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Communication

Cationic conjugated polymers as signal reporter for label-free assay based on targets-mediated aggregation of perylene diimide quencher

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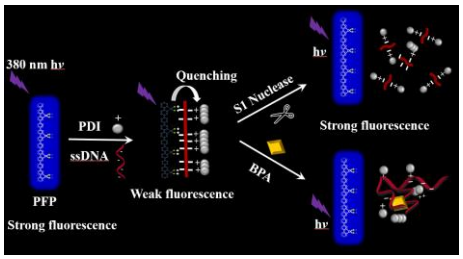
Graphical abstract



Herein, we reported a cationic conjugated polymers-based new biosensor with label-free and fluorescence turn-on strategy by virtue of targets-regulated aggregation and quenching ability of perylene diimide derivatives.

ABSTRACT

Herein, we reported a new label-free and fluorescence turn-on biosensor based on cationic conjugated poly(9,9-bis(6′-*N*,*N*,*N*-trimethylammonium) hexyl) fluorine phenylene) (PFP) and perylene diimide derivatives (PDI). Cationic PFP, single-stranded nucleic acid and PDI were used as signal reporter, probe and fluorescence quencher, respectively. In the presence of nucleic acids, they form complexes with PFP and PDI through strong electrostatic attraction interactions, resulting in PDI aggregating on nucleic acids and fluorescence of PFP being quenched. When nucleic acids are hydrolyzed by enzymes or their conformation is changed *via* recognizing targets, the effective aggregation of PDI is disrupted and the quenching ability is decreased. Thus the fluorescence of PFP recovers significantly. By taking advantage of the mechanism, we construct a new biosensor for endonuclease and small molecules detection. Here, S1 nuclease and bisphenol A are used as model systems. The detection limit of the S1 nuclease and BPA are 1.0×10^{-6} U/mL and 0.05 ng/mL, respectively. Our method is sensitive, cost-effective and simple, and provides a new platform for bioanalysis.

Keywords:
Conjugated polymers
Perylene diimide derivatives
Label-free
S1 nuclease
Bisphenol A
Fluorescence turn-on

Endonucleases are enzymes that can hydrolyze the phosphodiester bond within a polynucleotide chain, which catch much attention because they play an important role in lots of biological processes including recombination, DNA replication, molecular cloning, genetyping *etc*. [1-5]. The detection of endonuclease thus is of importance in biosensing and clinical diagnosis. Some conventional techniques, such as polyacrylamide gel electrophoresis, high performance liquid chromatography and enzyme-linked immunosorbent assay, have been applied for the detection of endonuclease activity [6-8]. However, they are time-consuming and laborious. Recently, colorimetric, electrochemical, and fluorescent assays have been employed to develop sensitive and selective assays for endonuclease activities [5,9-12]. It is noted that fluorometric detection has become an attractive means due to its high sensitivity, rapid response, and simple manipulation [13-17]. Especially, label-free and fluorescence turn-on method is desirable for endonuclease detection because it is economic and can avoid false positive response.