Encapsulating Cu NCs with Aggregation-induced emission into Metal–Organic Framework ZIF-8 as a Novel Fluorescent Nanoprobe for the highly sensitive detection of felodipine

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1. Experimental Section

1.1 Chemical reagent

Lipoic acid (LA) was purchased from Shanghai McLean Biochemical Technology Co. Sodium borohydride ($NaBH_4$) was obtained from Nanjing Chemical Reagent Co. Copper chloride dihydrate ($CuCl_2 \cdot 2H_2O$) and zinc nitrate hexahydrate ($Zn(NO_3)_2 \cdot 6H_2O$) were purchased from Sinopharm Chemical Reagent Co. 2-Methylimidazole (2-MIM) was purchased from Shanghai Aladdin Biochemical Technology Co. Felodipine tablets were purchased from Jiangsu Suhuan Pharmaceutical Co.

1.2 Instrument

Fluorescence spectrophotometer (RF-5301(PC) S, Shimadzu, Japan); Transmission electron microscope (JEM 2100PLUS, Japan Electronics Co., Ltd.); UV-visible spectrophotometer (T6-New Century, Beijing Pudian General Instrument Co. (JEM 2100PLUS, Nippon Electron Co., Ltd.); UV-Vis Spectrophotometer (T6-New Century, Beijing Pudian General Instrument Co., Ltd.); Fourier Transform Infrared (FTIR) Spectroscopy (Varian-3100, Varian, U.S.A.); Powder X-Ray Diffractometer (Bruker D8, Bruker, Germany); X-Ray Photoelectron Spectroscopy (Escalab 250xi, Cytec, U.S.A.); and X-Ray Photoelectron Spectroscopy (Escalab 250xi, Thermo Fisher Scientific, USA); Malvern particle size potentiostat (Malvern Nano ZS90, Malvern Instruments, UK).

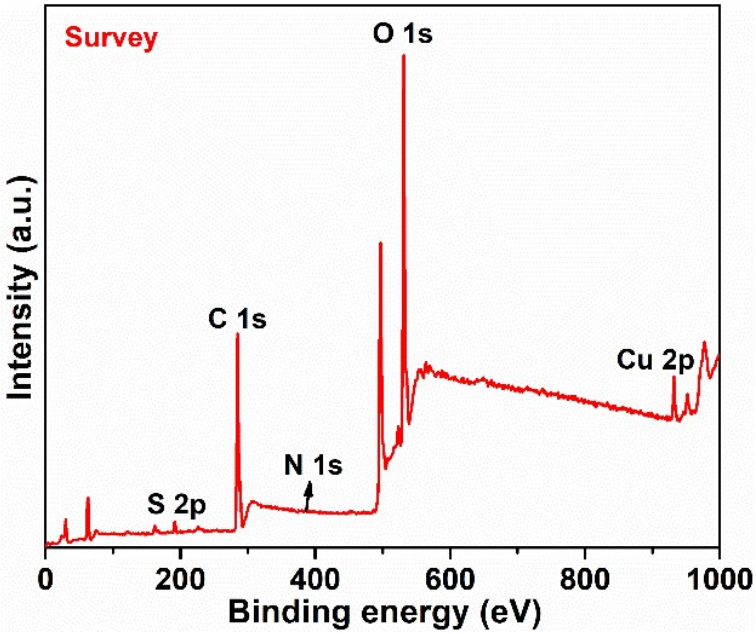

Fig. S1 Survey XPS spectrum of Cu NCs.

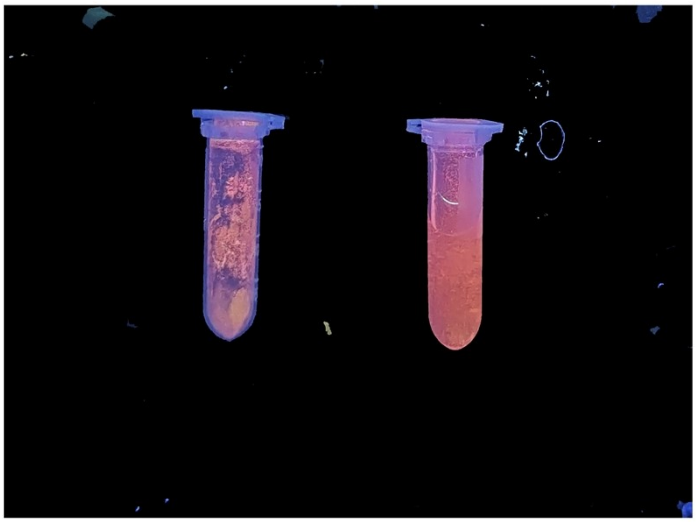

Fig. S2 Fluorescence emission spectra of Cu NCs@ZIF-8 (From left to right: Cu NCs@ZIF-8 powder and aqueous solution under UV light of 365 nm).

