Supporting Information

A novel AgNPs-based colorimetric sensor for rapid detection of Cu^{2+} or Mn^{2+} via pH control

Genhua Wu,[a] Chen Dong,[a,b] Yonglong Li,[b] Zhuqing Wang,[a,b] Yuexia Gao,[b] Zheyu Shen*[,b] and Aiguo Wu*[,b]

[a] *School of Chemistry and Chemical Engineering, Anqing Normal College, Anqing, Anhui 246001, China*

[b]*Key Laboratory of Magnetic Materials and Devices, Chinese Academy of Sciences,& Division of Functional Materials and Nano Devices, Ningbo Institute of Materials Technology& Engineering, Chinese Academy of Sciences, Ningbo, Zhejiang 315201, China*

*Corresponding Author

Tel: 0086-574-86685039, or 0086-574-87617278; Fax: 0086-574-86685163

Email: aiguo@nimte.ac.cn or shenzheyu@nimte.ac.cn

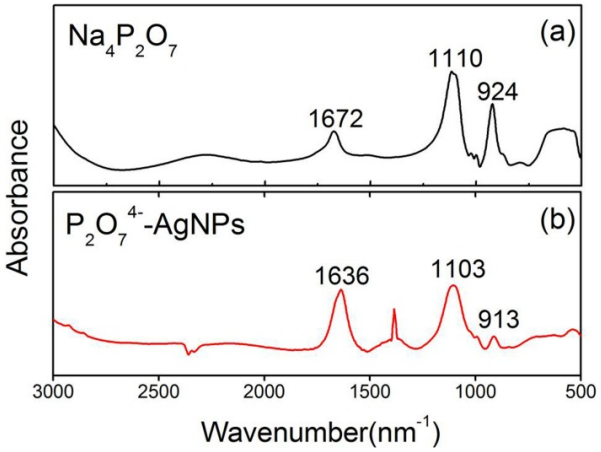

Figure S1. FT-IR spectra of $Na_4P_2O_7$ (a) and $P_2O_7^{4-}$-AgNPs (b).

