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Support information

Tb^{3+} luminescence cholate hydrogel-based multi-functionalized platform for Hg^{2+} and NO_2 detection

Jiaxin Yuan[a, b]; Ao Shen[a]; Xiaohui Hao[a]; Man Du[c*]; Xiaoyu Du[a]; Shufeng Ma[a]; Mengwen Li[a]; Lifeng Zhang[b*]; Yunxu Yang[a, b*]

[a] *Department of Chemistry and Chemical Engineering, School of Chemistry and Biological Engineering, University of Science and Technology Beijing, Beijing 100083, China.*

[b] *State Key Laboratory of Baiyunobo Rare Earth Resource Researches and Comprehensive Utilization, Baotou Research Institute of Rare Earths, Baotou 014030, P. R. China.*

[c] *School of Chemical and Pharmaceutical Engineering, Hebei University of Science and Technology, Shijiazhuang, 050018, China.*

Corresponding Author: Yunxu Yang[a, b]; Lifeng Zhang[b]; Man Du[b].

E-mail addresses:

yxyang@ustb.edu.cn (Yunxu Yang);

131310212@163.com (Lifeng Zhang)

mandu@hebust.edu.cn (Man Du).

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Materials and instrumentation

Ethylene dithiol, 4-biphenylmethanol and 4-phenylbenzaldehyde were purchased from Tianjin Siensi Opto Technology Co., Ltd. (Tianjin, China); Tert-butyldimethylchlorosilane, DMAP (4-dimethylaminopyridine) were purchased from Beijing Coupling Technology Co., Ltd.; Sodium cholate, Tetrachloride hexahydrate was purchased from Beijing Yinuokai Technology Co., Ltd. (Beijing, China); Solvents and other chemical reagents were purchased from Beijing Lanyi Chemical Products Co., Ltd. (Beijing, China), all of which were analytically pure and could be used without further purification. The water used in the experiment was all ultrapure water. Chitosan non-woven fabric was purchased from Tianjing Youtai nonwoven fabric Co. Ltd.

Ultraviolet visible (UV) absorption spectra were obtained by a UV-2600 spectrometer (Techcomp, China), Fluorescence emission studies were carried out with a Hitachi F-4500 Fluorescence Spectrophotometer. ^{1}H NMR and ^{13}C NMR spectra were measured on a Varian Gemin-400 MHz spectrometer with chemical shifts reported in ppm (TMS as internal standard). ESI-HRMS spectra were recorded with Bruker spectrometers. Spectrophotometer CS-520 and iPhone 12 promax were used to construct the smart sensing platform. Scanning Electron Microscope (SEM) images were recorded using Zeiss G300 instrument. Inductively Coupled Plasma-Mass spectrometry (ICP-MS) was recorded in Skyray instrument with ICP20607.

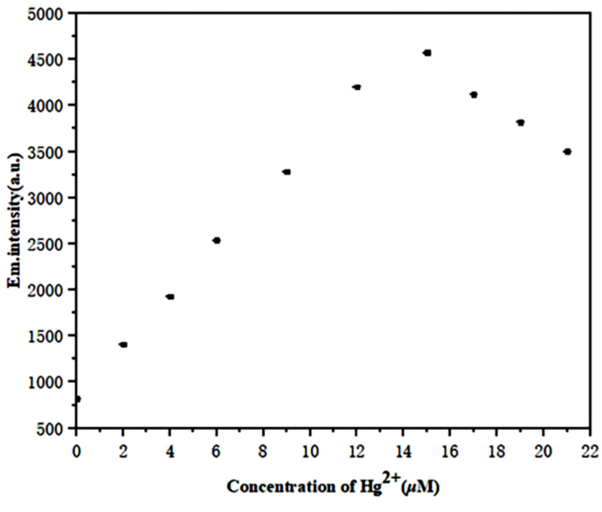

Fig. S1 Time-delayed emission spectrum of **PS-BD@ Tb^{3+}/hydrogel** (20 μM) excited at 300 nm when Hg^{2+} (0-21 μM) is gradually added.

