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Label-free colorimetric aptasensor utilizing cationic perylene probe and localized surface plasmon resonance of gold nanoparticles for rapid detection of Aflatoxin B1

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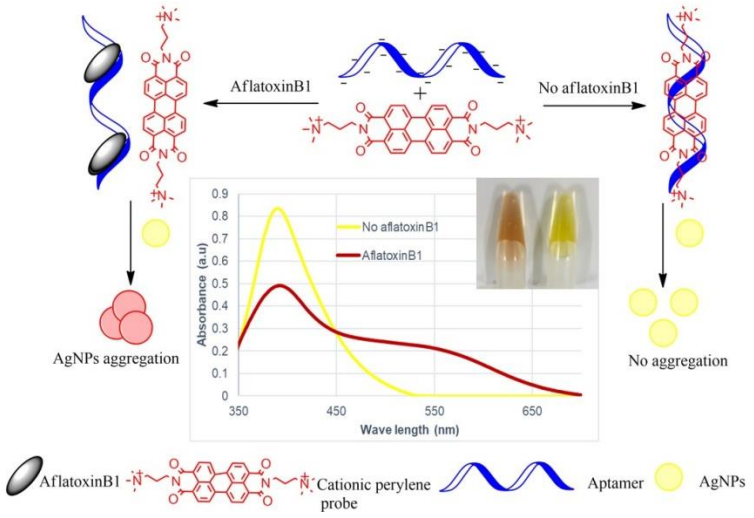
Abstract

A label-free colorimetric aptasensor for rapid detection of aflatoxin B1 (AFB1) has been developed using specific aptamer, cationic perylene probe (CPP), and unmodified citrate – stabilized AuNPs. In the absence of AFB1, the free specific aptamer forms complex structures with the CPP, resulting in the solution remaining red without aggregation of AuNPs. Conversely, in the presence of AFB1, the aptamer competes for interaction with AFB1 and CPP. Notably, the aptamer is strongly specific to AFB1, leading to CPP free in the solution. When unmodified citrate – stabilized AuNPs are supplemented, the color turns blue as a result of AuNPs aggregation induced by CPP. The color change of AuNPs comes from localized surface plasmon resonance absorption, which relates to the size, shape, and agglomeration of the nanoparticles. This phenomenon can be measured through colorimetric detection. In this work, we presented two approaches, i.e., by using a spectrophotometer and a homemade colorimeter as a detector, which provided the limit of detections of 0.36 and 0.18 ng/mL, respectively. The application for the determination of AFB1 in rice and peanut samples was carried out. The proposed colorimetric aptasensor offers advantages in terms of simplicity, rapid detection, and high selectivity. Furthermore, the sensitivity for the real application is practical when coupled with an affinity column as sample preparation.



Keywords: Aflatoxin; Aptamer; Cationic perylene probe; Gold nanoparticles; Colorimetric detection