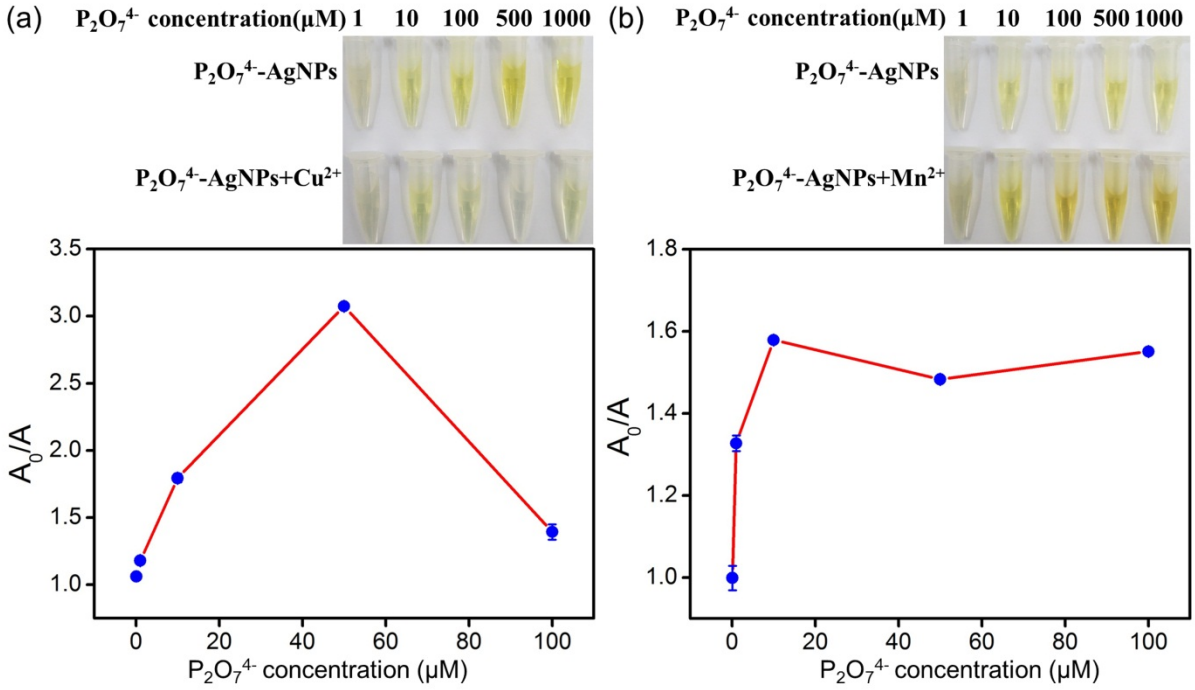

Figure S2. Influence of $P_2O_7^{4-}$ concentration in the AgNPs-based detection systems on the sensing effect of Cu^{2+} or Mn^{2+}. (a): Photographic image and corresponding plot of A_0/A (A is the absorbance value at 414 nm in the UV-vis spectra of the detection systems incubated with 10 μM of Cu^{2+}, and A_0 is that of the detection systems without Cu^{2+}) of the detection systems with different $P_2O_7^{4-}$ concentrations at pH 1.9. (b) Photographic image and corresponding plot of A_0/A (A is the absorbance value at 395 nm in the UV-vis spectra of the detection systems incubated with 10 μM of Mn^{2+}, and A_0 is that of the detection systems without Mn^{2+}) of the detection systems with different $P_2O_7^{4-}$ concentrations at pH 12.0. The incubation time is 10 min. The HPMC concentration in the detection systems is 50 mg/L.