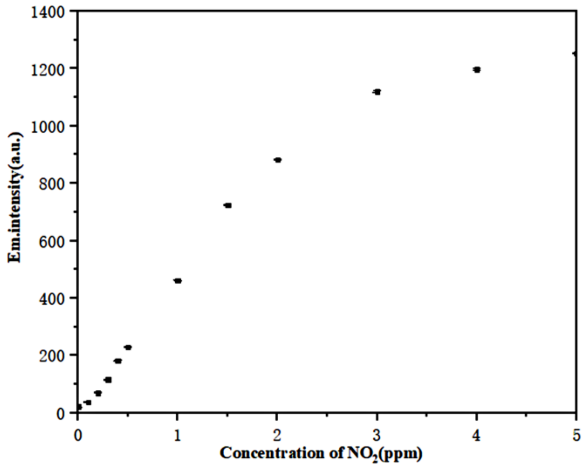

Fig. S2 Time-delayed emission spectrum of **PS-BS@Tb^{3+}/hydrogel** (20 μM) excited at 300 nm after 10 min in NO_2 (0-5 ppm) environment.

Table S1 Compares with some documents that detect for Hg^{2+}.

Probe	Sensor Materials	Detection Limit	Sensing Mode	Ref.
1	CN-vinyl	3.7×10^{-8} M	turn-on	[1]
2	AADT	2.34×10^{-8} M	both	[2]
3	2,2'-(2,2-di(thiophen-2-yl)eth-ene-1,1-diyl)dipyridine and 2,2'-2,2-di([2,2'-bithiophen]-5-yl)ethene-1,1-diyl)dipyridine	4.8×10^{-8} M	turn-on	[3]
4	naphthalene-based chemodosimeter 1	5.0×10^{-6} M	turn-on	[4]
5	1-(2-phenyl-2H-[1,2,3] triazole-4-carbonyl)thiosemicarbazide	3.70×10^{-8} M	turn-on	[5]

6	Schiff base	2.64×10^{-8} M	off-on-off	[6]
7	pyren-1-ylmethylene-thiazol-2-yl-amine	2.7×10^{-7} M	colorimetric	[7]
8	D1	6.62×10^{-7} M	turn-off	[8]
9	TbTATAB	4.4×10^{-9}M	turn-off	[9]
10	CA-S(tandain)	1.26×10^{-7} M	colorimetric	[10]
11	CDs-AgNPs	3.6×10^{-12} M	both	[11]
12	**PS-BD@Tb^{3+}/hydrogel**	**2.4×10^{-7} M**	**turn-on**	**This work**

Table S2 Compares with some documents that detect for NO_2.

Number	Sensor Materials	Detection Limit	Sensing Mode	Ref.
1	Ni(II) complexes- sulforhodamine B	-	turn-on	[12]
2	Cu(II) complexes–DDMEP/DMABP	-	turn-on	[13]
3	BODIPY	0.46 ppm	colorimetric	[14]
4	Trimethylsily benzyl ether or oxime groups	0.02 ppm(Ab)	colorimetric	[15]
5	TICT	0.09 ppm	turn-off	[16]
6	CDs-QDs	19 nM	colorimetric	[17]
7	MFM-520	-	adsorption	[18]
8	Tb(BTC) (BTC = benzene-1,3,5-tricarboxylate)	4.0 ppm	turn-off	[19]
9	**PS-BD@Tb^{3+}/hydrogel**	**0.075 ppm**	**turn-on**	**This work**

