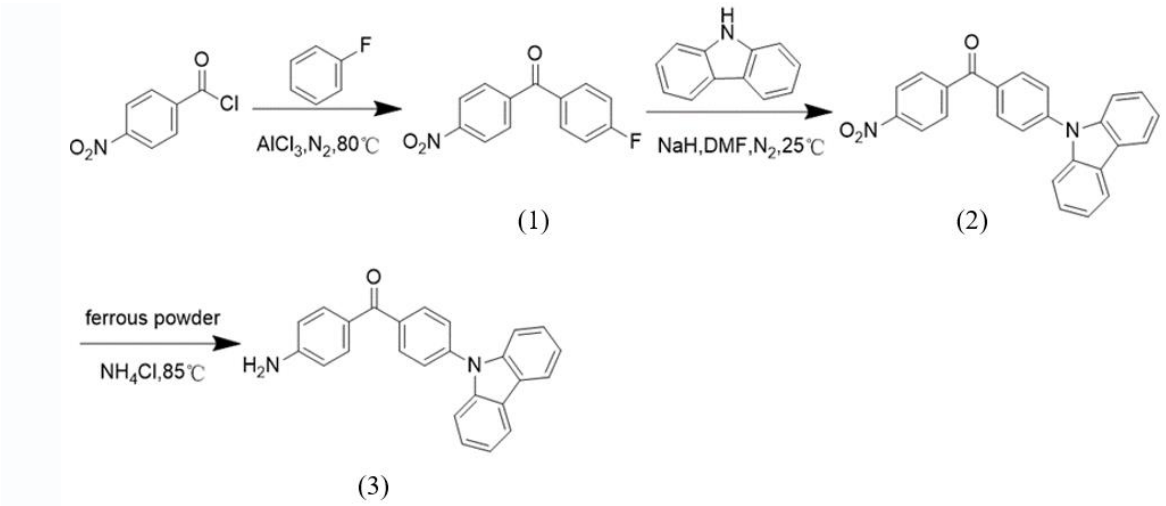


Fig. S1 The synthetic route of compounds (1)~ (3).

(1) 4-nitrobenzoyl chloride (2.2g, 10.02mmol) and fluorobenzene (40ml) were added to a 100ml three-mouth flask, then anhydrous aluminum chloride (3.6g, 2.67 mmol) was added, and the temperature was raised to 80℃. The reaction time was 6h. The reaction was quenched by adding 1mol/L dilute hydrochloric acid, extracted by adding dichloromethane, collected the organic phase, and dried by adding anhydrous magnesium sulfate[1]. The filtrate was extracted and filtered, and then purified by chromatography column (P: D =2:1), and the solvent was dried to obtain 2.08g yellow solid with a yield of 78.2%. ^{1}H NMR (400 MHz, DMSO-d6) δ 8.41 – 8.37 (m, 2H), 8.00 – 7.94 (m, 2H), 7.91 – 7.86 (m, 2H), 7.48 – 7.41 (m, 2H).

(2) Intermediates (1) (2g,8.1mmol) and carbazole (1.61g,9.6mmol) were added into a three-mouth flask, 120mlDMF was added, NaH(0.32g,8.1mmol) was added, and the reaction was filled with nitrogen at room temperature. The reaction time was 5h. After completion of the reaction, water was added to quench the reaction, and the organic phase was extracted with ethyl acetate[2,3]. The organic phase was collected and dried with anhydrous magnesium sulfate. Then, the filtrate was spun dry and purified by chromatography column method ((P: D =1:2), and the solvent was spun dry to obtain 2.02g red solid with a yield of 59.6%. ^{1}H NMR (400 MHz, DMSO-d6) δ 8.48 – 8.42 (m, 2H), 8.32 – 8.28 (m, 2H), 8.11 (dq, J = 8.9, 2.3 Hz, 4H), 7.95 – 7.90 (m, 2H), 7.62 – 7.57 (m, 2H), 7.51 (ddd, J = 8.3, 7.1, 1.2 Hz, 2H), 7.37 (td, J = 7.5, 7.0, 1.0 Hz, 2H).

(3) Intermediate (2) (1g,2.7 mmol), reduced iron powder (1.21g,21.6 mmol) and ammonium chloride (2.84g,3.2mmol), 80ml ethanol and 20ml deionized water were added, and the temperature was raised to 80℃. After 6h of reaction, the ethanol was dried and ethyl acetate was added for extraction. The organic phase was dried by adding anhydrous magnesium sulfate. The filtrate was filtered, dried and purified by chromatography column (the eluent was pure methylene chloride), and 0.67g yellow solid was obtained with a yield of 62.1%. ^{1}H NMR (400 MHz, DMSO-d6) δ 8.31 – 8.26 (m, 2H), 7.92 (d, J = 8.2 Hz, 2H), 7.80 (d, J = 8.2 Hz, 2H), 7.67 (d, J = 8.4 Hz, 2H), 7.55 (d, J = 8.2 Hz, 2H), 7.49 (ddd, J = 8.3, 7.0, 1.2 Hz, 2H), 7.34 (td, J = 7.5, 7.0, 1.1 Hz, 2H), 6.68 (dd, J = 8.8, 2.3 Hz, 2H), 6.24 (s, 2H).

