Supplementary Information for

Recognition and determination of multi-metal ions based on silver nanoclusters capped by polyethyleneimine with different molecular weights

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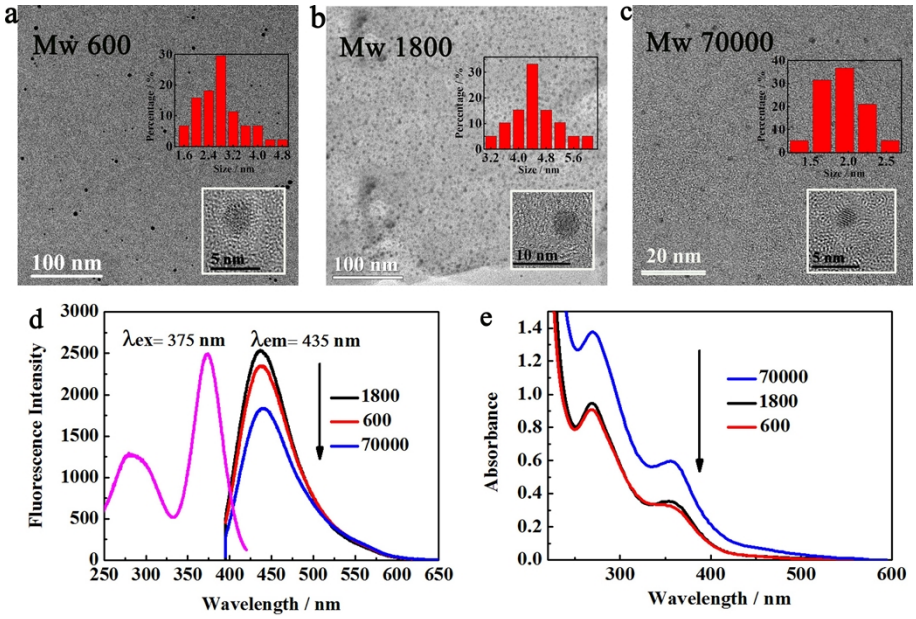

Figure S1. TEM images, HRTEM images, UV−vis absorption spectra and fluorescence spectra of AgNC-PEIs.

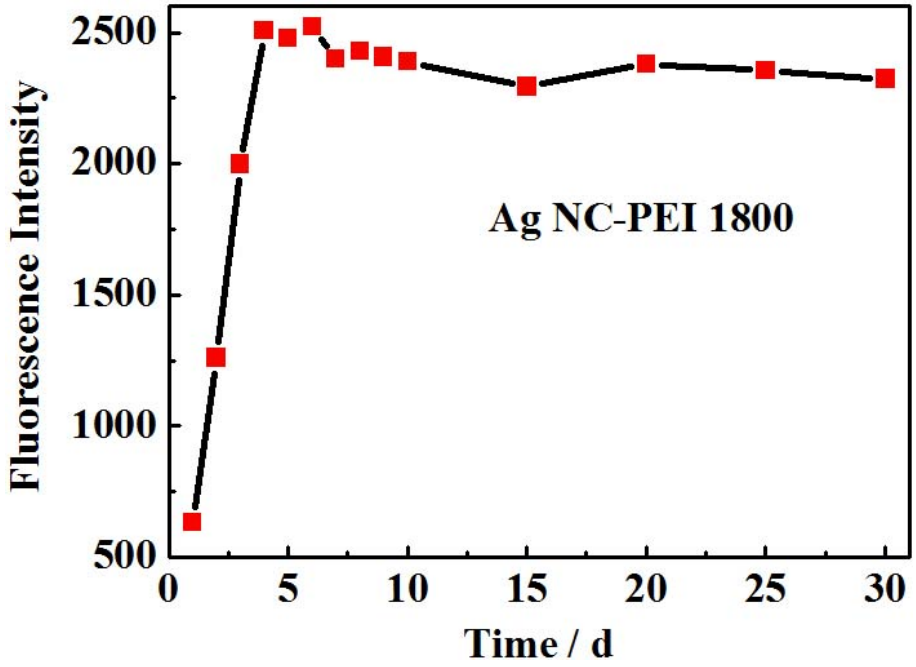

Figure S2. Stability of Ag NC-PEI 1800.