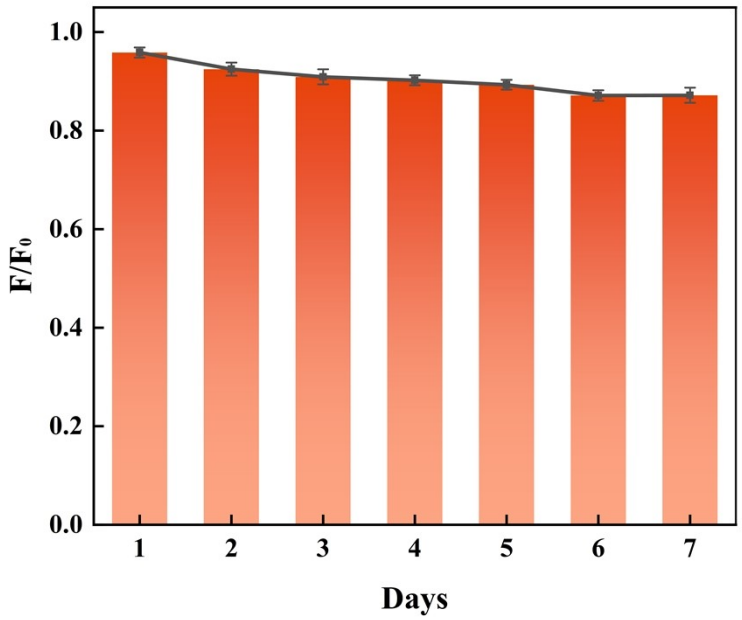

Fig. S3 Stability of Cu NCs@ZIF-8 solid powder.

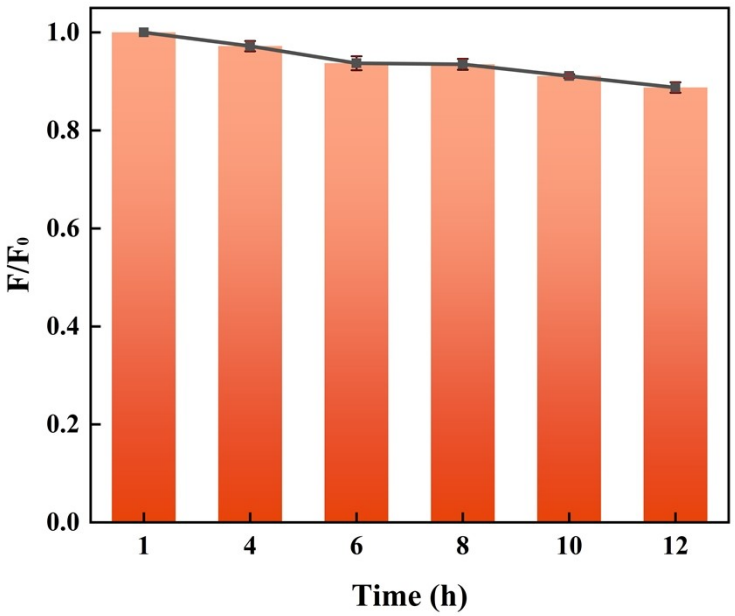

Fig. S4 Stability of Cu NCs@ZIF-8 aqueous solution.