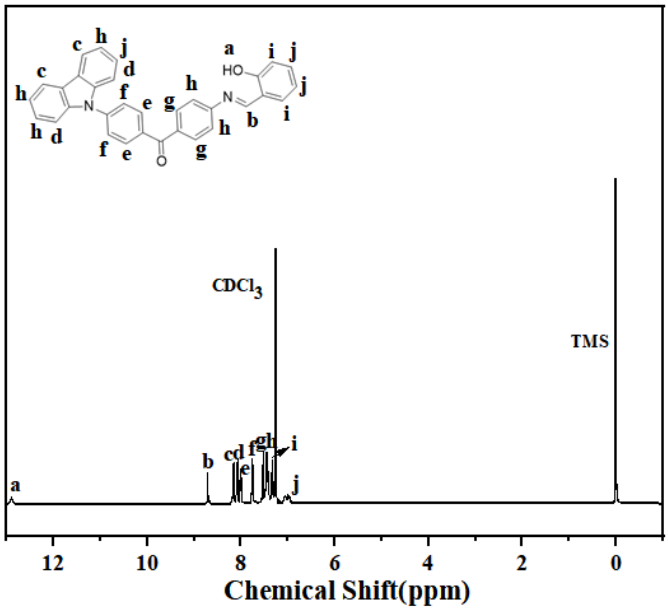


Fig. S2 ^{1}H NMR spectra of BKS.

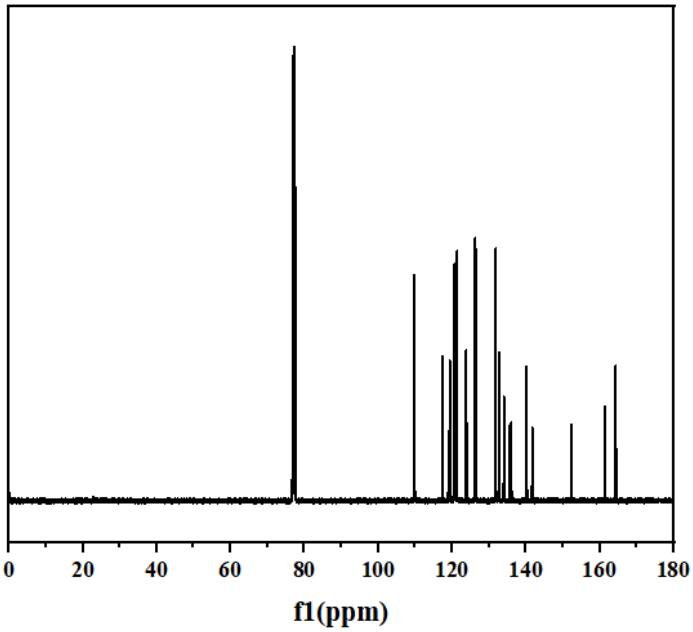


Fig. S3 ^{13}C NMR spectra of BKS.

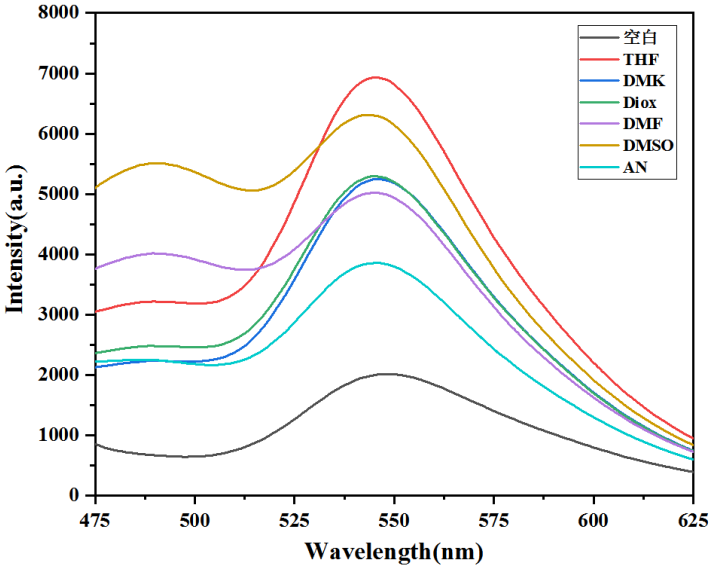


Fig. S4 Fluorescence emission spectra of BKS in six different pure organic solvents.

