Supporting information for

Trace carbonyl analysis in water samples by integrating magnetic molecular imprinting and capillary electrophoresis

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Preparation of MMIPs

The ferrofluid was prepared with the precipitation method as following. First, the PEG solution was prepared by dissolving 10 g PEG 600 in 50 mL H_2O at 60℃, and then it was mixed with 10 mL of 0.5 M $FeCl_2$ and 40 mL of 0.25 M $FeCl_3$. Next, 40 mL of 1 M NaOH was added dropwise. After being heated for 4 h at 60 ℃, the ferrofluid suspension was obtained. And after resting overnight, the ferrofluid was obtained by removing the supernatant.

Based on the ferrofluid, the MMIPs were fabricated. First, 0.1831 g (1 mmol) DNAN and 0.3451g (4 mmol) MAA were dissolved with 15 mL CH_3CN. After being sonicated for 20 min, the mixture was allowed to stand overnight to form a template-monomer complex. A PEG solution was prepared by dissolving 2 g PEG 600 with 5 mL CH_3CN in a three-necked flask in a water bath (60 ℃). Then, 10 mL magnetic fluid, 20 mmol EDMA or DVB and 0.24 mmol AIBN (initiator) were added into the PEG solution. Subsequently, the template-monomer complex was transferred into the three-neck flask. After being sonicated under nitrogen stream for 30 min, the polymerization was allowed to carry out at 60 ℃ for 24 h. Then, the resulted polymers were eluted with methanol/acetic acid solution (8/2, v/v) to remove the template molecules and the unreacted monomers. These procedures were repeated until no template molecules can be detected in the extract at 340 nm with UV spectrometer. Subsequently, the polymers were collected magnetically. After being washed with deionized water and ethanol in sequence, the polymers were dried at 60 ℃ and stored for the future use. The magnetic non-imprinted polymeric microspheres (MNIPs) were obtained under the same conditions, but in the absence of the template molecule.

MEKC Separation

MEKC buffer (pH = 8.9) containing 50 mM SDS, 20 mM borate and 15% (v/v) methanol was used for analyte separation. A fused-silica capillary (80 cm×50 μm i.d., 51 cm to the detector) was used as a separation channel. Before the first use, the new uncoated capillary was rinsed in sequence with 1.0 M NaOH, 0.1 M NaOH, 0.1 M HCl, deionized water and the background buffer solution for 10 min respectively. The sample was introduced into the capillary by electric

injection at a voltage of 5 kV for 3 s. A constant 24 kV high voltage was applied to separate carbonyls at detection wavelength of 360 nm. Between runs, the capillary was rinsed with 0.1 M NaOH for 1 min, deionized water for 2 min and background buffer for 2 min successively. The solution and buffer were filtered with a 0.45 μm membrane filter and sonicated before use. The instrument was kept at 20 ℃ when running.

