

Lanthanide-Mediated Aggregation of Glutathione-Capped Gold Nanoclusters Exhibiting Strong Luminescence and Fluorescence Turn-on for Sensing Alkaline Phosphatase

Authors : Jyun-Guo You, Wei-Lung Tseng

Abstract : Herein, this study represents a synthetic route for producing highly luminescent AuNCs based on the integration of two concepts, including thiol-induced luminescence enhancement of ligand-insufficient GSH-AuNCs and Ce³⁺-induced aggregation of GSH-AuNCs. The synthesis of GSH-AuNCs was conducted by modifying the previously reported procedure. To produce more Au(I)-GSH complexes on the surface of ligand-insufficient GSH-AuNCs, the extra GSH is added to attach onto the AuNC surface. The formed ligand-sufficient GSH-AuNCs (LS-GSH-AuNCs) emit relatively strong luminescence. The luminescence of LS-GSH-AuNCs is further enhanced by the coordination of two carboxylic groups (pKa1 = 2 and pKa2 = 3.5) of GSH and lanthanide ions, which induce the self-assembly of LS-GSH-AuNCs. As a result, the quantum yield of the self-assembled LS-GSH-AuNCs (SA-AuNCs) was improved to be 13%. Interestingly, the SA-AuNCs were disassembled into LS-GSH-AuNCs in the presence of adenosine triphosphate (ATP) because of the formation of the ATP- lanthanide ion complexes. Our assay was employed to detect alkaline phosphatase (ALP) activity over the range of 0.1–10 U/mL with a limit of detection (LOD) of 0.03 U/mL.

Keywords : self-assembly, lanthanide ion, adenosine triphosphate, alkaline phosphatase

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