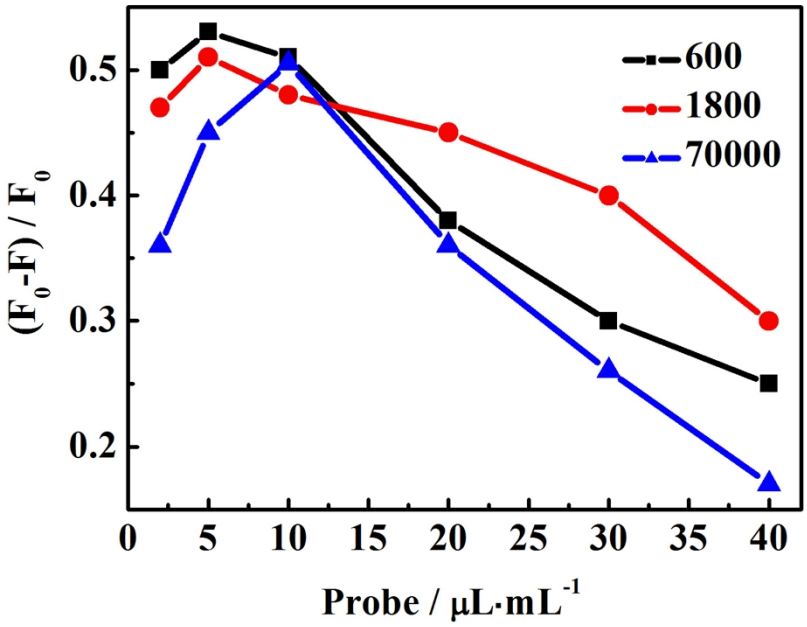

Figure S3. The responses between fluorescence quenching rates and probe concentrations under the concentration of 8 μM Hg^{2+} (black: Ag NC-PEI 600; red: Ag NC-PEI 1800; blue: Ag NC-PEI 70000).

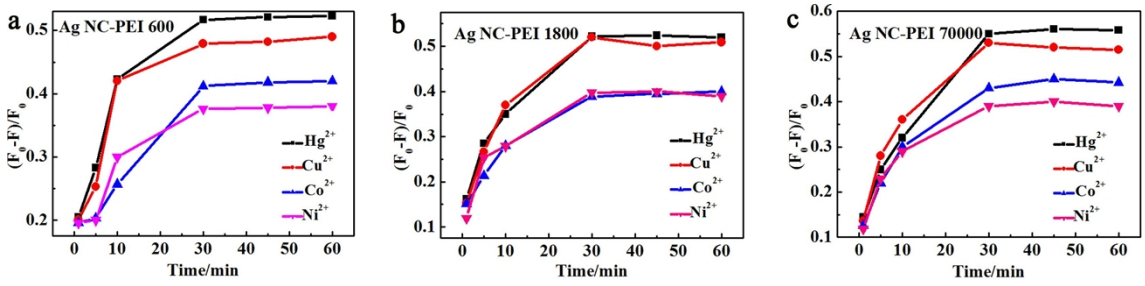

Figure S4. Time-dependent fluorescence responses upon addition of 8 μM Hg^{2+}, 8 μM Cu^{2+}, 8 μM Co^{2+}, and 15 μM Ni^{2+}, respectively. (a, Ag NC-PEI 600; b, Ag NC-PEI 1800; c, Ag NC-PEI 70000).

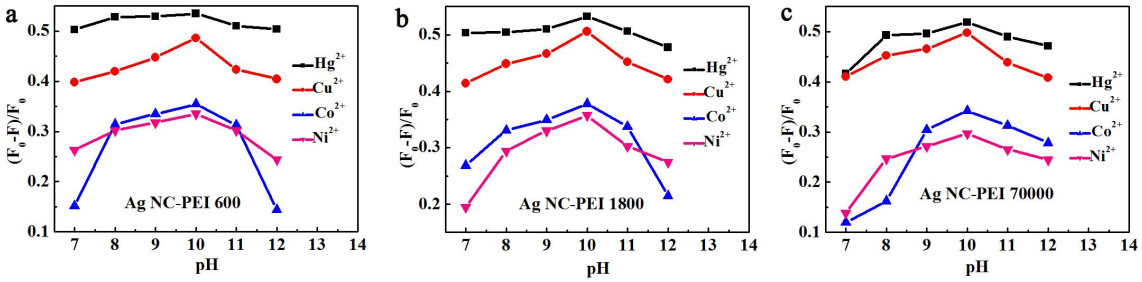

Figure S5. PH-dependent fluorescence quenching rates of Ag NC-PEIs in the presence of 8 μM Hg^{2+}, 8 μM Cu^{2+}, 8 μM Co^{2+}, and 15 μM Ni^{2+}, respectively. (a, Ag NC-PEI 600; b, Ag NC-PEI 1800; c, Ag NC-PEI 70000).

