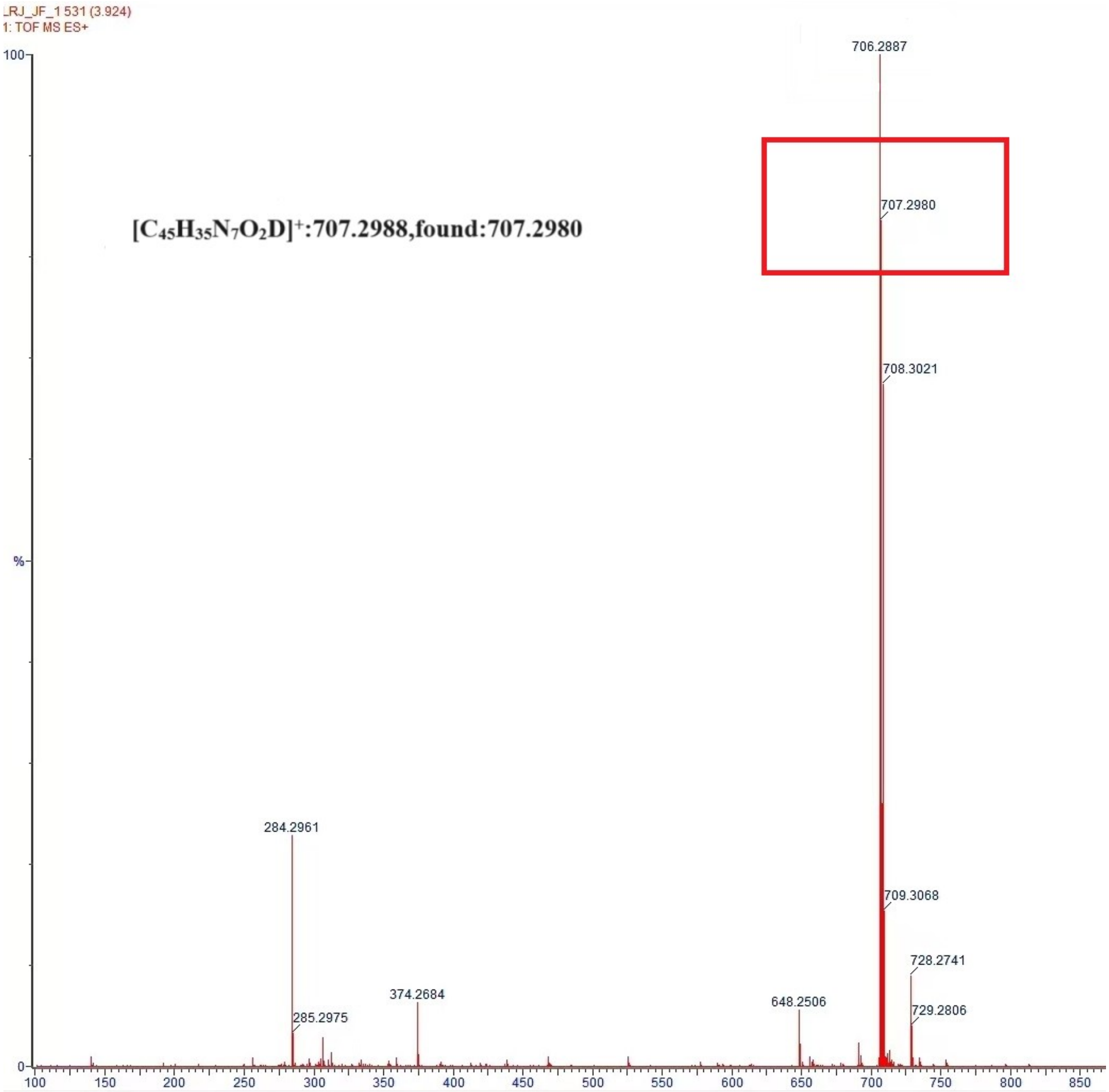


Fig. S1 The HRMS of TLA.