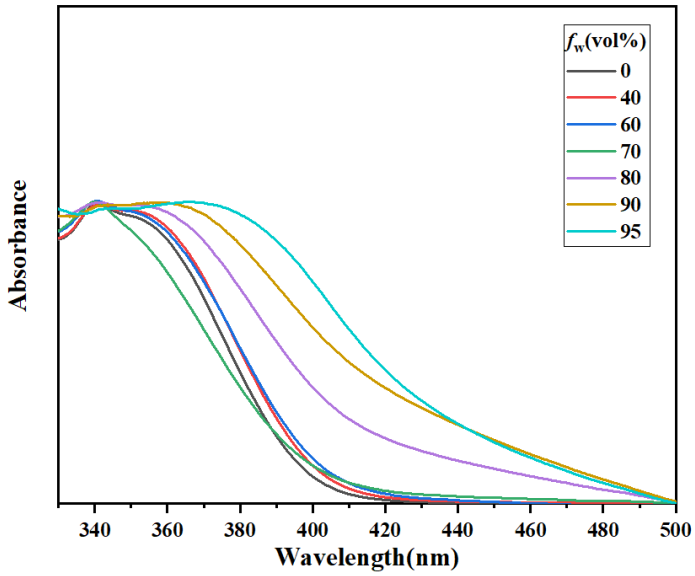


Fig. S5 Absorption spectra of BKS under different water content.

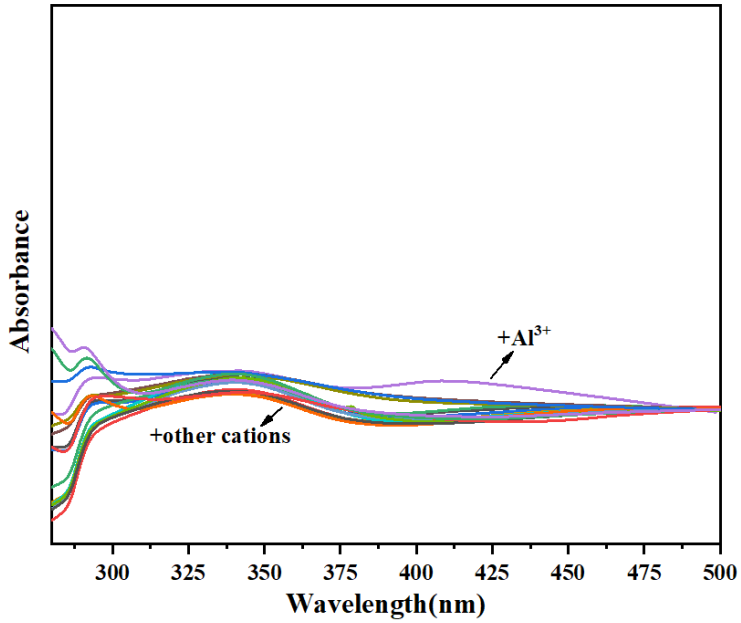


Fig. S6 Absorption spectra of probe BKS in the presence of different metal cation.

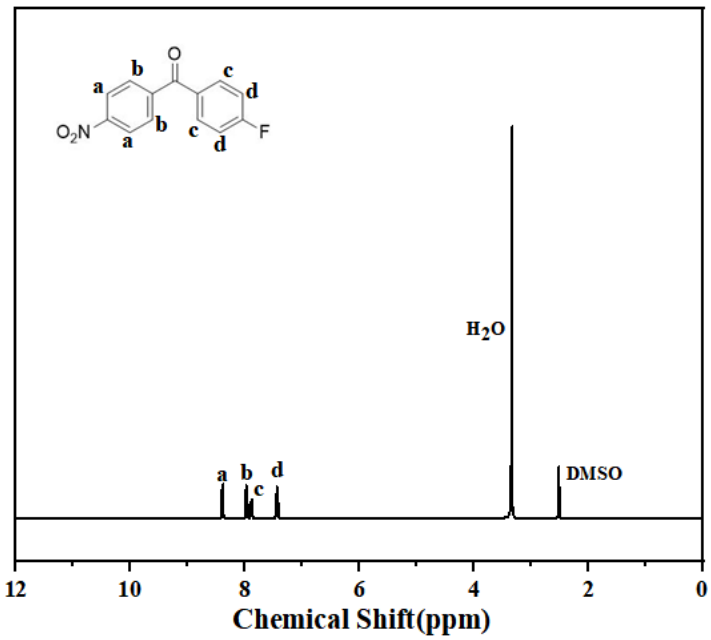


Fig. S7 ^{1}H NMR spectra of compound (1).