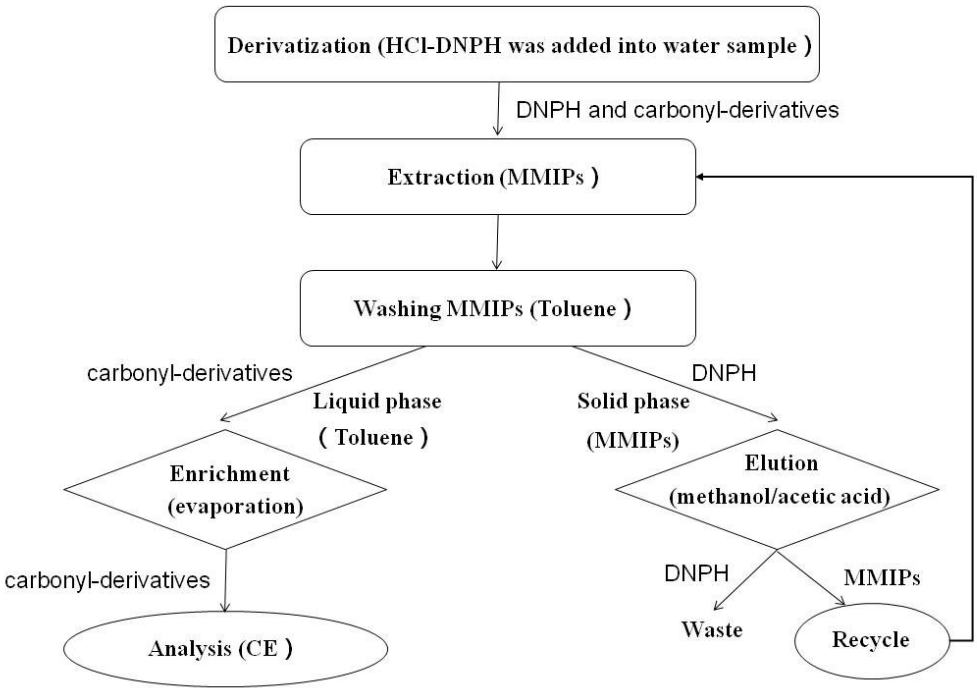

Fig. S1 The flow chart for the experimental procedure

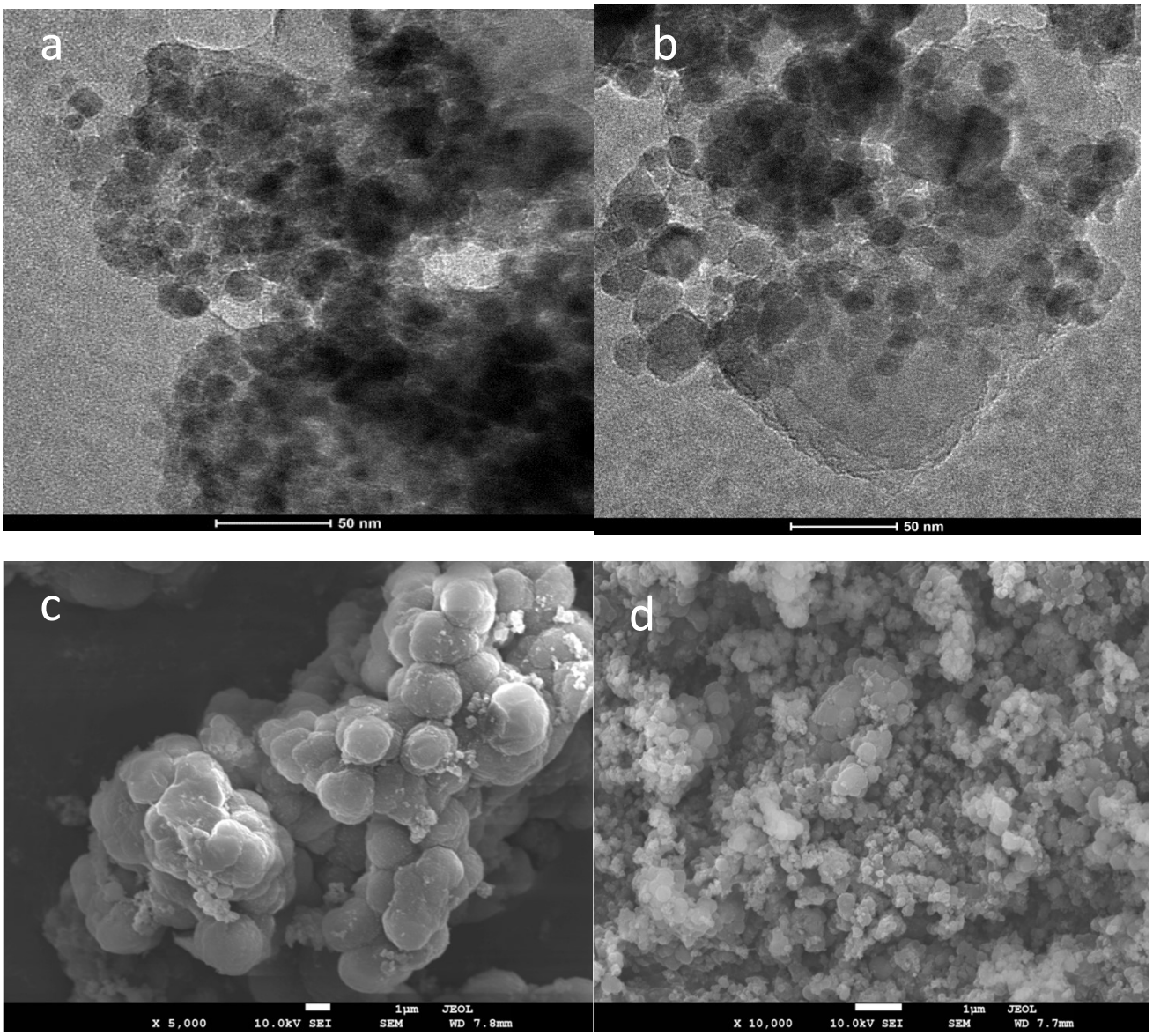

Fig. S2 TEM pictures of (a) MMIPs-EDMA and (b) MMIPs-DVB;

SEM pictures of (c) MMIPs-EDMA and (d) MMIPs-DVB.