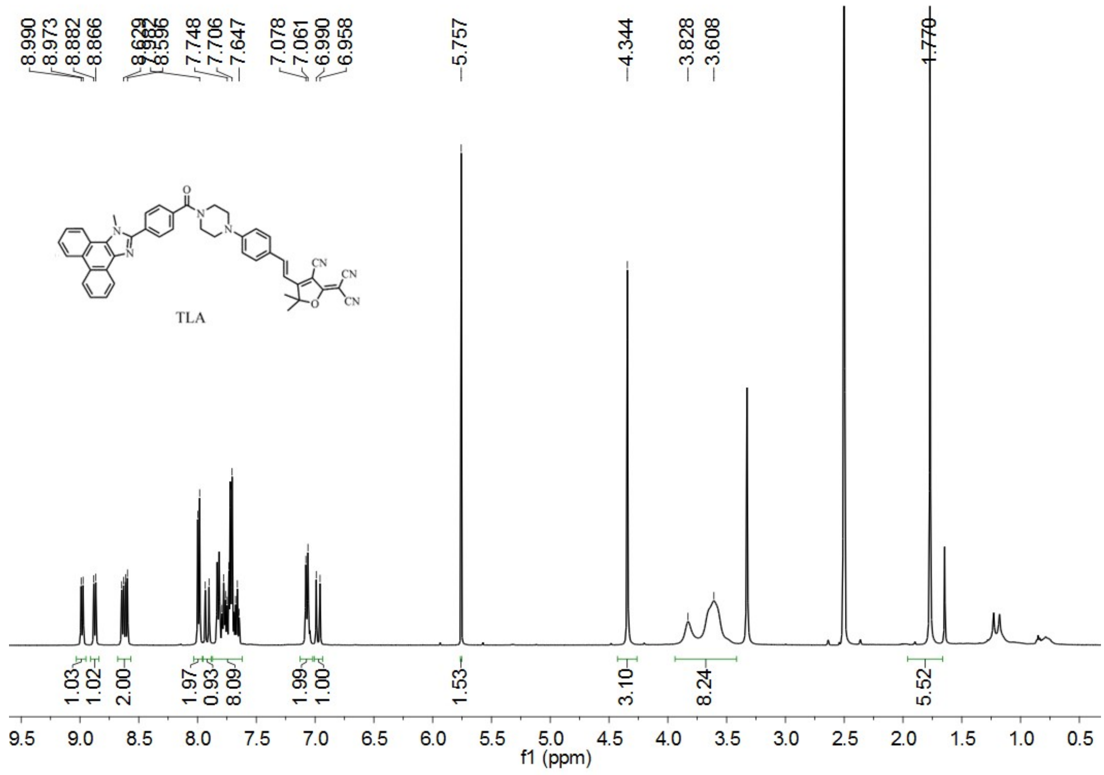


Fig. S2 The ^{1}H NMR of TLA.

