A simple and novel system for colorimetric detection of cobalt ions

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Materials:

2-aminothiophenol (2-ATP) and methylene blue (MB) were achieved from Alfa Aesar (Tianjin, China). 1,2-Benzenedithiol (BDT), o-phenylenediamine (OPD), 4-aminobenzenethiol (4-ATP), aniline (AN), and mercapto-ethylamine (MEA) were purchased from purchased from Sigma (USA). Nitrate metal salts (analytical reagent) and ethanol were obtained from Beijing Chemical Reagents Co. (China) and used for preparation of the metallic cation stock solutions. Milli-Q water (18.2 MΩ cm) was used in all experiments. Absorption spectra were recorded on a UV-2550 spectrophotometer (Shimadzu Instruments, Japan). The structures of materials were studied by Fourier transform infrared spectroscopy (FTIR) with a KBr pellet. The photographic images of solution were obtained by Canon SX210is.

Preparation of the sensing system:

In general, methylene blue (MB, 0.04 mM) and copper nitrate (1.5 mM) were successively added into the 2-aminothiophenol (ATP, 9 mM) solutions in ethanol to fabricate the sensor of cobalt ion. The obtained sensing system was named as MB-ATP-Cu^{2+} and incubated 3 min for use.

Detection of Co^{2+} by MB-ATP-Cu^{2+}:

A series of MB-ATP-Cu^{2+} solutions were mixed with desired amount Co^{2+} stock solutions. After 2 min incubation, UV-vis spectra of the mixtures were recorded by UV–vis spectrophotometer. Micro quartz cuvette with a 1 cm path length was used for all UV–vis spectra measurements.

Selectivity of the assay:

For studying selective detection of Co^{2+}, a series of MB-ATP-Cu^{2+} solutions were mixed with desired amount metallic cation solutions to obtain desired concentrations (0.7 mM). After 2 min incubation, UV–vis spectra of the mixtures were recorded by UV–visi spectrophotometer. The solution of metal ions were prepared from the nitrate salts of Na^{+}, K^{+}, Fe^{3+}, Hg^{2+}, Ca^{2+}, Al^{3+}, Ba^{2+}, Cu^{2+}, Cd^{2+}, Pb^{2+}, Mn^{2+}, Zn^{2+}, Cr^{3+} and Mg^{2+}.

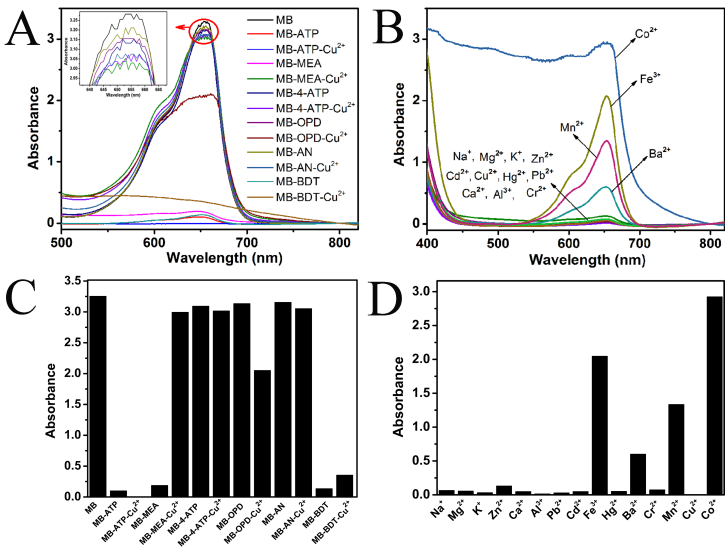

Fig. S1 UV-vis spectra (A) and absorbance (C) of MB after the addition of different reducing agents and Cu^{2+}. Inset: the amplification of curves in the red circle; UV-vis spectra (B) and absorbance (D) of MB-ATP for various metallic ions (0.7 mM).

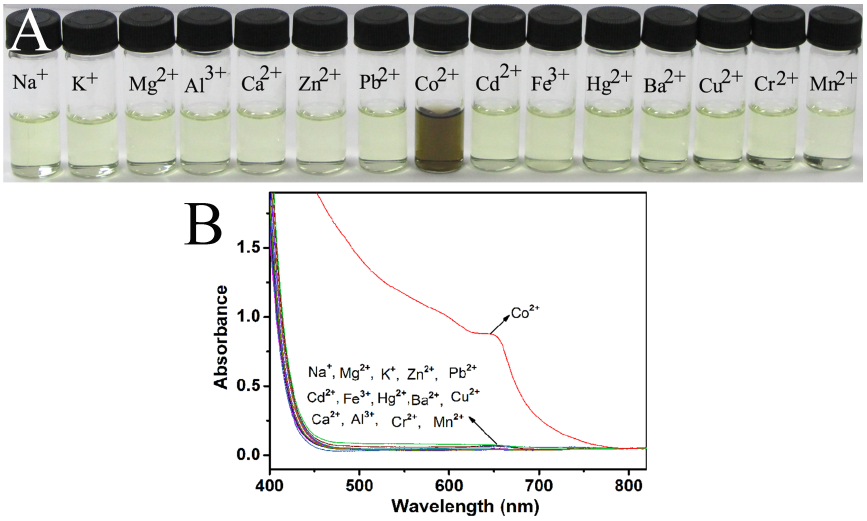

Fig. S2 The interfering effects of other metallic ions on the Co^{2+} detection. (A) photographic images; (B) UV-vis spectra of the MB-ATP-Cu^{2+} for various metallic ions (0.7 mM).