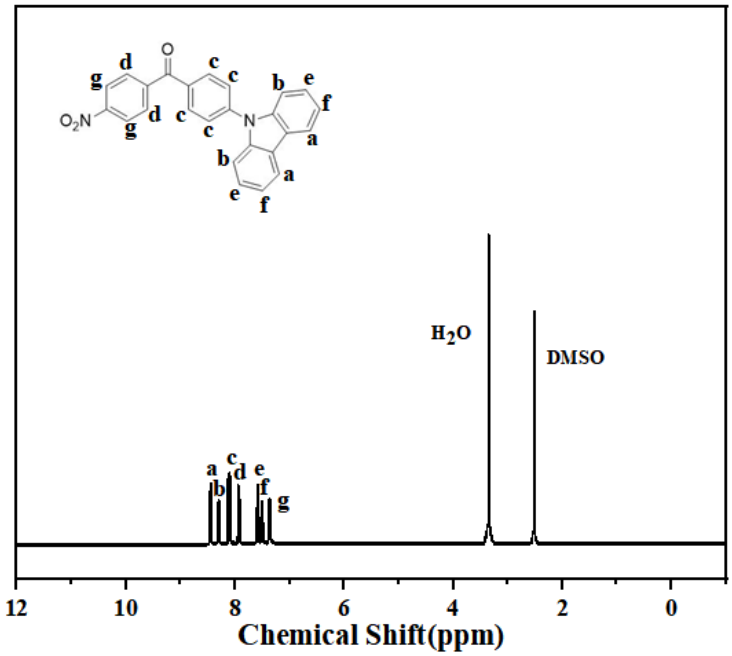


Fig. S8 ^{1}H NMR spectra of compound (2).

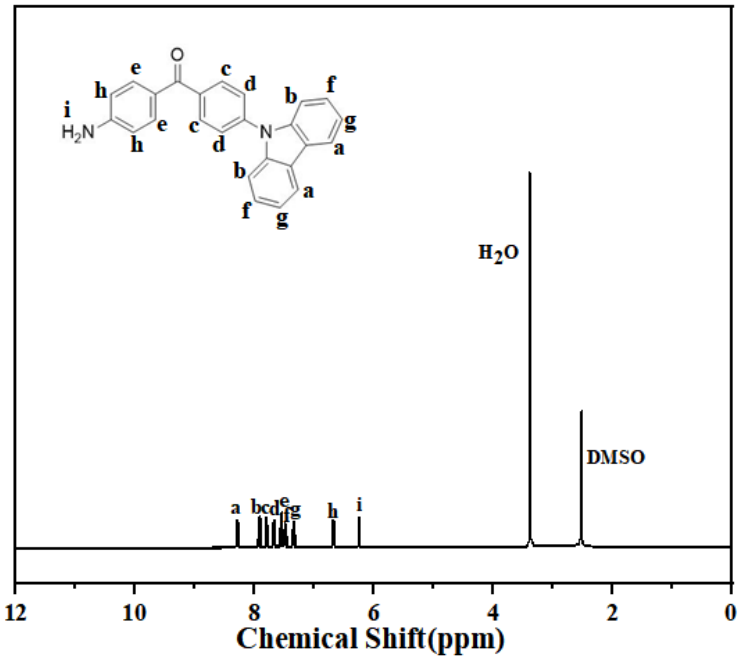
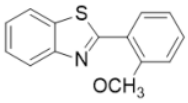
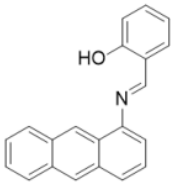
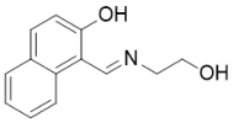
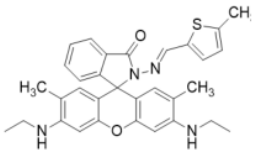
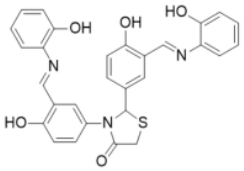
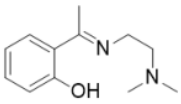
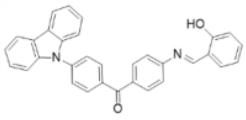


Fig. S9 ^{1}H NMR spectra of compound (3).

Table. S1. Comparison of sensor BKS for Al^{3+} with published related sensors.

Compound structure	Analyte	LOD (μM)	AIE	H_2O (%)	Response time	Reversibility	Ref.
	Al^{3+}	31μM	No	0	-	-	[108]
	Al^{3+}	5.2μM	No	0	20min	-	[109]
	Al^{3+}	2.9μM	No	10	-	Yes	[110]
	Al^{3+}	4.17μM	No	0	-	Yes	[111]
	Al^{3+}	4.4μM	No	50	2min	-	[112]
	Al^{3+}	4.3μM	No	10	10s	-	[113]
	Al^{3+}	1.49μM	Yes	95	20s	Yes	This work

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