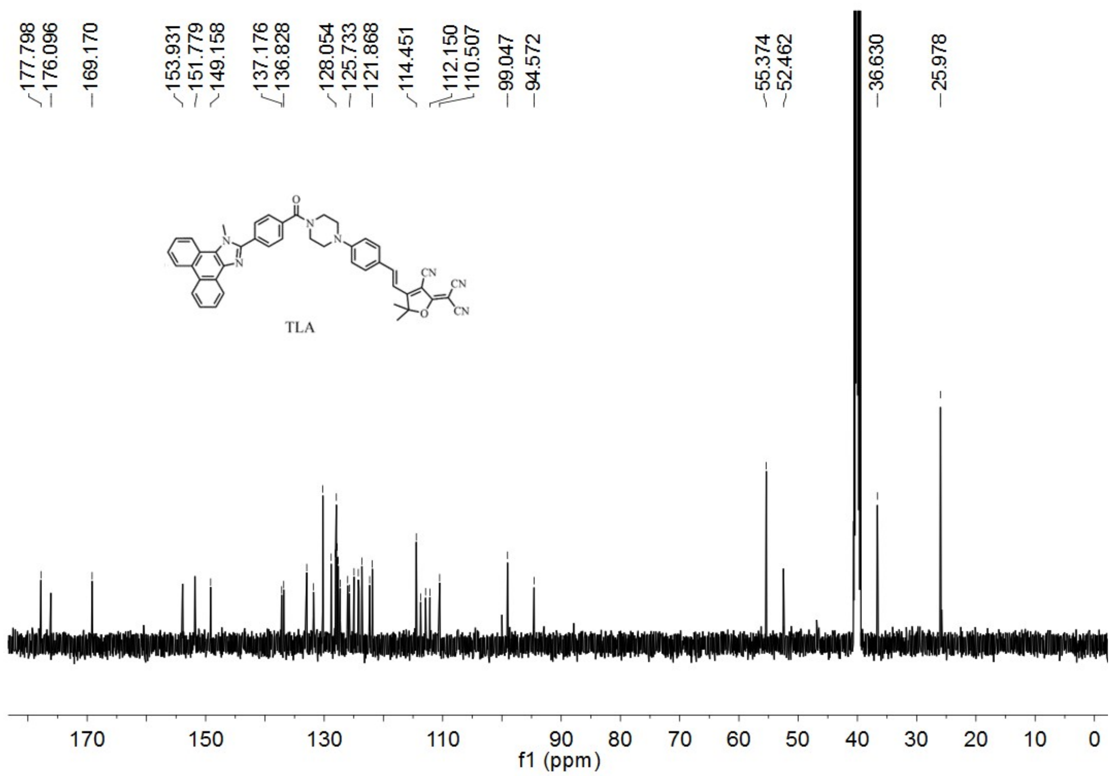


Fig. S3 The ^{13}C NMR of TLA.

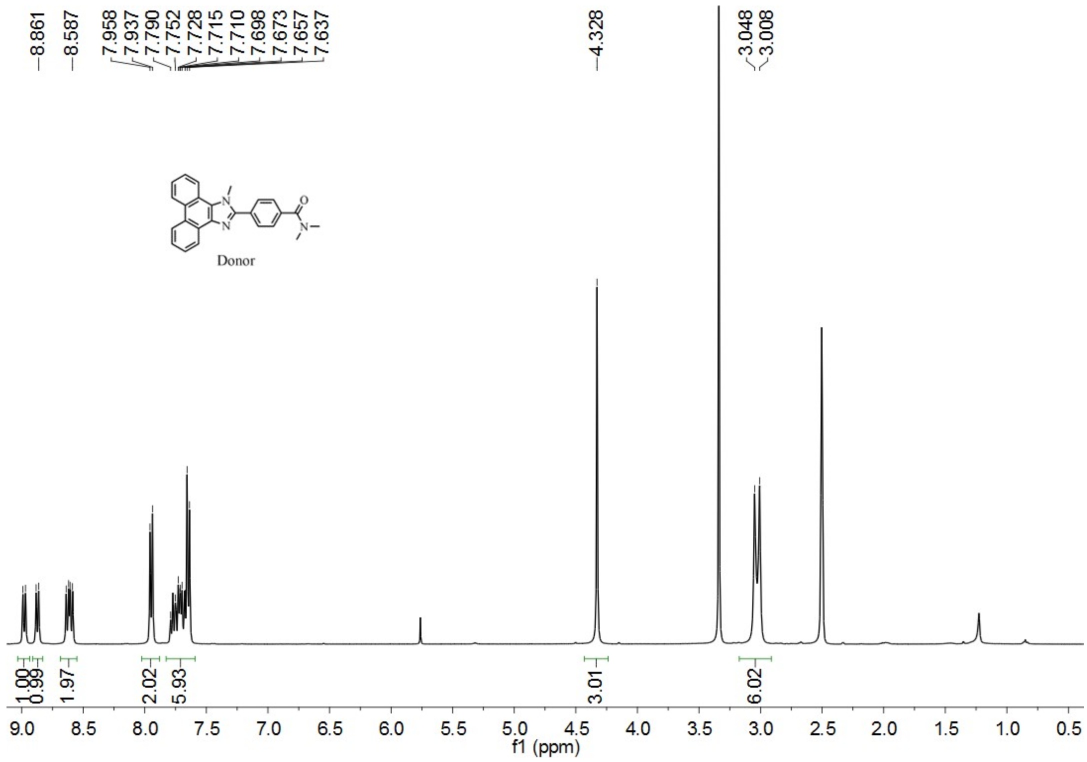


Fig. S4 The ^{1}H NMR of donor.