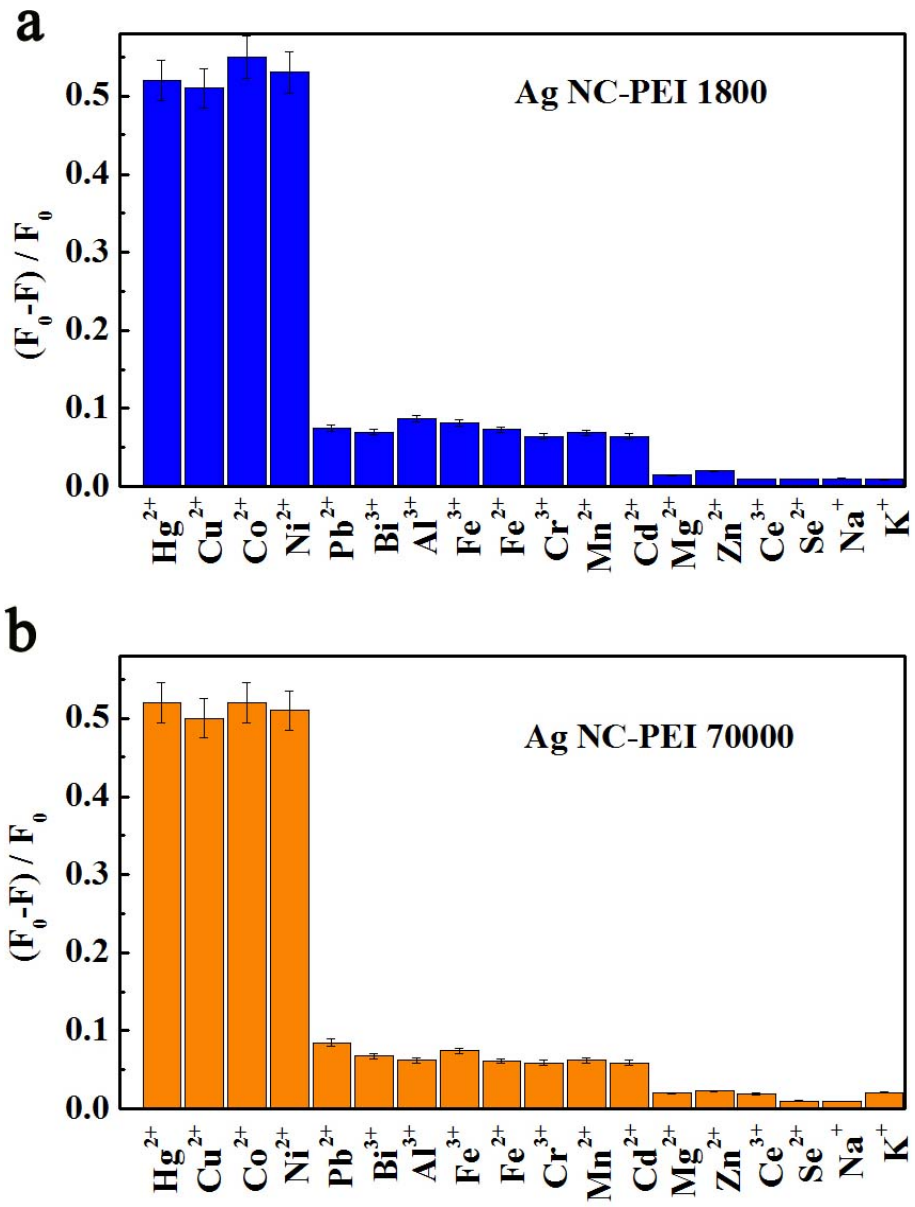

Figure S6. Selectivity of Ag NC-PEI 1800 (a) and Ag NC-PEI 70000 (b) for the detection of Hg^{2+}, Cu^{2+}, Co^{2+}, and Ni^{2+}: the concentrations of Hg^{2+} and Cu^{2+} were 8 μM, Co^{2+} 15 μM, Ni^{2+} 25 μM; Pb^{2+}, Bi^{3+}, Al^{3+}, and Fe^{3+} were 30 μM; Fe^{2+}, Cr^{3+}, Mn^{2+}, and Cd^{2+} were 50 μM; Mg^{2+}, Zn^{2+}, Ce^{3+}, Se^{2+}, Na^{+}, and K^{+} were 100 μM.