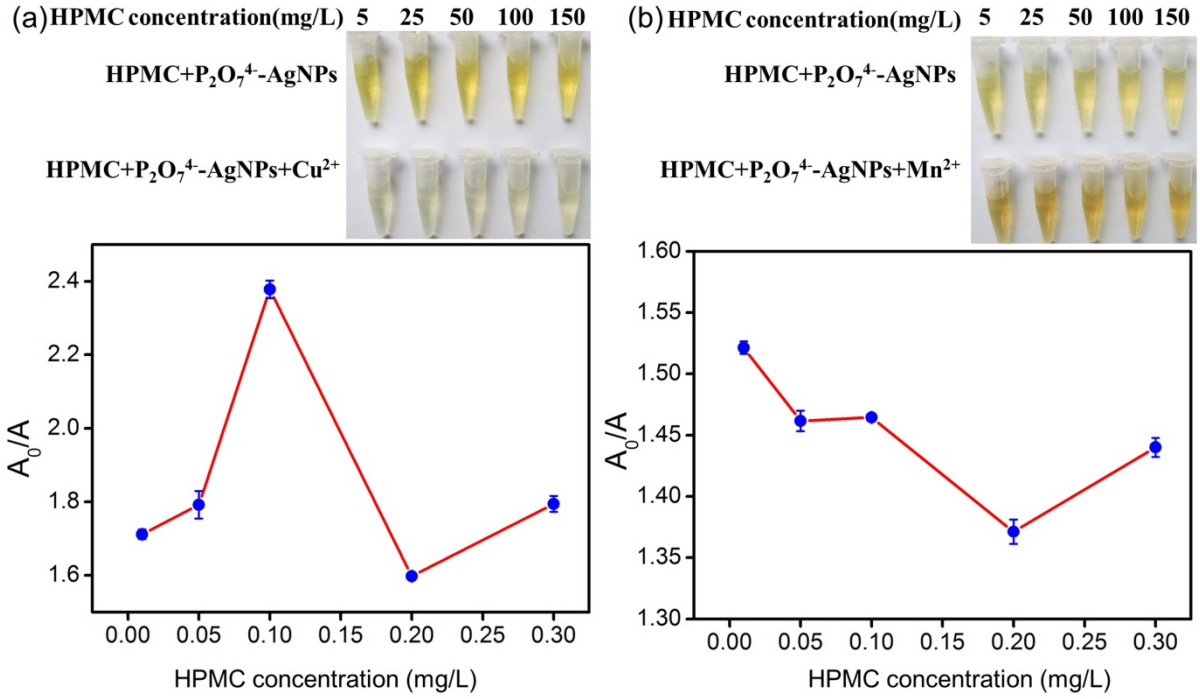

Figure S3. Influence of HPMC concentration in the AgNPs-based detection systems on the sensing effect of Cu^{2+} or Mn^{2+}. (a) Photographic image and corresponding plot of A_0/A (A is the absorbance value at 414 nm in the UV-vis spectra of the detection systems incubated with 10 μM of Cu^{2+}, and A_0 is that of the detection systems without Cu^{2+}) of the detection systems with different HPMC concentrations at pH 1.9. (b) Photographic image and corresponding plot of A_0/A (A is the absorbance value at 395 nm in the UV-vis spectra of the detection systems incubated with 10 μM of Mn^{2+}, and A_0 is that of the detection systems without Mn^{2+}) of the detection systems with different HPMC concentrations at pH 12.0. The incubation time is 10 min. The $P_2O_7^{4-}$ concentration in the detection systems is 500 μM.

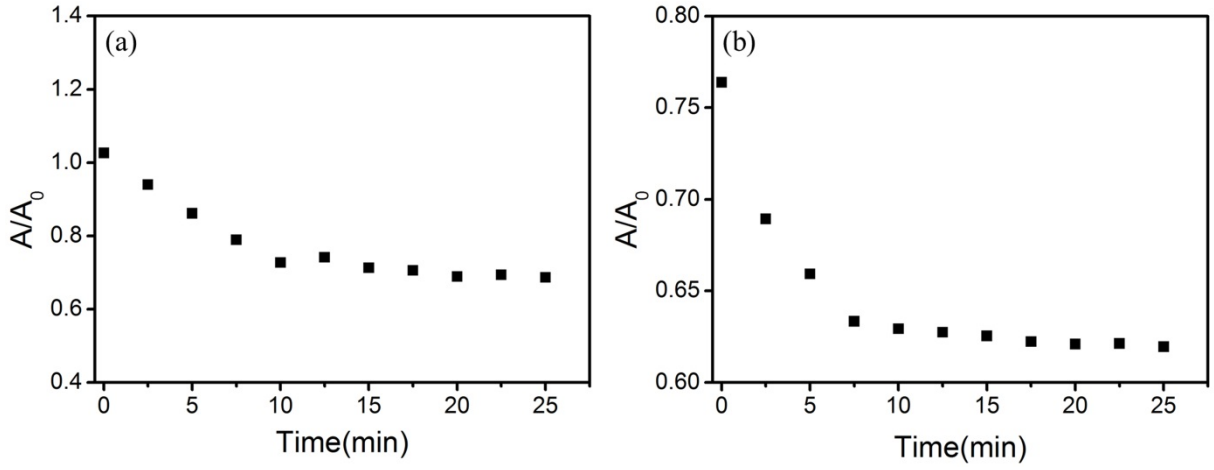

Figure S4. Influence of the incubation time between the detection system and Cu^{2+} (0.2 μM) at pH 1.9 (a) or between the detection system and Mn^{2+} (5.0 μM) at pH 12.0 (b) on the A/A_0 values. A is the absorbance value at 414 nm or 395 nm in the UV-vis spectra of the detection systems incubated with 0.2 μM of Cu^{2+} or 5 μM of Mn^{2+}, and A_0 is that of the detection systems without Cu^{2+} or Mn^{2+}. The $P_2O_7^{4-}$ concentration in the detection systems is 500 μM. The HPMC concentration in the detection systems is 50 mg/L.