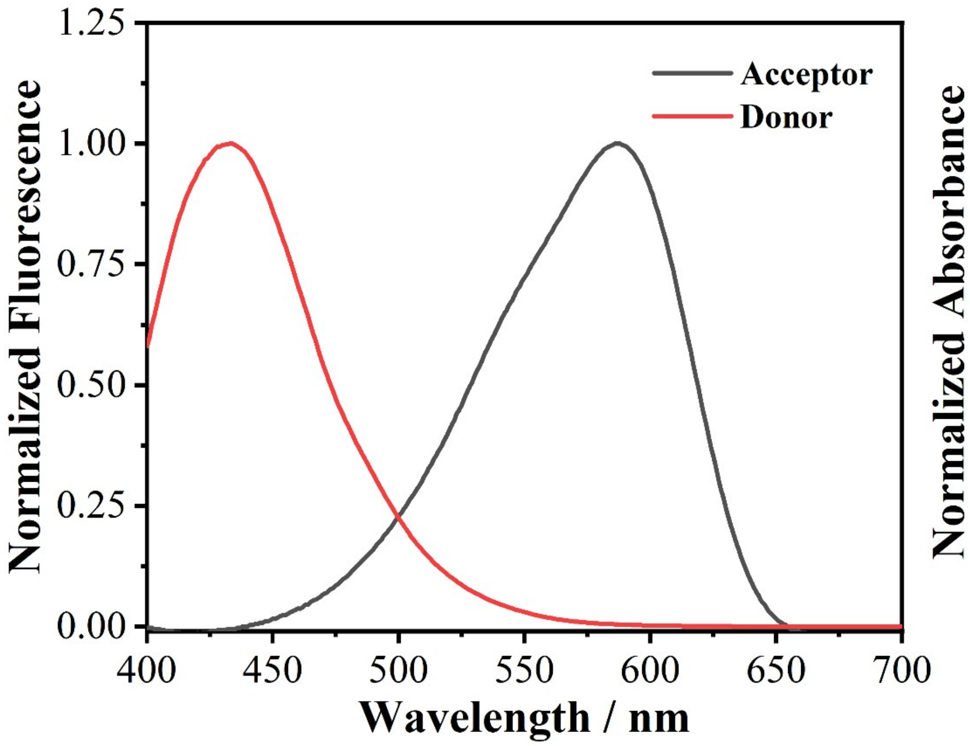


Fig. S5 The overlap of the normalized fluorescence spectra of donor and the absorbance spectra of acceptor.

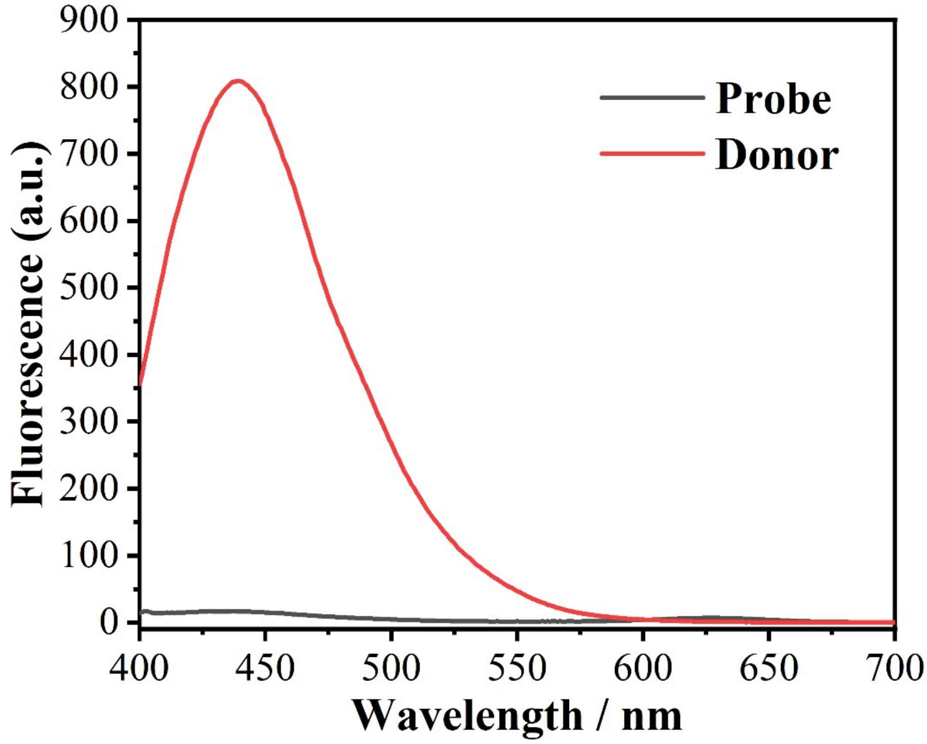


Fig. S6 The energy transfer efficiency.

