Supplementary Material (ESI) for Analytical Methods

Supporting Information

for

A one-step sensitive dynamic light scattering method for adenosine detection using split aptamer fragments

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Experimental section

Reagents

Trisodium citrate and chloroauric acid ($HAuCl_4$) were obtained from Sinopharm Chemical Reagent Co., Ltd (China). Adenosine, uridine, cytidine and guanosine were purchased from Sigma (USA). Different concentration of adenosine and 1 mM uridine, cytidine, and guanosine were all prepared in 10 mM PBS buffer (pH=7.3). DNA oligonucleotides were purchased from TaKaRa Biotechnology (Dalian, China) Co., Ltd. Sequences of these DNA were as follows: (1) DNA1: 5' -HS-C6- TTT TTT TTT TAC CTG GGG GAG TAT - 3'; (2) DNA2: 5' -HS-C6- TTT TTT TTT TTG CGG AGG AAG GT- 3'; (3) DNA3: 5' -HS-C6- TTT TTT TTT T- 3'. All of them were dissolved into 10 mM PBS buffer (pH=7.3) before use. All of the chemical reagents were of analytical grade or higher. Ultrapure water (18.2 MΩ·cm) was used throughout.

Instruments

UV-visible absorption spectroscopy was recorded on a DU800 Spectrophotometer (Beckman, USA). The hydrodynamic diameters of AuNPs were measured using a Zetasizer Nano ZS from Malvern Instruments (Malvern, UK) under the following conditions: temperature 25 ^{o}C, detector angle 173^{o}, incident laser wavelength 633 nm, laser power 4.0 mW. Transmission electron microscopy (TEM) images were collected by using a JEM 1230 TEM (JEOL, JP).

Preparation and Characterization of AuNPs-DNA

AuNPs (13±1 nm diameters) were prepared by citrate reduction of $HAuCl_4$ as previously described.[1] AuNPs-DNA1 and AuNPs-DNA2 were prepared according to the literature with minor modifications.[2, 3] DNA1 (or DNA2) (90 μl, 40 μM) and DNA3 (90 μl, 40 μM) were first mixed with 810 μl AuNPs solution for 16 h at 4 ^{o}C, and then the solution was brought to 100 mM NaCl solution (pH 7, 10 mM phosphate buffer) for aging 40 h at 4 ^{o}C. The adding of DNA3 blocked the uncovered AuNPs surface. Next, the AuNPs-DNA1 (or AuNPs-DNA2) was centrifugated (30 min, 13,500×g) to remove excess reagents. The supernatant was discarded and the red oily precipitate was washed with 100 mM NaCl solution (pH 7, 10 mM phosphate buffer). After a second centrifugation, the red oily precipitate was dispersed in 500 μl 300 mM NaCl solution (pH 7, 10 mM phosphate buffer). UV-visible absorption spectroscopy was used for optical characterization of AuNPs, AuNPs-DNA1 and AuNPs-DNA2 in solution.

Detection of Adenosine

AuNPs-DNA1 (50 μl, 3.78 nM) and AuNPs-DNA2 (50 μl, 3.78 nM) were first mixed in a 1:1 ratio, and 400 μl different concentration of adenosine was added and reacted for 30 min at room temperature. Finally, the size of nanopaticles in mixture was measured. For identifying the target-specificity of this sensing system, 400 μl 1.0 mM adenosine analogue solutions of uridine, cytidine, and guanosine were, respectively,

reacted with the mixture of AuNPs-DNA1 (50 μl, 3.78 nM) and AuNPs-DNA2 (50 μl, 3.78 nM) for 30 min at room temperature, then the change of diameter was recorded.

