Multifunctional Modified Silver Nanoparticles as Ion and pH Sensors in Aqueous Solution

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Figure S1. FT-IR spectra of mercaptoacetic acid, 2-aminoethanethiol and these two short-chain thiol molecules functionalized silver nanoparticles

Figure S2. FT-IR spectra of the mercaptoacetic acid and 2-aminoethanethiol functionalized silver nanoparticles with and without various ions. Except Pb²⁺, Cu²⁺ and Fe²⁺, K⁺, Ca²⁺, Ba²⁺, Zn²⁺, Cr²⁺ or Cd²⁺ ions showed no change as Na⁺ in the spectra.
**Figure S3.** UV/Vis spectra (i) and the plot of absorbance against incubation time (ii) of the functionalized silver nanoparticles system in the presence of (a) Pb$^{2+}$, (b) Fe$^{2+}$ ions.

**Figure S4.** FT-IR spectra of the mercaptoacetic acid and 2-aminoethanethiol functionalized silver nanoparticles in present of Pb$^{2+}$ (green line), Cu$^{2+}$ (blue line), Pb$^{2+}$ and Cu$^{2+}$ (red line) and no ions (black line).
Figure S5. FT-IR spectra of the mercaptoacetic acid and 2-aminoethanethiol functionalized silver nanoparticles in present of Fe^{2+} (green line), Cu^{2+} (blue line), Fe^{2+} and Cu^{2+} (red line) and no ions (black line).

Figure S6. FT-IR spectra of the mercaptoacetic acid and 2-aminoethanethiol functionalized silver nanoparticles at alkaline (a) and acidic (b) solution.