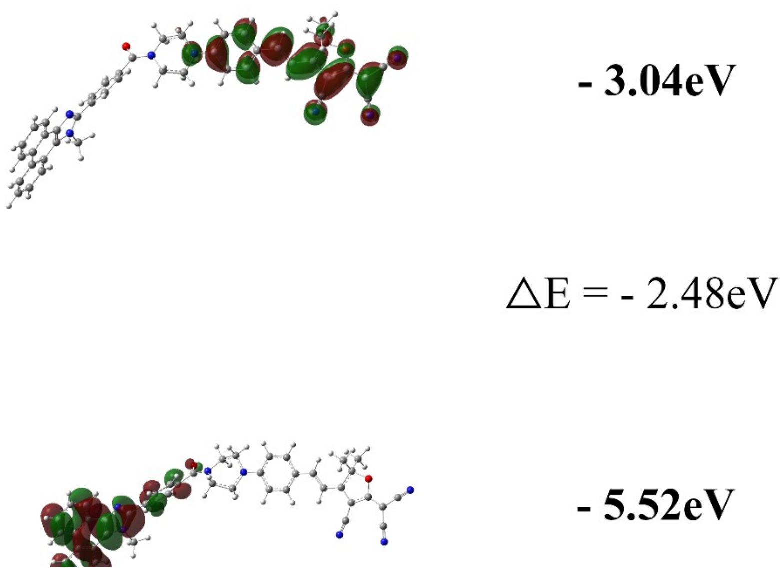


Fig. S7 HOMO and LUMO of TLA by DFT calculations

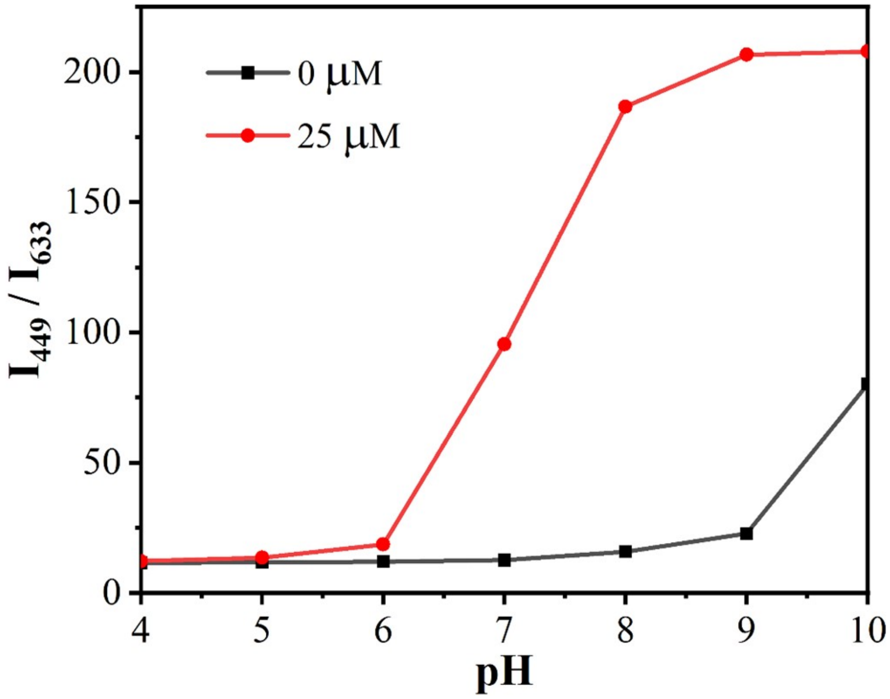


Fig. S8 The fluorescence of TLA relying on the variation of pH condition.

