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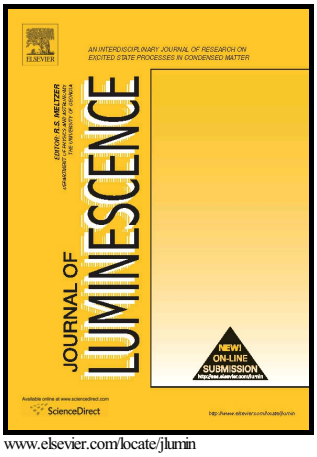

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Triplex-forming oligonucleotide as a lighting-up switch for a DNA abasic site-binding fluorescent ligand

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Abstract

DNA apurinic/apyrimidinic site (AP site) has received much attention due to its importance in disease evolution and development of selective genetic drugs. Fluorescence technique has been widely employed in identifying the AP sequence environment using fluorophores as the AP site-targeting probes. However, the sequence effect on the AP site binding of a ligand should be fully understood for illustrating the binding behavior. Triplex-forming oligonucleotide (TFO) can bind with its partner ds-DNA via specific hydrogen bonding interactions different from the canonical Watson-Crick pattern to form a triplex DNA structure. Due to its wide bioactivity, triplex has been recently investigated using small molecules as the structure identifiers and tuners. In this work, we spectroscopically characterized a novel fluorescent benz[e]indolium probe of BIFS and found that BIFS can selectively target the AP site and its fluorescence is significantly enhanced only when the TFO strand binds to the AP site-containing duplex DNA. The TFO binding restricts the non-radiative twist relaxation process of the excited state BIFS and results in the emissive BIFS. Because BIFS alone in aqueous solution is non-fluorescent, this selective lighting-up emission is advantageous for developing a practical sensor to target the triplex AP site with a weak fluorescence background. This selective recognition of the AP site by the lighting-up fluorescent probe would find wide applications including fluorescently evaluating the triplex-based small molecular binders.

Keywords: DNA, triplex, ligand, abasic site, fluorescence

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