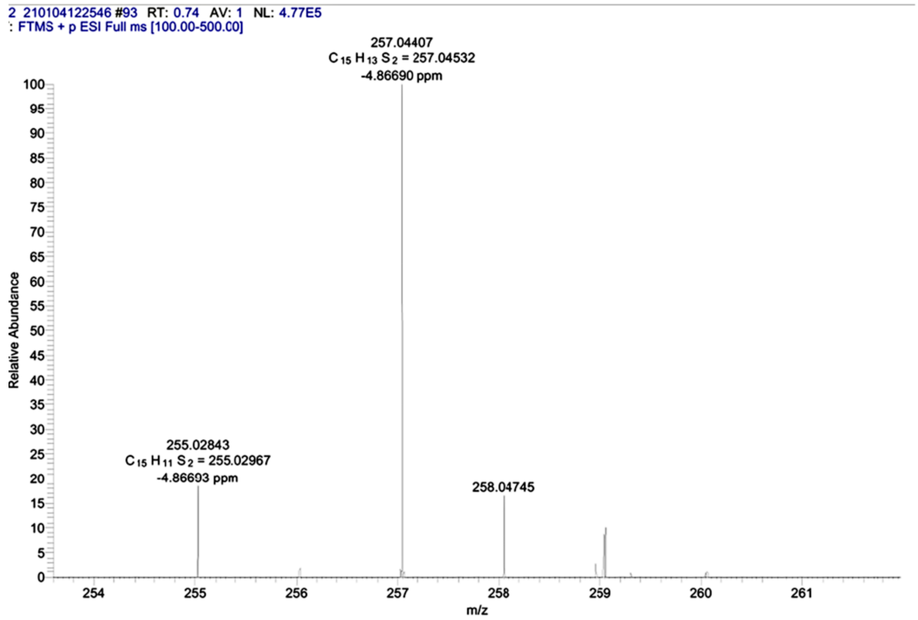

Fig. S3 The mass spectrum of PS-BD.

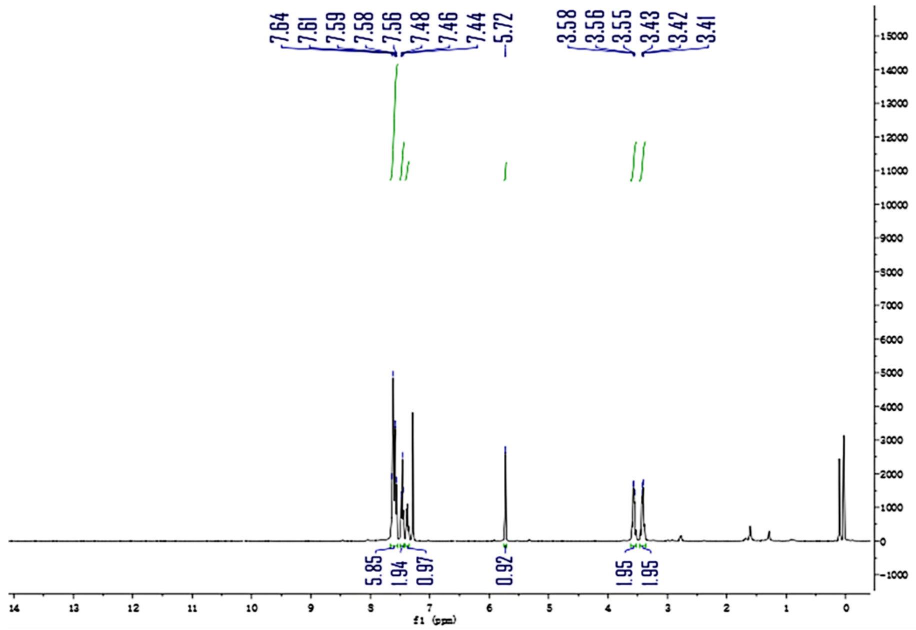

Fig. S4 The ^{1}H NMR spectrum of PS-BD.

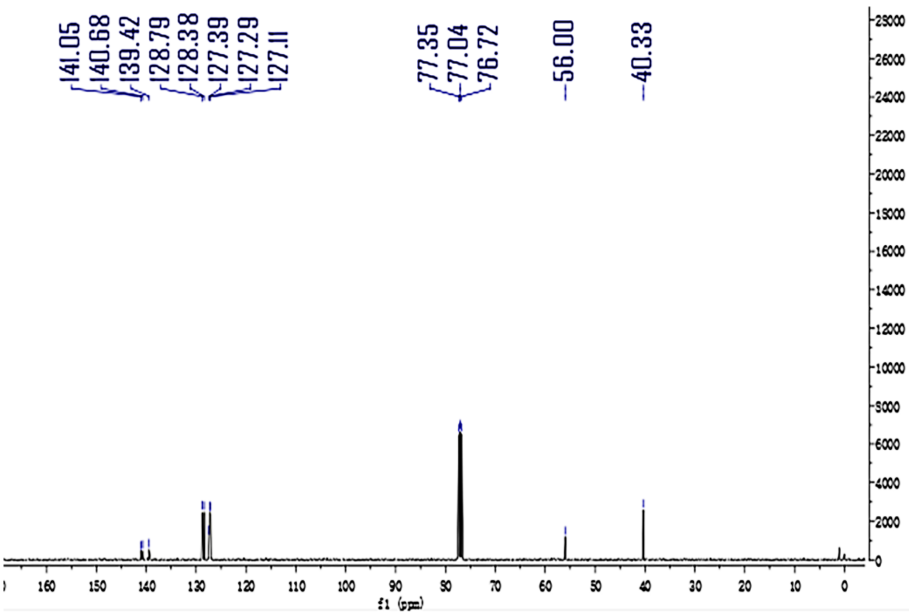

Fig. S5 The ^{13}C NMR spectrum of PS-BD.