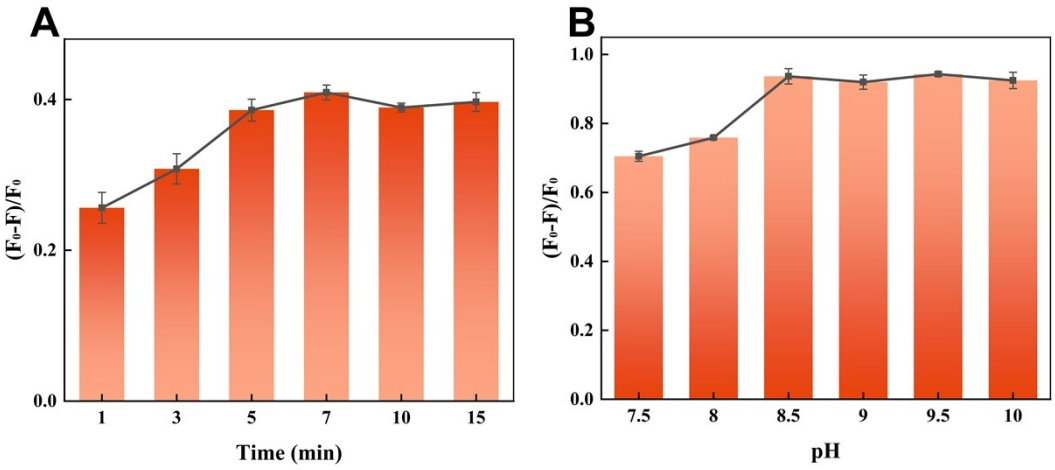

Fig. S5 Optimization of detecting conditions of the fluorescence sensor Cu NCs@ZIF-8 for detecting felodipine (A) Reaction time and (B) pH.

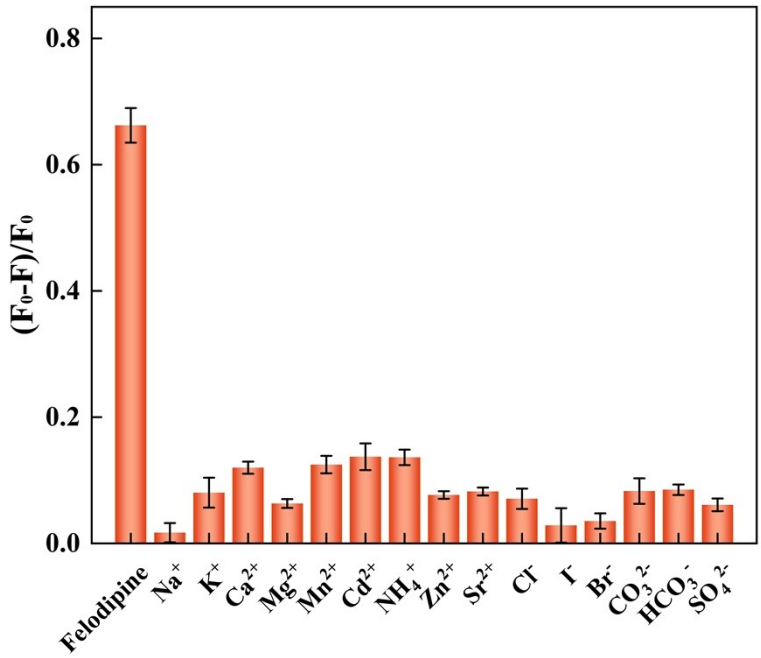

Fig. S6 The $(F_0\text{-}F)/F_0$ of Cu NCs@ZIF-8 before and after adding felodipine in the presence of various interfering substances.

Table. S1 Determining the labelling amount percentage of felodipine tablets by our proposed Cu NCs@ZIF-8 nanoprobe.

Sample	Labelling amount concentration (μM)	Found concentration (μM)	Percentage of labelling amount (%)	Average percentage of labelling amount (%)	RSD (%, n=6)
1	20.00	20.17	100.8	102.6	1.5
2	20.00	20.31	101.5		
3	20.00	21.02	105.1		
4	20.00	20.82	104.1		
5	20.00	20.33	101.6		
6	20.00	20.48	102.4		

Table. S2 The determined percentages of labelling amount of commercially available felodipine tablets by HPLC method.

Sample	Labelling amount concentration (μM)	Found concentration (μM)	Percentage of labelling amount (%)	Average percentage of labelling amount (%)	RSD (%, n=6)
1	20.00	19.82	99.10	99.42	1.4
2	20.00	19.68	98.40		
3	20.00	20.39	101.9		
4	20.00	19.66	98.30		
5	20.00	19.71	98.55		
6	20.00	20.03	100.1		

Table.S3 The recoveries of Felodipine tablets determined by Cu NCs@ZIF-8.

Samples	Spiked amount (μM)	Found amount (μM)	Recovery (%)	RAD (%, n=3)
1	16.00	15.95	99.71	3.6
2	20.00	20.57	102.9	1.1
3	24.00	24.24	101.0	2.1