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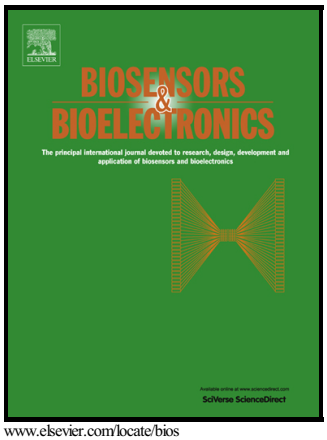

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Fluorescence analysis of 6-mercaptopurine with the use of a nano-composite consisting of BSA-capped Au nano-clusters and core-shell Fe_3O_4-SiO_2 nanoparticles

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Abstract

A magnetic and fluorescent nano-composite was prepared. It comprised of a core of Fe_3O_4 nanoparticles (NPs), a silica shell and satellitic Au nano-clusters (AuNCs) capped with bovine serum albumin (BSA). This nano-composite has many desirable properties, e.g. magnetism, red emission, high water solubility, and high resistance to photo-bleaching. On addition of the analyte, 6-mercaptopurine (6-MP) or indeed other similar thiols, AuNCs formed aggregates because the existing cross-links within the Fe_3O_4 NPs@SiO_2 and AuNC structure were broken in favour of the gold-thiol bonds. On suitable irradiation of such aggregates, red fluorescence was emitted at 613 nm. It decreased significantly as a function of the added 6-MP concentration, and the quenching ratio $(F_0 - F) / F_0$ was related linearly to the concentration of 6-MP in the range of 0.01 to 0.5 μmol L^{-1}. The detection limit was 0.004 μmol L^{-1} (S/N = 3). The method was strongly selective for 6-MP in the presence of oxidants, phenols, heavy-metal ions, and especially bio-thiols.

Keywords: Au nano-clusters; 6-mercaptopurine; Fluorescence analysis; Fe_3O_4 nanoparticles.

1. Introduction

Gold nano-clusters (AuNCs) exist as a sub-nanometer material, and usually, the clusters consist of several to