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Supporting Information

Magnetic molecularly imprinted polymers as a fluorescent sensor for selective detection of Sudan I in chili powder

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Experimental

Materials

25 Ethylene glycol, sodium hydroxide (NaOH), acetic acid, glucose, sucrose,
26 lactose, urea, citric acid, sodium citrate, sodium citrate, sodium acetate, ferrous
27 chloride ($\text{FeCl}_2 \cdot 4\text{H}_2\text{O}$) and other metallic salt ions were obtained from Beijing
28 Chemical Works (Beijing, China). Ferric trichloride ($\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$), ammonia, ethyl
29 alcohol, Sudan I, Sudan II, Sudan B, Sudan G, azophloxine, orange II, L-tryptophan,
30 L-cysteine, isoleucine (Ile), methionine (Met), threonine (Thr), phenylalanine (Phe),
31 valine (Val), and histidine (His) were obtained from Sinopharm Group Co. Ltd.
32 (Shanghai, China). Methyl alcohol, ascorbic acid, sodium chloride (NaCl),
33 potassium chloride (KCl), and tetraethoxysilane (TEOS, 40%) were purchased from
34 Tianjin Guangfu Institute of Fine Chemicals (Tianjin, China). 3-aminopropyl
35 triethoxysilane (APTES, 98%) was purchased from Shanghai McLean Biochemical
36 Technology Co. Ltd (Shanghai, China). All the other reagents in the present work
37 were analytical reagent without any purification. Deionized water used throughout the
38 experiments was acquired by the laboratory purification system.

39 **Instruments**

40 The morphology and microstructure of CDs@SiO_2 were characterized by
41 JEM-2100 Field-emission transmission electron microscope (TEM, JEOL, Japan).
42 The morphologies of MMIPs and MNIPs were characterized by SU8020 Field-
43 emission scanning electron microscope (SEM, Hitachi, Japan). Elemental analysis
44 was investigated by energy dispersive X-ray spectroscopy (EDS, Thermo, USA). X-
45 ray diffraction (XRD) measurements were performed using an Empyrean X-ray
46 diffractometer equipped with a $\text{Cu K}\alpha$ radiation source (PANalytical B.V.,

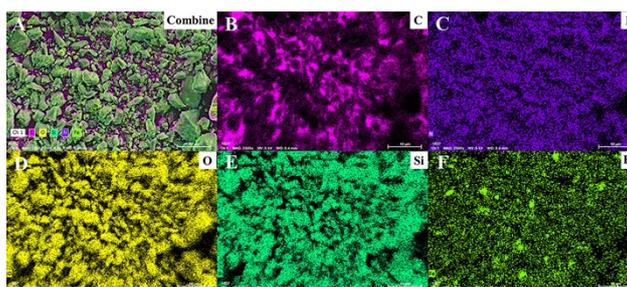
47 Netherlands). Fourier-transform infrared spectroscopies (FT-IR) were recorded on a
48 Nicolet-iS5 FT-IR spectrophotometer (Thermo, USA) with KBr pellets. The water
49 contact angle was measured using a droplet angle measuring instrument
50 (Changchun, Jilin). Thermal gravimetric analysis (TGA) was carried out with a TGA
51 Q500 thermal analyzer instrument (TA, USA). X-ray photoelectron spectroscopy
52 (XPS) was performed on an ESCALAB 250 electron spectrometer (Thermo Electron,
53 USA). The magnetic hysteresis loops of samples were measured using a SQUID-VSM
54 Magnetic Property Measurement System (Quantum Design, USA). Ultraviolet-visible
55 (UV-Vis) absorption spectroscopies were collected on a Shimadzu UV-2550
56 spectrophotometer (Shimadzu, Japan). Fluorescence spectra were performed on an
57 F-2700 fluorescence spectrophotometer (Hitachi, Japan). Nanosecond fluorescence
58 lifetime was investigated by FLS 920 fluorescence spectrophotometer (Edinburgh,
59 UK).