Table S1. Comparison of Analytical Performance of Various Different Methods for Determination of adenosine

Method / technique	Detection limit (M)	reference
turbidimetry	2.5×10^{-4}	4
absorbance spectrum	6×10^{-6}	5
colorimetry	2.5×10^{-4}	2
colorimetry	2.5×10^{-4}	6
fluorescent	2×10^{-5}	7
fluorescent	1×10^{-6}	8
fluorescent	1×10^{-7}	9
colorimetry and fluorescent	5×10^{-5}	10
chronocoulometry	1×10^{-7}	11
electrochemical biosensor	1×10^{-8}	12
surface plasmon resonance	1×10^{-9}	13
dynamic light scattering	7×10^{-9}	This work

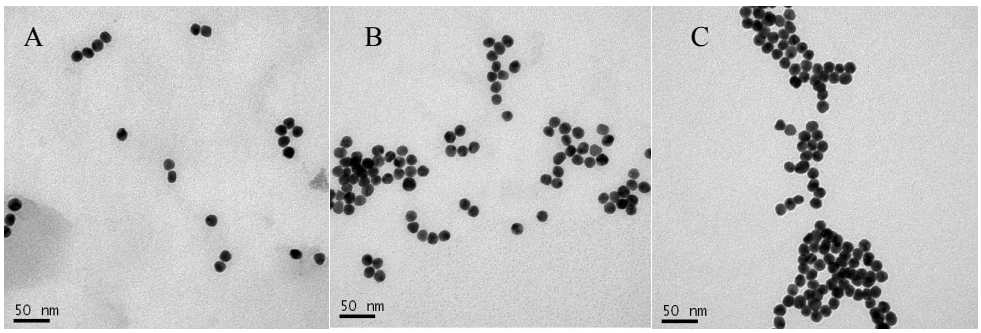

Figure S1. (A) TEM image of the mixture of AuNPs-DNA1 and AuNPs-DNA2; (B) TEM image of the aggregation of AuNPs-DNA1 and AuNPs-DNA2 after addition of 0.8 μM adenosine. (C) TEM image of the aggregation of AuNPs-DNA1 and AuNPs-DNA2 after the addition of 80 μM adenosine.

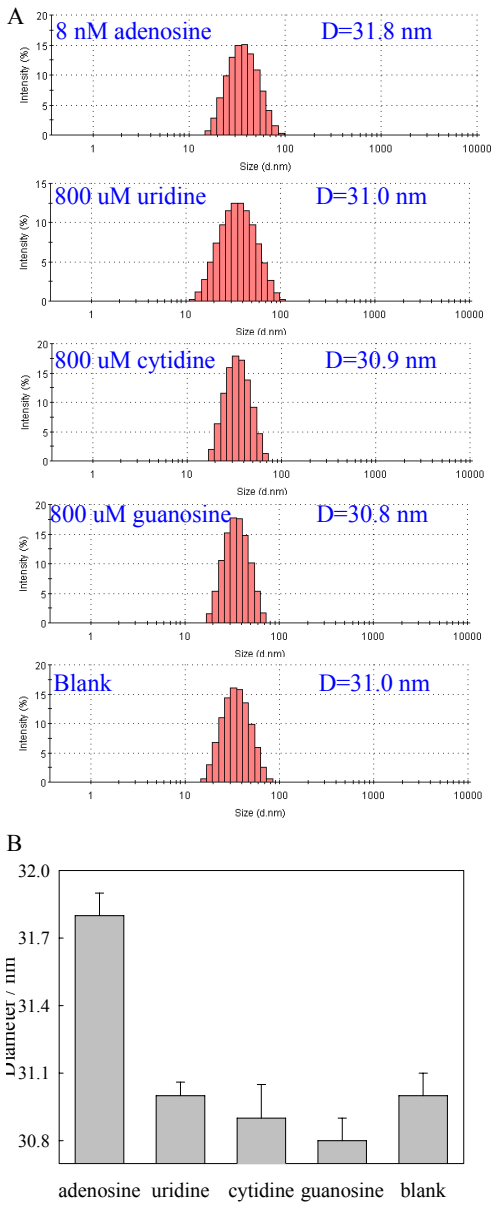

Figure S2. DLS analysis data (A) and the change of size (B) of AuNPs-DNA probes in the presence of adenosine and its analogues. The concentration of adenosine analogues was 800 μM, while the concentration of adenosine was 8 nM.

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