Supplementary Material (ESI) for Chemical Communications

Supplementary Information

G-Quadruplex-based DNAzyme as sensing platform for ultrasensitive colorimetric potassium detection

Tao Li, Erkang Wang and Shaojun Dong*

State Key Laboratory of Electroanalytical Chemistry, Changchun Institute of Applied Chemistry, Chinese Academy of Sciences, Changchun, Jilin, 130022, China, and Graduate School of the Chinese Academy of Sciences, Beijing, 100039, China.

Experimental Details

Materials. Two G-quadruplex DNAs (AGRO100: 5'-GGT GGT GGT GGT TGT GGT GGT GGT GG-3', HT-DNA: 5'-GGG TTA GGG TTA GGG TTA GGG-3') and hemin were purchased from Sangon Biotechnology Co., Ltd (Shanghai, China). Before use, these oligonucleotides were dissolved in the TE buffer (10 mM Tris-HCl, 0.1 mM EDTA, pH 7.4), and quantified by using UV-Vis absorption spectroscopy with the following extinction coefficients (ε_{260nm}, M^{-1} cm^{-1}): A = 15400, G = 11500, C = 7400, T = 8700. The stock solution of hemin (5 mM) was prepared in DMSO, stored in the dark at –20 ℃, and diluted to the required concentration with the Tris-HCl buffer (25 mM Tris-HCl, pH 8.0, 0.05% Triton X-100, 1% DMSO).

Instrumentation. A Cary 500 Scan UV-Vis-NIR Spectrophotometer (Varian, USA) was used to record the absorption spectra of reaction product $ABTS^{\cdot+}$ at room temperature in the wavelength range from 390 to 500 nm.

Preparation of G-quadruplex-based DNAzymes. Firstly, the DNA solutions were heated at 88 ℃ for 10 min, and gradually cooled to room temperature. Then, to these DNA solution was added an equal volume of same concentration of hemin. Finally, an equal volume of different concentrations of K^+ (dissolved in the Tris-HCl buffer) was added into the mixtures. These mixtures were kept at room temperature for 1 h,

allowing the G-quadruplex DNAs to bind hemin properly to form the G-quadruplex-based DNAzymes.

Colorimetric measurement. The detection of K^+ was performed at room temperature in the Tris-HCl buffer. Briefly, to 980 μL of 6 mM ABTS solution was added 10 μL of 60 mM H_2O_2, quickly followed by 10 μL DNAzymes. The absorption spectra of the reaction product were recorded every 1 min by the UV-Vis spectrophotometer in the wavelength range from 500 to 390 nm.

Activity comparison between DNAzyme and HRP

Fig. S1 shows a comparison between the peroxidase activities of hemin-AGRO100 DNAzyme and HRP. It is found that 100 nM of pure hemin-AGRO100 DNAzyme exhibits about 170% activity as compared with 1 nM HRP. Further experiments reveal that the DNAzyme activity is improved by ca. 3-fold whereas the HRP activity is almost not changed when the concentration of H_2O_2 increases (data not shown). Even so, HRP still possesses over one order of magnitude higher peroxidase activity than DNAzyme under same conditions. Hence, further endeavor is needed to exploit more excellent DNAzyme, which will significantly contribute to analytical chemistry.

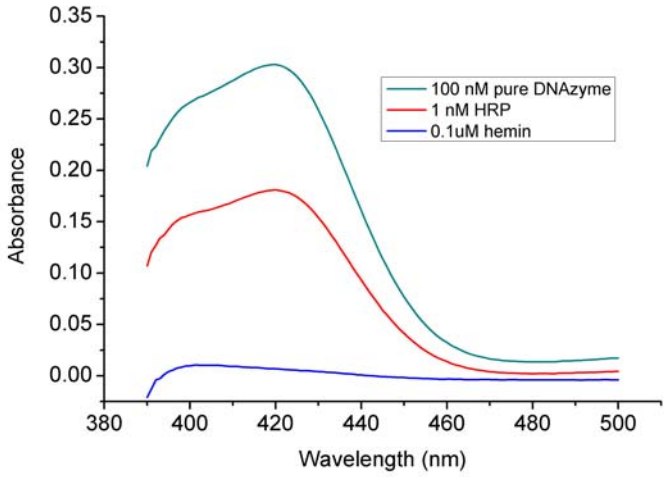

Fig. S1 Comparison between the peroxidase activities of 100 nM hemin-AGRO100 DNAzyme and 1 nM HRP.