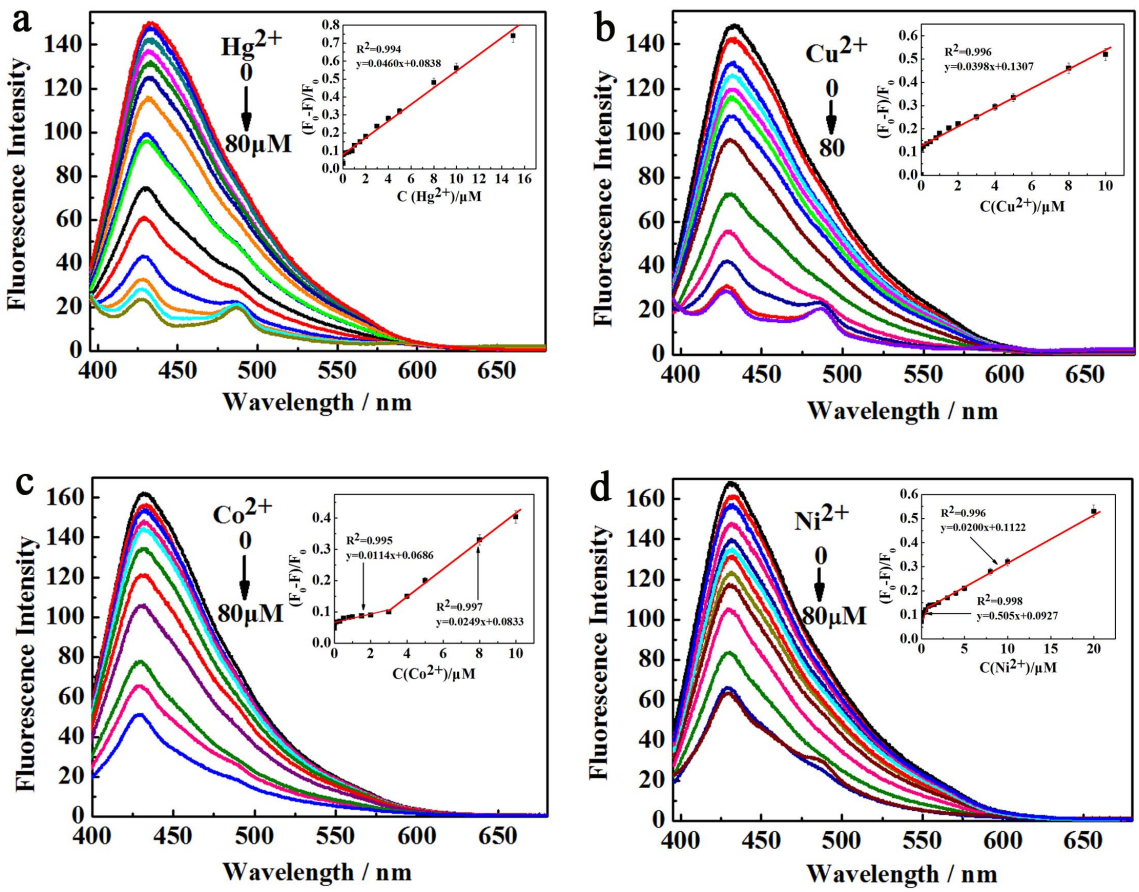

Figure S7. Fluorescence emission spectra of Ag NC-PEI 1800 upon addition of different concentrations of Hg^{2+}, Cu^{2+}, Co^{2+}, and Ni^{2+}. The insets of a, b, c, and d display the linear ranges for 0.1 nM to 15 μM Hg^{2+}, 0.1 nM to 10 μM Cu^{2+}, 1 nM to 10 μM Co^{2+}, and 1 nM to 20 μM Ni^{2+}, respectively.