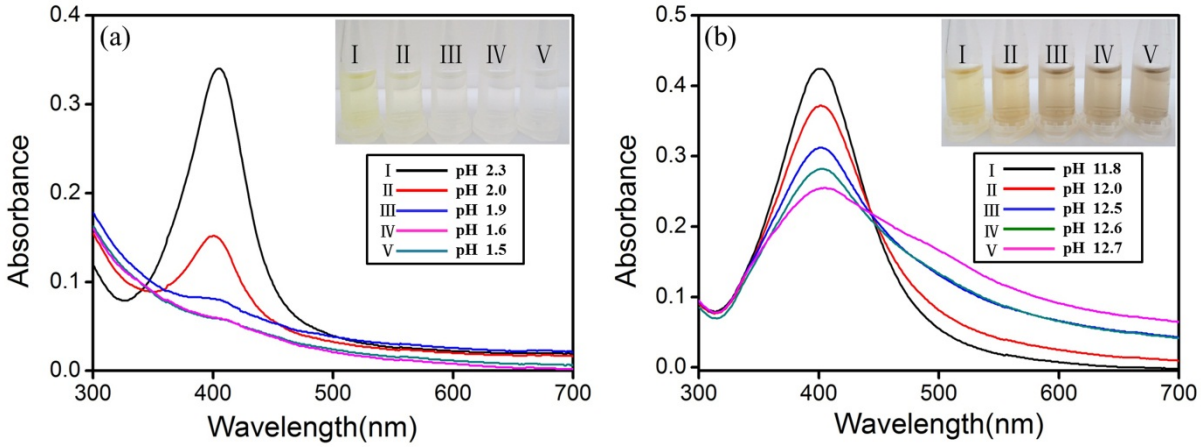

Figure S5. Influence of pH values on the UV-vis absorption of the detection systems containing 0.5 μM of Cu^{2+} (a) and 5.0 μM of Mn^{2+} (b). The inset shows the photographic image of the corresponding solutions. The $P_2O_7^{4-}$ concentration in the detection systems is 500 μM. The HPMC concentration in the detection systems is 50 mg/L. The incubation time is 10 min.

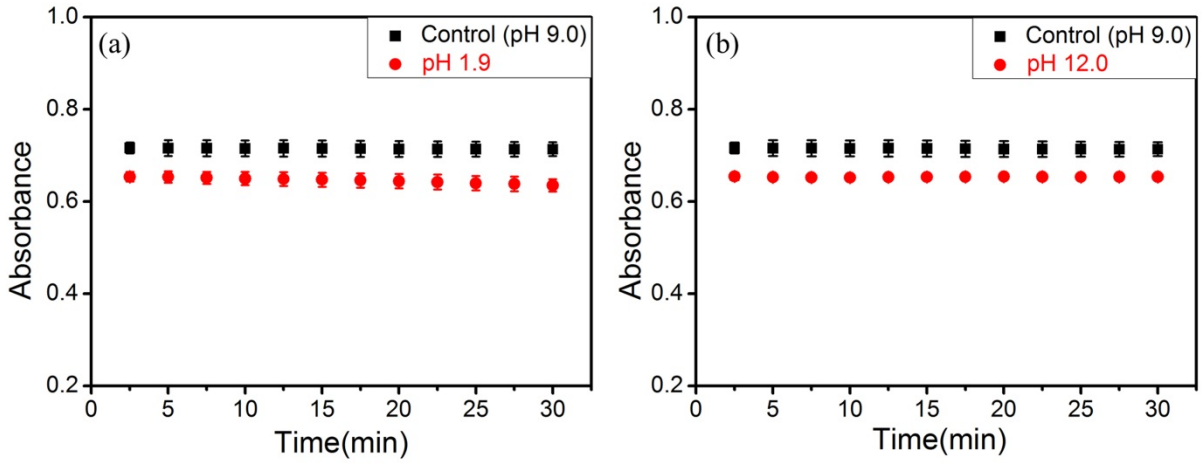

Figure S6. Change in UV-vis absorption of AgNPs dispersions without Cu^{2+} at pH 1.9 (a) and without Mn^{2+} at pH 12.0 (b) compared with the control (pH 9.0) during storage at room temperature within 30 min. The $P_2O_7^{4-}$ concentration in the detection systems is 500 μM. The HPMC concentration in the detection systems is 50 mg/L. The incubation time is 10 min.

