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A colorimetric logic gate based on urea-gold nanoparticles andapplications on Pb^{2+} and Cr^{3+} detection

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Gold nanoparticle (AuNP) exhibits unique surface plasmon resonances, which is susceptible to several parameters like particle size and shape, inter-particle distance, and local dielectric environment of nanoparticles.In this study, a urea-AuNPs system was fabricated for an OR logic gate fabrication and its application on Pb^{2+} and Cr^{3+}colorimetric detection based on the selective binging behavior of decorators on Au surface and the metal ions. The plasmon band of urea-AuNP (13 nm) in water media is centered on520 nm, while aggregated AuNP solution shows obvious red-to-blue color changes with blue-shifted absorption bond to 650 nm with introduction of either Pb^{2+} or Cr^{3+}. If we define the free AuNPs (aqueous solution is red) and aggregated AuNPs (aqueous solution is blue) as the output "0"and "1" respectively, while the absence and presence of metal ions as the input "0" and "1". This system showsobvious OR logic behavior with Pb^{2+} and Cr^{3+} as inputs. Importantly, it exhibits good selectivity and sensitivity to Pb^{2+} and Cr^{3+} among heavy and transition metal ions. The result in this study can provide qualitative and quantitative determination by colorimetric changes for content, which shows important significance in water environmental monitoring.

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