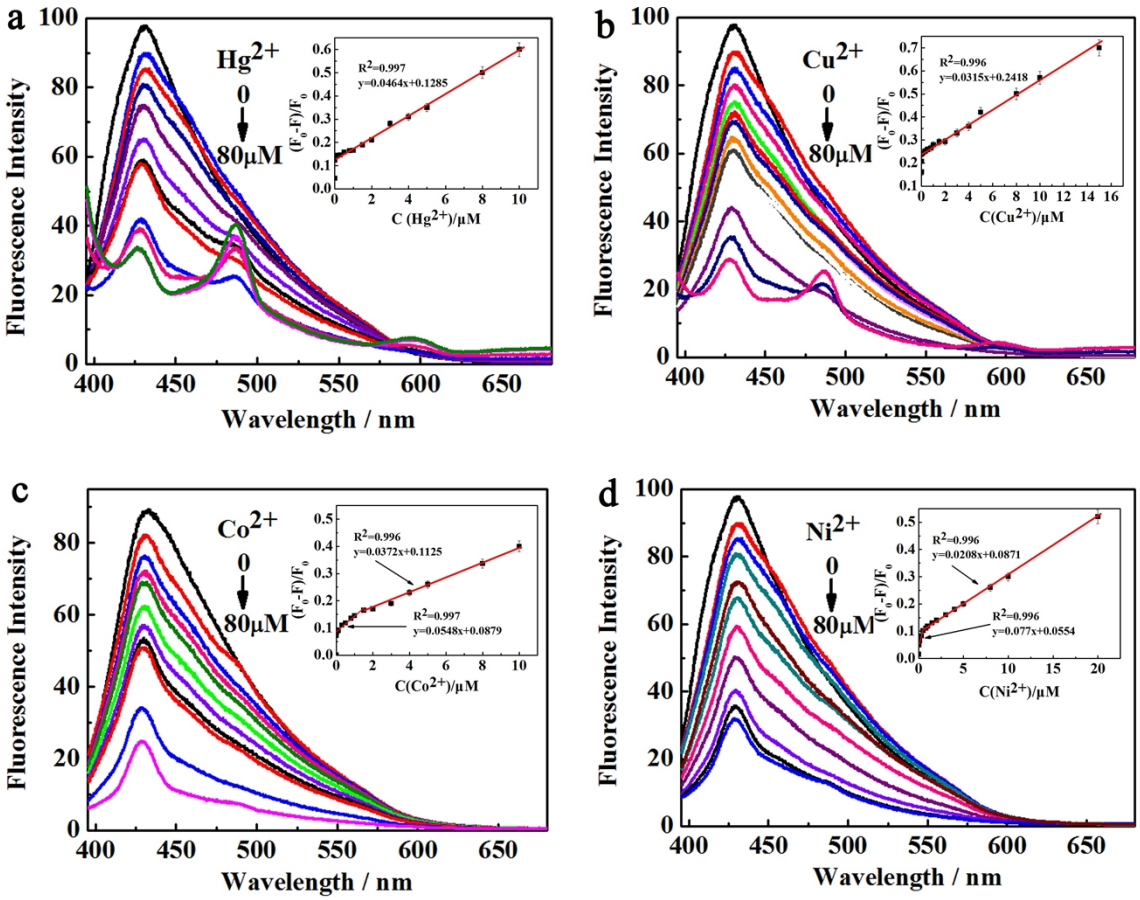

Figure S8. Fluorescence emission spectra of Ag NC-PEI 70000 upon addition of different concentrations of Hg^{2+}, Cu^{2+}, Co^{2+}, and Ni^{2+}. The insets of a, b, c, and d display the linear ranges for 0.1 nM to 10 μM Hg^{2+}, 0.1 nM to 15 μM Cu^{2+}, 1 nM to 10 μM Co^{2+}, and 1 nM to 20 μM Ni^{2+}, respectively.