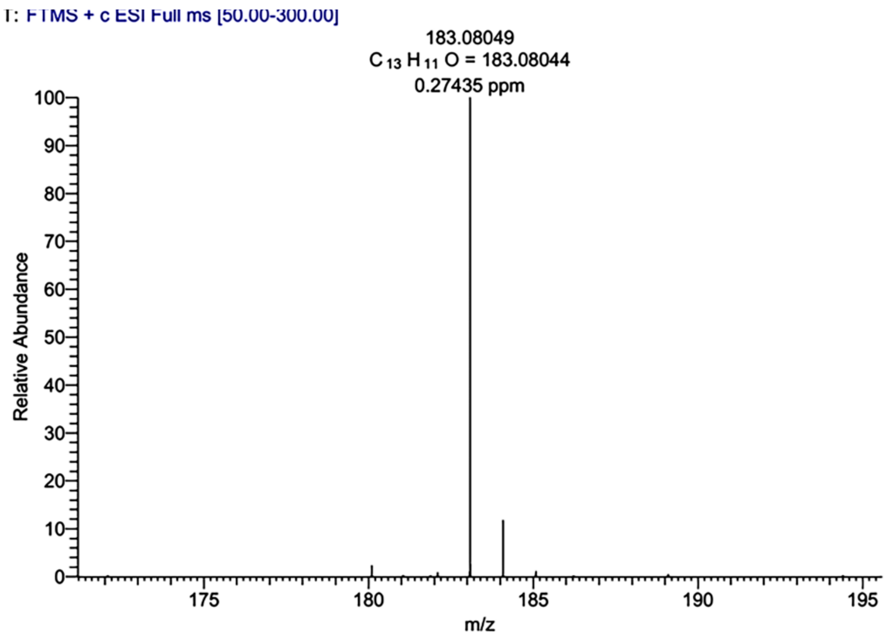

Fig. S6 The mass spectrum of the reaction of PS-BD with Hg^{2+} to form compounds.

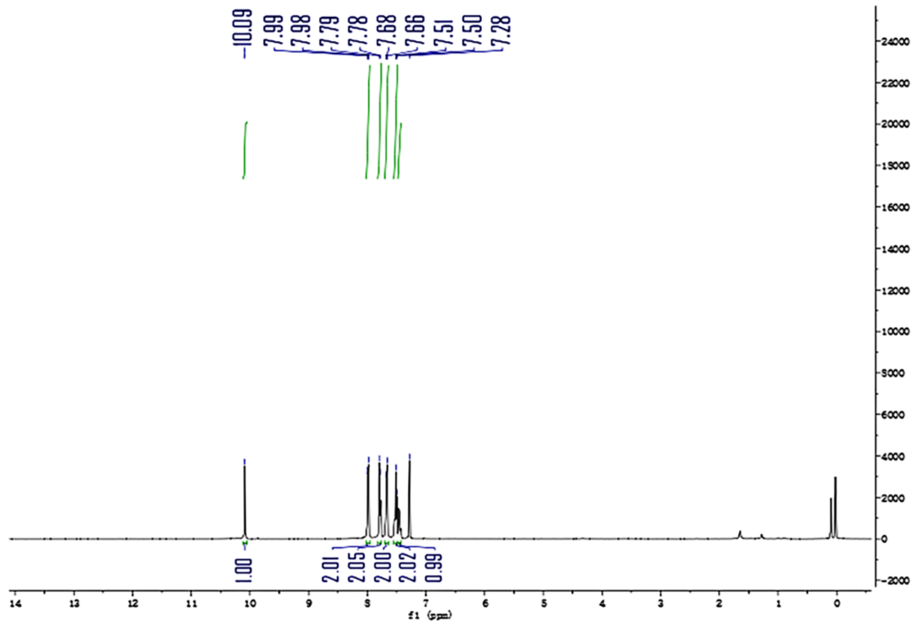

Fig. S7 The ^{1}H NMR spectrum of the reaction of PS-BD with Hg^{2+} to form compounds.

