World Academy of Science, Engineering and Technology
International Journal of Bioengineering and Life Sciences
Vol:11, No:08, 2017

Fluorescing Aptamer-Gold Nanoparticle Complex for the Sensitive Detection of Bisphenol A

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Abstract : Bisphenol A (BPA) is one of the endocrine disruptors (EDCs), which have been suspected to be associated with reproductive dysfunction and physiological abnormality in human. Since the BPA has been widely used to make plastics and epoxy resins, the leach of BPA from the lining of plastic products has been of major concern, due to its environmental or human exposure issues. The simple detection of BPA based on the self-assembly of aptamer-mediated gold nanoparticles (AuNPs) has been reported elsewhere, yet the detection sensitivity still remains challenging. Here we demonstrate an improved AuNP-based sensor of BPA by using fluorescence-combined AuNP colorimetry in order to overcome the drawback of traditional AuNP sensors. While the anti-BPA aptamer (full length or truncated ssDNA) triggered the self-assembly of unmodified AuNP (citrate-stabilized AuNP) in the presence of BPA at high salt concentrations, no fluorescence signal was observed by the subsequent addition of SYBR Green, due to a small amount of free anti-BPA aptamer. In contrast, the absence of BPA did not cause the self-assembly of AuNPs (no color change by salt-bridged surface stabilization) and high fluorescence signal by SYBP Green, which was due to a large amount of free anti-BPA aptamer. As a result, the quantitative analysis of BPA was achieved using the combination of absorption of AuNP with fluorescence intensity of SYBR green as a function of BPA concentration, which represented more improved detection sensitivity (as low as 1 ppb) than did in the AuNP colorimetric analysis. This method also enabled to detect high BPA in water-soluble extracts from thermal papers with high specificity against BPS and BPF. We suggest that this approach will be alternative for traditional AuNP colorimetric assays in the field of aptamer-based molecular diagnosis.

Keywords : bisphenol A, colorimetric, fluoroscence, gold-aptamer nanobiosensor
Conference Title : ICABB 2017 : International Conference on Applied Biology and Biotechnology
Conference Location : Vancouver, Canada
Conference Dates : August 07-08, 2017