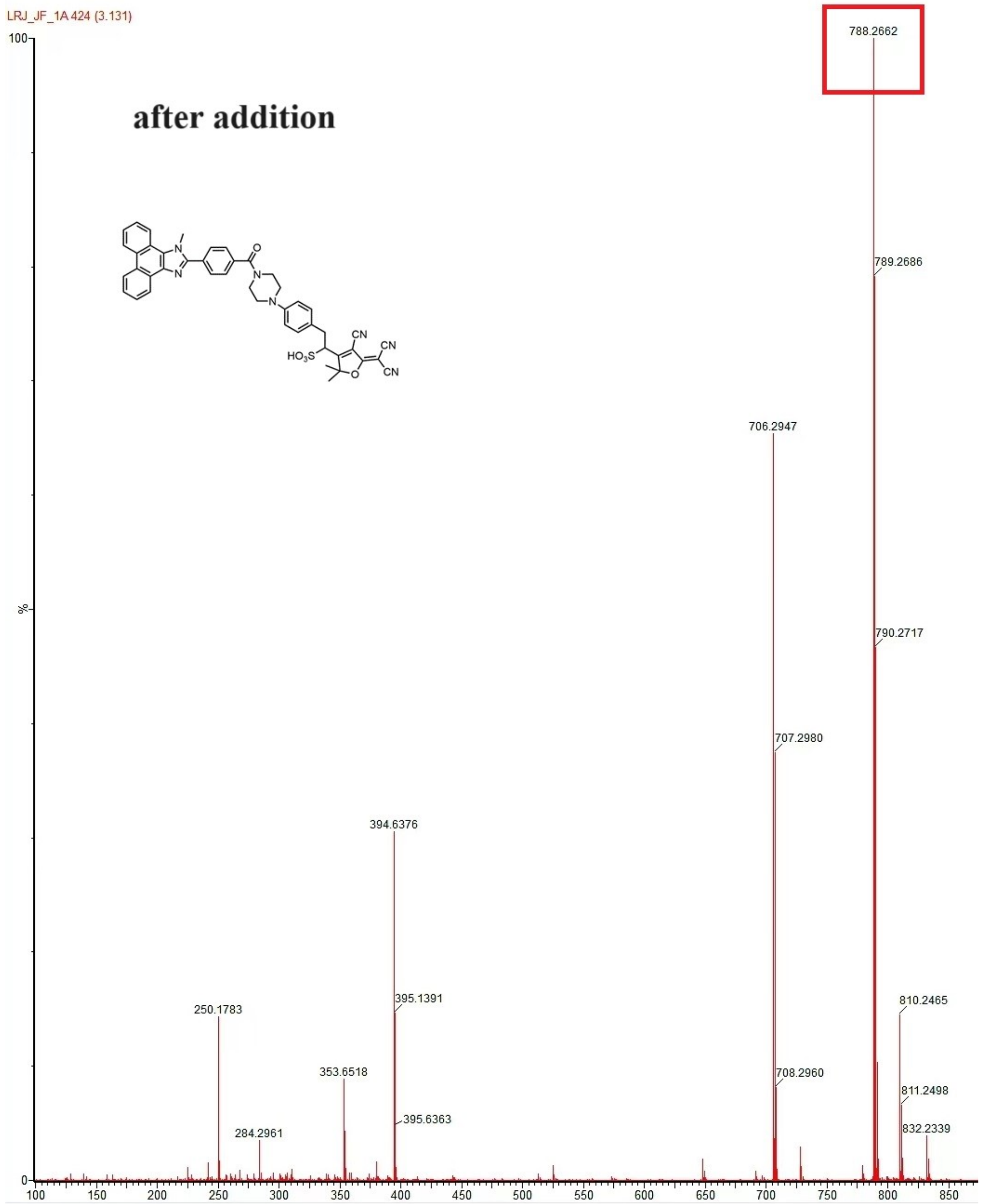
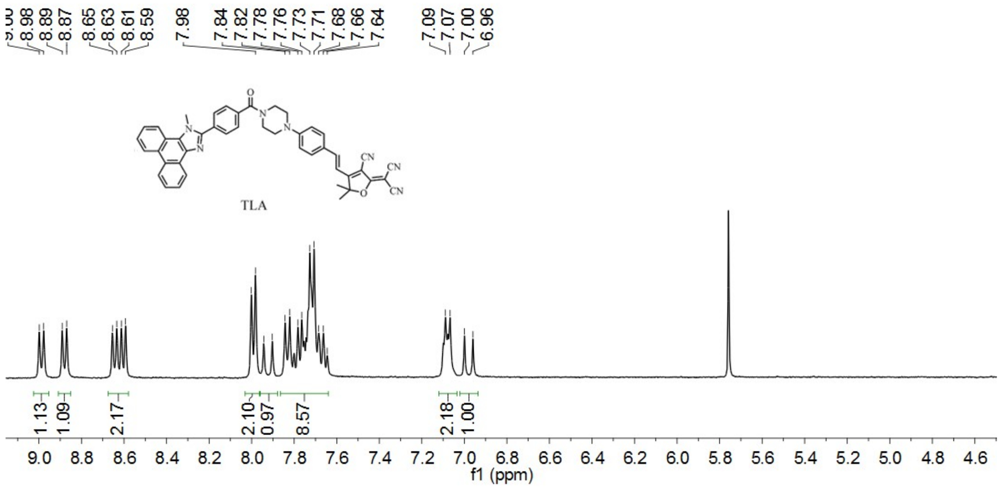


Fig. S9 The HRMS of the addition product.