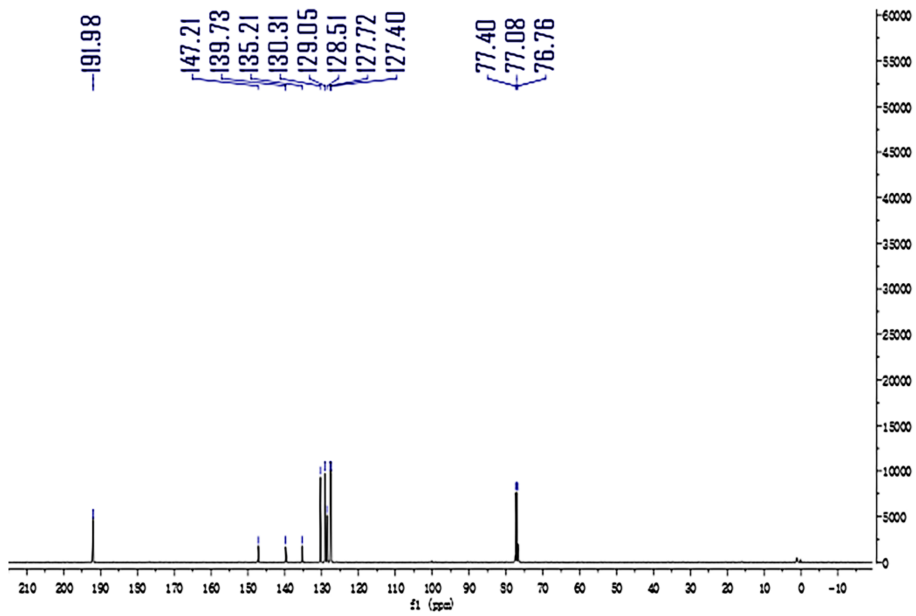

Fig. S8 The ^{13}C NMR spectrum of the reaction of PS-BD with Hg^{2+} to form compounds.

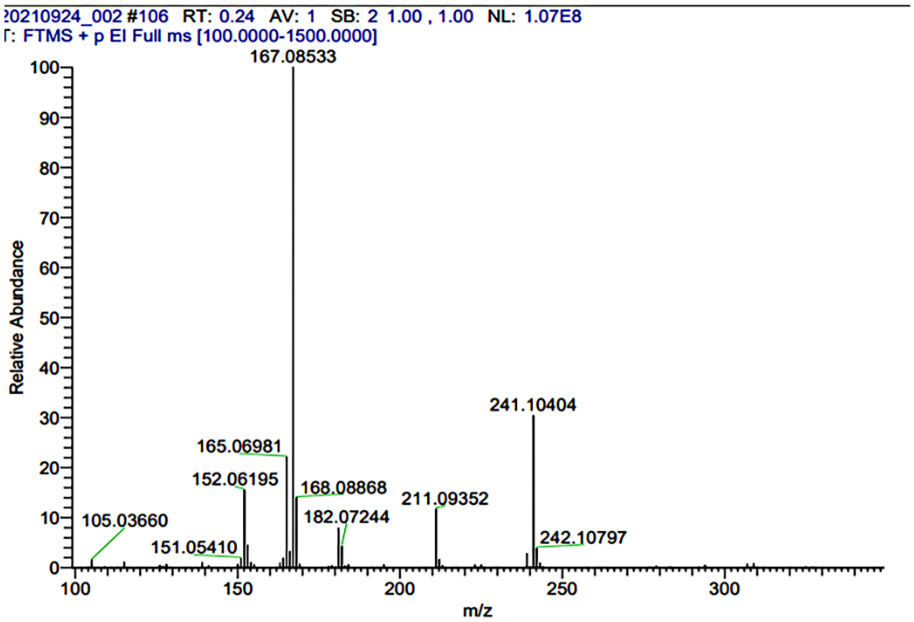

Fig. S9 The mass spectrum of PS-BS.

