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Peptide-Gold Nanocluster as an Optical Biosensor for Glycoconjugate Secreted from Leishmania

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Abstract : In this work, we show the important results about of synthesis of photoluminiscents gold nanoclusters using a small peptide as template for biosensing applications. Interestingly, we design one peptide (NBC2854) homologue to conservative domain from 215 250 residue of a galactolectin protein which can recognize the proteophosphoglycans (PPG) from Leishmania. Peptide was synthetized by multiple solid phase synthesis using FMoc group methodology in acid medium. Finally, the peptide was purified by High-Performance Liquid Chromatography using a Vydac C-18 preparative column and the detection was at 215 nm using a Photo Diode Array detector. Molecular mass of this peptide was confirmed by MALDI-TOF and to verify the α-helix structure we use Circular Dichroism. By means of the methodology used we obtained a novel fluorescents gold nanoclusters (AuNC) using NBC2854 as a template. In this work, we described an easy and fast microsonic method for the synthesis of AuNC with ≈ 3.0 nm of hydrodynamic size and photoemission at 630 nm. The presence of cysteine residue in the C-terminal of the peptide allows the formation of Au-S bond which confers stability to Peptide-based gold nanoclusters. Interactions between the peptide and gold nanoclusters were confirmed by X-ray Photoemission and Raman Spectroscopy. Notably, from the ultrafine spectra shown in the MALDI-TOF analysis which containing only 3-7 KDa species was assigned to $Au_{8\text{-}18}[NBC2854]_2$ clusters. Finally, we evaluated the Peptide-gold nanocluster as an optical biosensor based on fluorescence spectroscopy and the fluorescence signal of PPG (0.1 μg-mL^{-1} to 1000 μg-mL^{-1}) was amplified at the same wavelength emission (≈ 630 nm). This can suggest that there is a strong interaction between PPG and Pep@AuNC, therefore, the increase of the fluorescence intensity can be related to the association mechanism that take place when the target molecule is sensing by the Pep@AuNC conjugate. Further spectroscopic studies are necessary to evaluate the fluorescence mechanism involve in the sensing of the PPG by the Pep@AuNC. To our best knowledge the fabrication of an optical biosensor based on Pep@AuNC for sensing biomolecules such as Proteophosphoglycans which are secreted in abundance by parasites Leishmania.

Keywords : biosensing, fluorescence, Leishmania, peptide-gold nanoclusters, proteophosphoglycans
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