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61 **Results and discussion**

62 **Characterization of MMIPs**

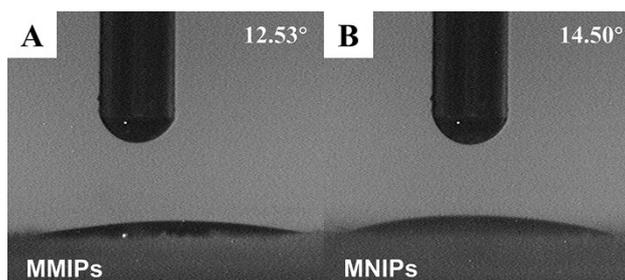
63 The elemental analysis of MMIPs was investigated through EDS mapping (**Fig.**
64 **S1**). The results revealed the presence of C, N, O, Si and Fe elements in the MMIPs
65 composites.



66

67 **Fig. S1** Elemental mapping images of Combine, C, N, O, Si and Fe of MMIPs (A–F,
68 respectively)

69 The hydrophilic properties of MMIPs and MNIPs were investigated by water
70 contact angle test, and the corresponding results were shown in **Fig. S2**. The water
71 contact angles of MMIPs and MNIPs are 12.53° and 14.50° respectively, indicating
72 that the prepared MMIPs exhibited good hydrophilicity.



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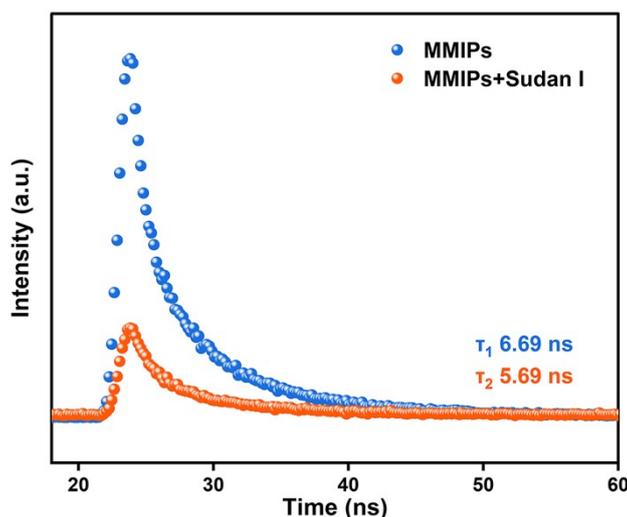
74 **Fig. S2** Water contact angle test of MMIPs (A) and MNIPs (B)

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76 Calculation of fluorescence lifetime

77 When a substance molecule is excited by the exciting light, it absorbs energy and
78 transitions from the ground state to the excited state, and then emits fluorescence in
79 the form of a radiation transition and returns to the ground state. The time required for
80 the fluorescence intensity to decay to $1/e$ of the initial intensity is the fluorescence
81 lifetime of the fluorescent substance under the measurement conditions.¹ **Fig. S3**
82 showed the fluorescence decay curves of MMIPs in the presence and absence of

83 Sudan I, and the fluorescence lifetime of MMIPs gradually decreased from 6.69 ns to
 84 5.69 ns with the increase of Sudan I concentration. Combined with previously
 85 reported literatures,¹⁻⁴ it was further confirmed that the fluorescence lifetime of donor
 86 NS-CDs decreased after the addition of acceptor Sudan I.



87

88 **Fig. S3** Fluorescence decay curves of MMIPs in the absence and presence of Sudan I

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90 **Different fluorescence methods for detection of Sudan I**

91 In **Table S1**, the fluorescence detection methods of Sudan I was summarized,
 92 including the linear range and limit of detection (LOD) of the methods.

93 **Table S1** Comparison of different fluorescence detection methods of Sudan I with
 94 this work

Method	Linear range (μM)	LOD (μM)	Ref.
Mn-ZnS quantum dots	0.68–7.41	0.10	6
carbon quantum dots	2.40–104.0	0.95	7
CsPbBr ₃ quantum dots	0.40–40.28	0.013	8

tire-derived carbon dots	0.5–60	0.17	9
N, P co-doped carbon dots	0.043–52.0	0.043	10
MMIPs	1–40	0.38	This work

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