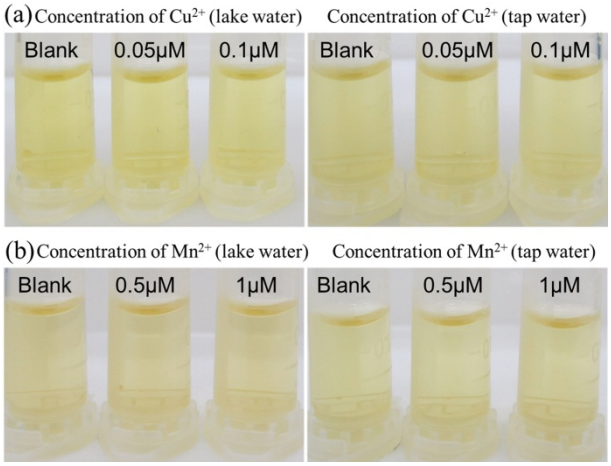

Figure S7. Detection of Cu^{2+} (a) or Mn^{2+} (b) in real water samples by our developed colorimetric method.

Table S1. Influence of potential interfering ions on the detection of Cu^{2+} or Mn^{2+}

Potential interfering ions of Cu^{2+} detection	Tolerance ratios (compared to 5×10^{-8} M)[a]
Ni^{2+}, Zn^{2+}, Na^{+}, K^{+}, PO_4^{3-}, SO_4^{2-}, NO_3^{-}, CO_3^{2-}	100000
Ba^{2+}, Cd^{2+}, Al^{3+}, Fe^{3+}, Mg^{2+}, Ca^{2+}, Fe^{2+}, Mn^{2+}, Co^{2+}	10000
Hg^{2+}, Pb^{2+}, Cr^{3+}	1000
Cr(Ⅵ)	100
Potential interfering ions of Mn^{2+} detection	**Tolerance ratios (compared to 5×10^{-7} M)[b]**
Mg^{2+}, Na^{+}, K^{+}, Ca^{2+}, PO_4^{3-}, SO_4^{2-}, NO_3^{-}, CO_3^{2-}	1000
Co^{2+}, Cr^{3+}	500
Al^{3+}, Fe^{3+}, Cr(Ⅵ)	200
Cu^{2+}	150
Cd^{2+}, Hg^{2+}, Ni^{2+}, Zn^{2+}	100
Ba^{2+}, Pb^{2+}	50
Fe^{2+}	20

[a]The limit of detection of Cu^{2+} is 5×10^{-8} M by the naked eyes;

[b]The limit of detection of Mn^{2+} is 5×10^{-7} M by the naked eyes.

Table S2. Comparison of Cu^{2+} or Mn^{2+} detection using AuNPs or AgNPs-based systems.

Method	**Probe**	**Target**	**LOD**	**Selectivity**	**Ref.**
Colorimetry	Starch-AgNPs	Cu^{2+}	0.632μM	Good	16
Colorimetry	Dopamine-AgNPs	Cu^{2+}	0.05μM	Good	6
Colorimetry	$P_2O_7^{4-}$-AgNPs	Cu^{2+}	2nM	Good	This work
Colorimetry	$P_3O_{10}^{5-}$- AgNPs	Mn^{2+}	0.05μM	Good	13
Colorimetry	L-tyrosine-AgNPs	Mn^{2+}	16 nM	Not good	18
Colorimetry	$P_2O_7^{4-}$-AgNPs	Mn^{2+}	20nM	Good	This work