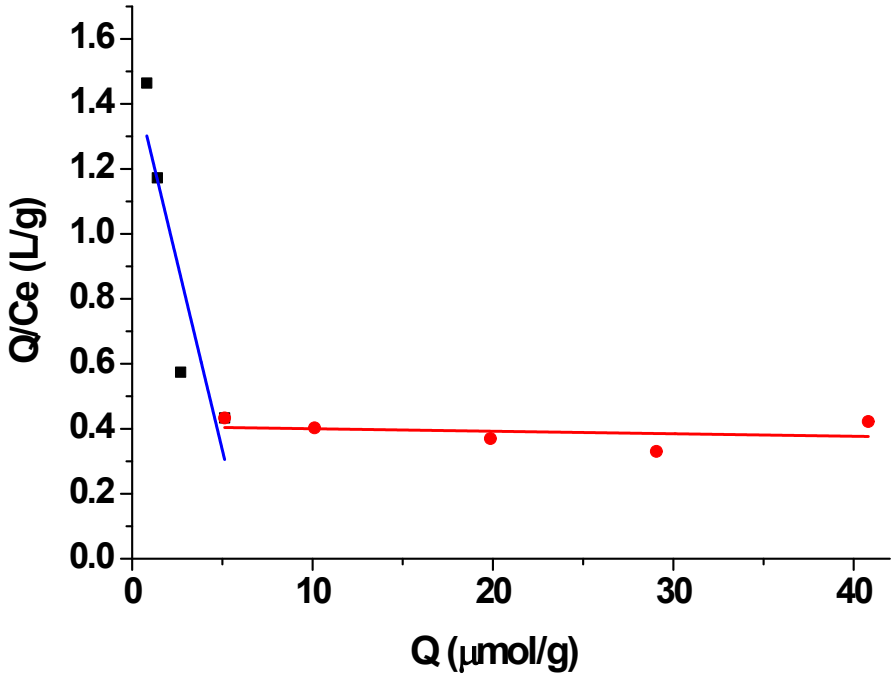

Fig. S3 Scachard analysis for the adsorption of 2,4-DNPH on MMIPs

TableS1 The comparison of the MMIPs-SPE-CE method with other reported methods for the determination of carbonyls in aqueous samples

Methods	Analytes	LOD (μg/L)	Samples	Derivative agent	Ref.
Spectrophotometry	total aldehyde	27	rain water	3,5-DHBA	[45]
DLLME spectrophotometriy	formaldehyde	100	milk	acetylacetone	[46]
DLEC Chemosensor	acetaldehyde	4.9	alcoholic beverage	_	[47]
HS-SPME-GC-MS	aldehydes/acetone	0.1-0.5	surface water	2,2,2-TFEH	[48]
PMME- HPLC-UV	aldehydes	0.43-1.40	saliva	2,4-DNPH	[49]
μSPE- HPLC-UV	aldehydes	0.5-50	rain water	2,4-DNPH	[18]
EPA Method:					
SPE- HPLC-UV	aldehydes	6.2-43.7	aqueous samples	2,4-DNPH	[11]
LLE- HPLC-UV		5.9-110.2			
MMIPs-SPE-MEKC-UV	aldehydes/acetone	1.2-8.7	drinking water，surface water	2,4-DNPH	This work

DLLME: dispersive liquid-liquid microextraction

DLEC: dual-ligands europium(III) complex

HS-SPME-GC-MS: head space solid-phase microextraction and gas chromatography-mass spectrometry

PMME: polymer monolith microextraction

μSPE: micro-solid-phase extraction

3,5-DHBA: 3,5-dinitrobenzhydrazide

2,2,2-TFEH: 2,2,2-trifluoroethylhydrazine