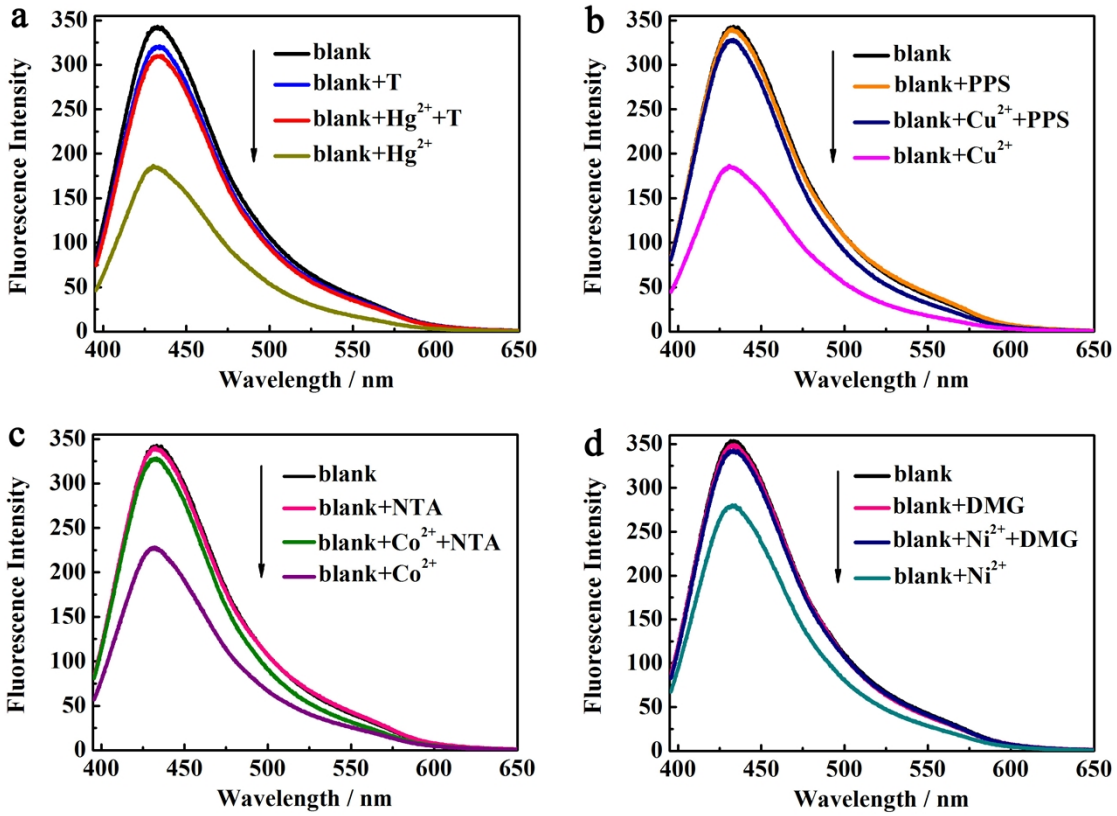

Figure S9. Fluorescence emission spectra of Ag NC-PEI 1800 for the detection of Hg^{2+}, Cu^{2+}, Co^{2+}, and Ni^{2+} in the absence (blank) and presence of corresponding masking agents: a, thymine (T) for Hg^{2+} (8 μM); b, potassium pyrophosphate (PPS) for Cu^{2+} (8 μM); c, nitrilotriacetic acid (NTA) for Co^{2+} (8 μM); d, dimethylglyoxime (DMG) for Ni^{2+} (15 μM).