(a) before addition



(b) after addition

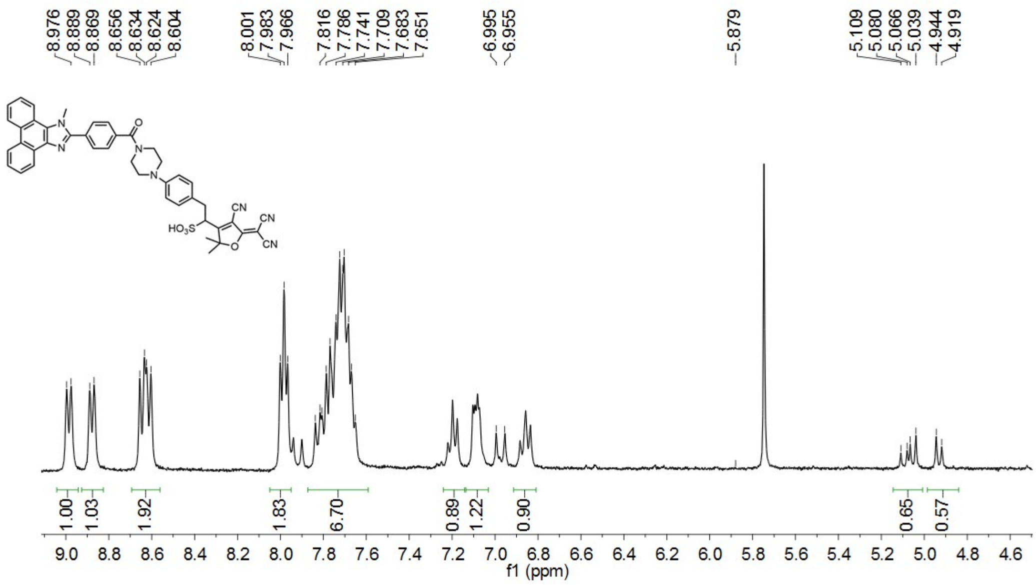
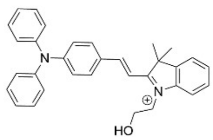
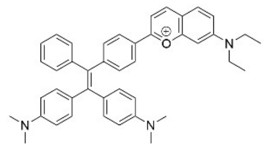
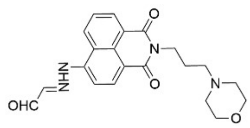
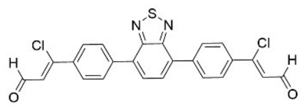
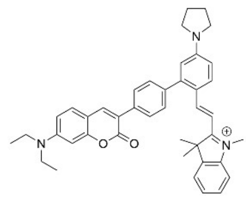
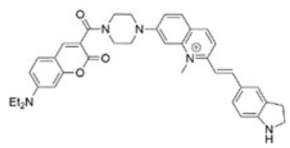
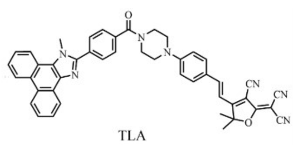


Fig. S10 ^{1}H NMR of the addition product.

Table S1 Comparison of TLA with other sensors based on different mechanisms for SO_2 detection.

REF	Type/mechanism	structure	λ_{ex}	LOD	Response time	stokes shift
1	AIE		300/530	1.42 μM	30min	265nm
2	AIE		400	27.22μM	About 20s	55nm
3	ESIPT		450	330μM	30s	92nm
4	ICT		390	190nM	30s	130nm
5	TBET		810	0.09 μM	5min	118nm
6	FRET		405	3.15 μM	60min	196nm
7	Nanoreactor	C11-BDP+PDMS-NH_2+PS-PEO	/	0.7 μM	65s	/
8	Electrochemical sensor	3D-rGO/CB/GCE	/	52.3ppm	/	/
9	Nanozyme Sensor	MIL-53(Fe/Mn)	/	0.05 μg mL^{-1}	20min	/
10	Fluorescence Sensor	metal−organic framework-5-NH_2/urushiol/PVP nanofiber composite films	365	447 μM	＜20 s	/
This work	FRET	 TLA	360	0.44 μM	30min	273nm

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