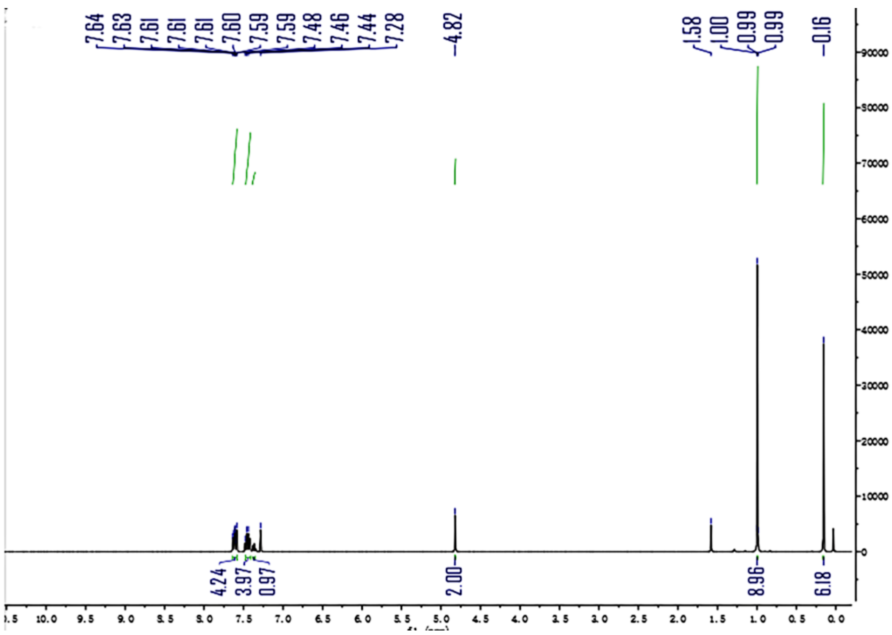

Fig. S10 The ^{1}H NMR spectrum of PS-BS.

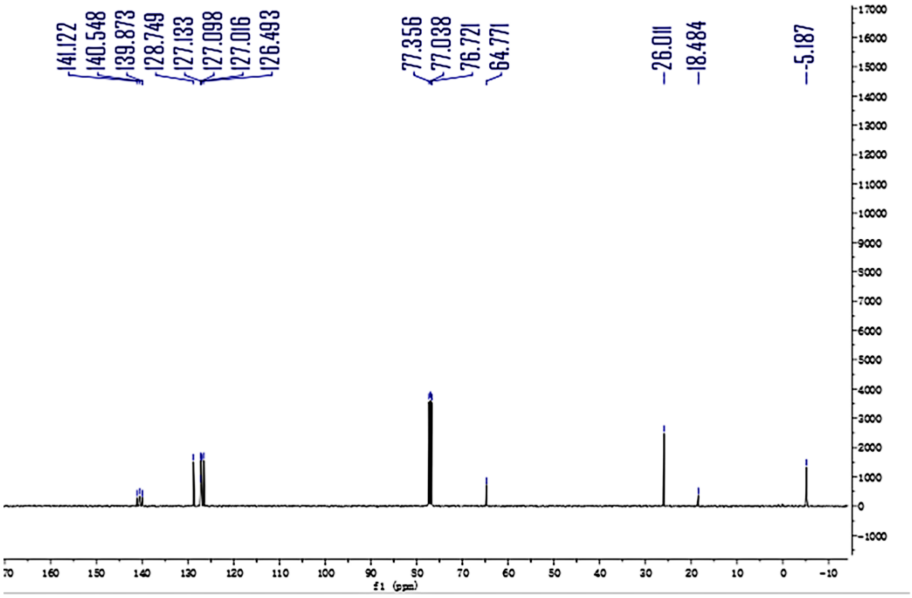

Fig. S11 The ^{13}C NMR spectrum of PS-BS.

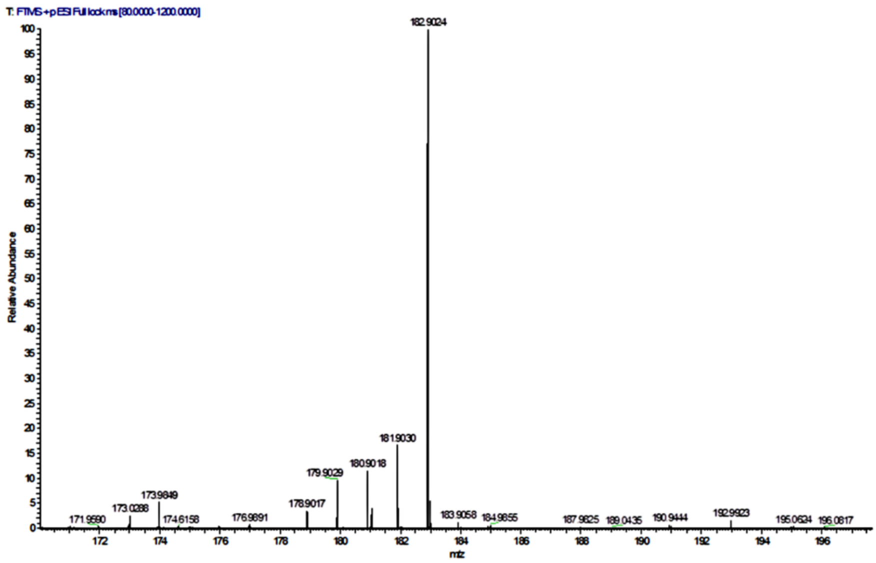

Fig. S12 The mass spectrum of the reaction of PS-BS with NO_2 to form compounds.