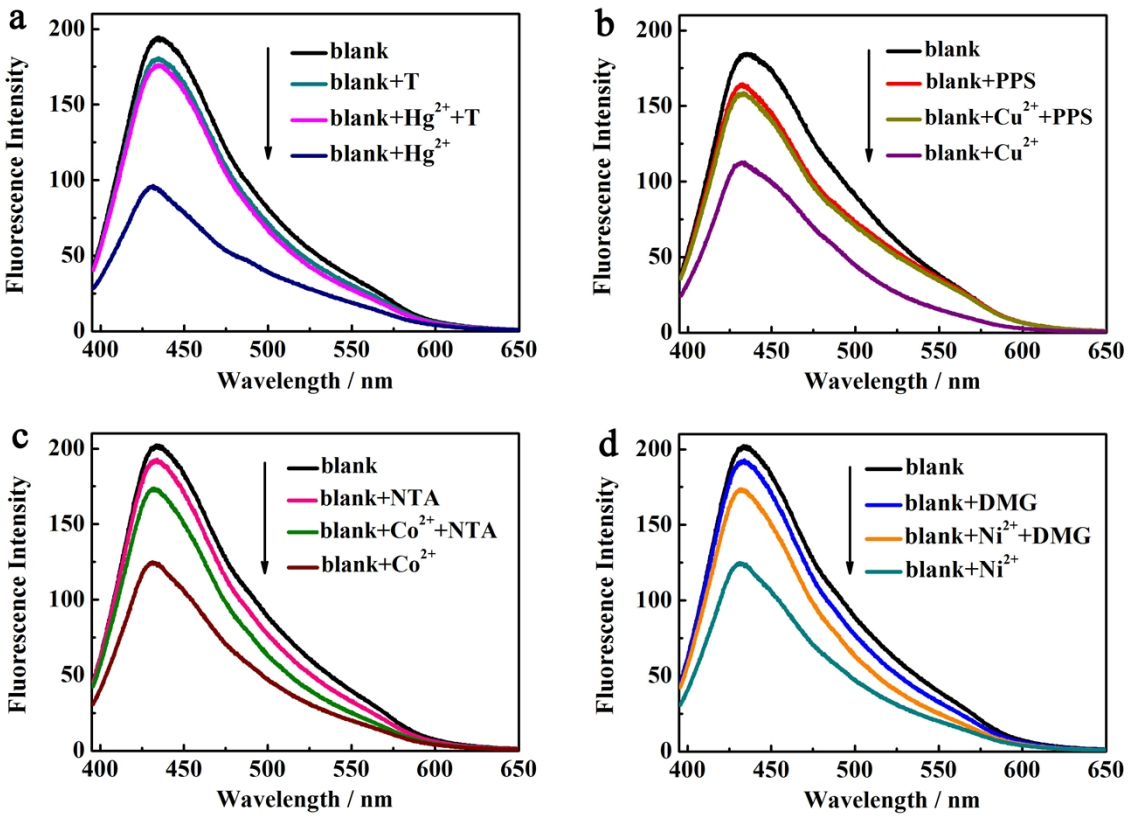

Figure S10. Fluorescence emission spectra of Ag NC-PEI 70000 for the detection of Hg^{2+}, Cu^{2+}, Co^{2+}, and Ni^{2+} in the absence (blank) and presence of corresponding masking agents: a, thymine (T) for Hg^{2+} (8 μM); b, potassium pyrophosphate (PPS) for Cu^{2+} (8 μM); c, nitrilotriacetic acid (NTA) for Co^{2+} (8 μM); d, dimethylglyoxime (DMG) for Ni^{2+} (15 μM).

Table S1. Comparison of the linear ranges and LOD of Hg^{2+}, Cu^{2+}, Co^{2+}, and Ni^{2+} ions by using Ag NC-PEIs as probes.

Metal ions	Ag NC-PEIs	Linear range	LOD
Hg^{2+}	Ag NC-PEI 600	0.1 nM-10 μM	35 pM
	Ag NC-PEI 1800	0.1 nM-15 μM	38 pM
	Ag NC-PEI 70000	0.1 nM-10 μM	32 pM
Cu^{2+}	Ag NC-PEI 600	0.1 nM-20 μM	28 pM
	Ag NC-PEI 1800	0.1 nM-10 μM	31 pM
	Ag NC-PEI 70000	0.1 nM-15 μM	35 pM
Co^{2+}	Ag NC-PEI 600	1 nM-20 μM	0.33 nM
	Ag NC-PEI 1800	1 nM-10 μM	0.35 nM
	Ag NC-PEI 70000	1 nM-10 μM	0.29 nM
Ni^{2+}	Ag NC-PEI 600	1 nM-30μM	0.30 nM
	Ag NC-PEI 1800	1 nM-20 μM	0.28 nM
	Ag NC-PEI 70000	1 nM-20 μM	0.33 nM

Table S2. Reproducibility of the proposed method.

Ag NC-PEIs	Metal ions	Intra-day RSD (%)	Inter-day RSD (%)
Ag NC-PEI 1800	Hg^{2+}	2.15	2.80
	Cu^{2+}	1.93	2.08
	Co^{2+}	1.66	1.76
	Ni^{2+}	2.03	2.40