

Supporting Information

A real-time microfluidic surveillance system for multiplex detection of heavy metal contamination in wastewater

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Experimental

1. Materials and chemicals

Lab Cas12a (Cpf1) and NEB 2.1 buffer were purchased from New England Biolabs Inc. (Ipswich, USA). Ultrapure water was purified through a Milli-Q system (Millipore, Synergy). 1,4-Benzenedicarboxylic acid, Zirconium Oxychloride Octahydrate ($\text{ZrOCl}_2 \cdot 8\text{H}_2\text{O}$), (3-aminopropyl) triethoxysilane (APTES), acetic acid and PEG were purchased from Aladdin (Shanghai, China). N,N-dimethylformamide (DMF), $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$, ethylene glycol, tetraethyl orthosilicate (TEOS), glutaraldehyde were purchased Macklin (Shanghai, China). Methanol, ethanol, concentrated ammonia aqueous solution and other inorganic salt reagents were obtained from HUSHI (Shanghai, China).

Supporting Figures

Table S1. Method Comparison Table¹⁻¹⁰

Number	Sensing method	Target ions	LOD (nM)	Linear range (nM)	Multiplex detection
1	Cu ²⁺ /S2T3 _{AT} -	Cu ²⁺	300	300-300000	No
2	N-CDs	Hg ²⁺	989	2000-10000	Yes
3	Fe ₃ O ₄ @SiO ₂ @SulfHydryl SPC	Hg ²⁺	4.985	4.985-24926	No
4	MnCo ₂ O ₄ /PAA-g-jute	Pb ²⁺	3.65	4-1448	No
5	PVDF/SiO ₂ -g-CDs	Hg ²⁺	1.6	1.5-20000	No
6	CD-PCH	Cu ²⁺ , Pb ²⁺	10000	10000-1000000	Yes
7	Nafion-blanketing	Pb ²⁺	0.178	10-50	Yes
8	AuNP colorimetic smartphone sensing	Cu ²⁺ , Pb ²⁺ , Hg ²⁺	Cu ²⁺ : 2.0 Pb ²⁺ : 1.0 Hg ²⁺ : 0.5	1-50	No
9	Bismuth film modified stripping voltammetre	Cu ²⁺ , Pb ²⁺ , Hg ²⁺	Cu ²⁺ : 2720 Pb ²⁺ : 2320 Hg ²⁺ : 1200	1500-110000	Yes
10	Thiacalixarene-based MOF electrochemical sensor	Cu ²⁺ , Pb ²⁺ , Hg ²⁺	Cu ²⁺ : 0.12 Pb ²⁺ : 0.28 Hg ²⁺ : 0.35	0.5-200	Yes

11	Bio-barcode	Cu ²⁺ , Pb ²⁺ , Hg ²⁺	Cu ²⁺ : 0.26 Pb ²⁺ : 0.06 Hg ²⁺ : 0.80	0.1-1.0	Yes
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