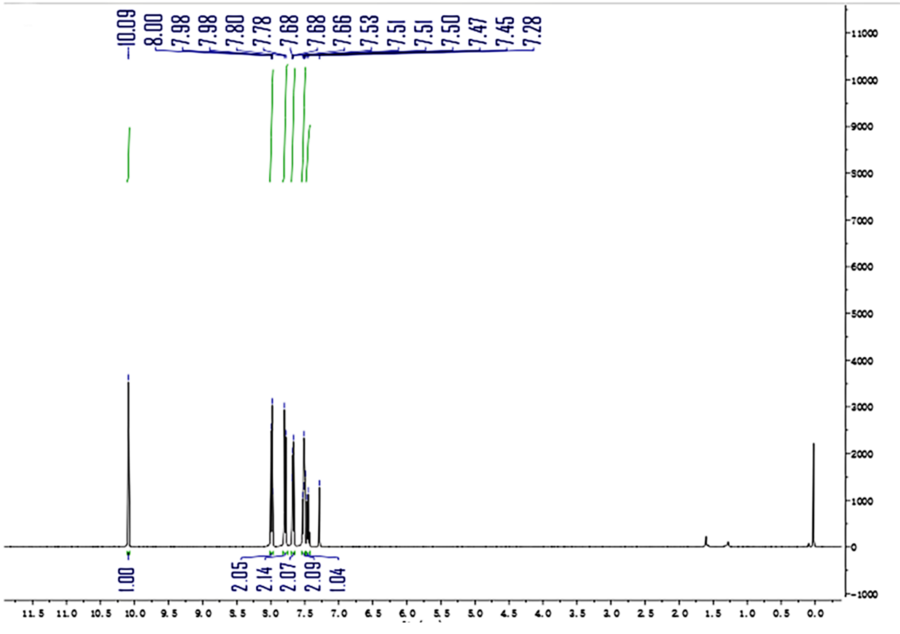

Fig. S13 The [1]H NMR spectrum of the reaction of PS-BS with NO_2 to form compounds.

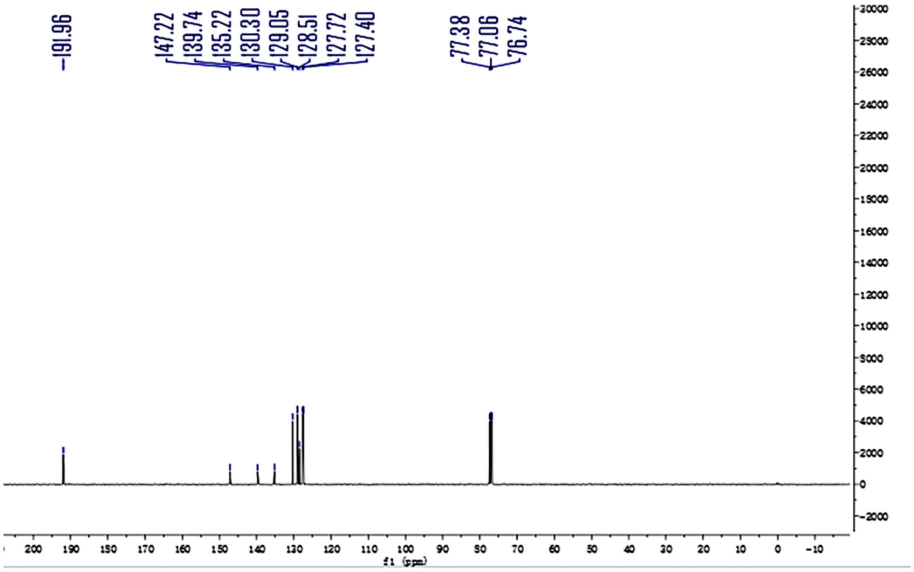

Fig. S14 The [13]C NMR spectrum of the reaction of PS-BS with NO_2 to form compounds.

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