Supporting Information

Specific detection of potassium ion in serum by a modified G-quadruplex method

Shan Zhang^{1,+}, Ruibin Zhang^{2,+}, Baojin Ma¹, Jichuan Qiu¹, Jianhua Li¹, Yuanhua Sang¹, Wei Liu^{1,*}, Hong Liu^{1,*}

¹ State Key Laboratory of Crystal Materials, Shandong University, Jinan, 250100,

China

² Blood Purification Center, Jinan Central Hospital, Jinan, 250013, China

* Corresponding Author. Hong Liu, hongliu@sdu.edu.cn;

Wei Liu, weiliu@sdu.edu.cn

⁺ These authors contributed equally to this work and they should be regarded as co-

first author.

Table S1. Comparison between method in this study and other existing methods based on G-quadruplex.

From properties of several different methods, we can see that the dual-labeled modified G-quadruplex method we presented has much better selectivity and linearity even in real serum containing all other metal ions together.

	Methods	Reagents	Schematic Diagram	Experimental Principle	Selectivity (With this ion exists, K* can still be well detected: V; Otherwise: X)	Linearity	Sensitivity to K ⁺
1	Crystal Violet-G- quadruplex Complexes	Oligonucleotide (13173 and Hum21) potassium chloride crystal violet	3 3 3 3 3 3 3 3 3 3 3 3 3 3	Olgonucleoide can fold into G- quadruples in the presence of K [*] (i), then crystal violet was added into solition (ii). The fluorescence intensity of crystal violet will increase when combine with G- quadruples, so the concentration of K [*] can be quantified by the variation of fluorescence intensity.	T₃TT₃ Hum21 Na ⁺ V Na ⁺ X Ca ²⁺ X Ca ²⁺ V Mg ²⁺ X Mg ²⁺ V	The linearity with high concentration of Na ⁺ is good.	0-10 mM
II	DNA G- quadruplex with Cationic Conjugated Polymer	single-labeled oligonucleotide potassium chloride cationic conjugated polymer		Distance between cationic onojugated polymer (CCP) and fluorascent group is closer when G-quadrupher exists, and efficient RET from CCP to fluorescent group can be observed, therefore we are quantified the K-concentration through the variation of fluorescence intensity of the fluorescent group.	Na* √ Ca²+ X Mg²* X	The linearity is good when Na ⁺ exists.	0-50 mM
III	Dual-labeled Oligonucleotide Derivative	dual-labeled oligonucleotide potassium chloride	hv finision we have the finise of the finis	FRET between two fluorescent groups is not significant. Before the addition of K because of the large distance. When we add K' in solution, there is efficient FRET between two fluorescence groups. Thardnow was can quantified the K' concentration through the variation of fluorescent groups.	Na ⁺ untested Ca ²⁺ untested Mg ²⁺ untested	The linearity is good when the number of Spacer bases is up to 7.	0-30 mM
IV	Dual-labeled modified G- quadruptex method	dual-labeled oligonucleotide potassium chloride EDTA-2Na	Entration	Based on the method III, I further test the selectivity of Na7, Ga^{2*} , M_{2*}^{100} of this dual-labeled G-quadrupice xystem, and added EDTA-2HA to inhibit the influence of Ce ²⁺ and Me ²⁺ and realized the K [*] detection in real serum.	Na* V Ca ²⁺ V Mg ²⁺ V	The linearity is very good even in real serum with different metal ions all together.	0-30 mM

I. De-Ming Kong et al., Crystal violet–G-quadruplex complexes as fluorescent sensors for homogeneous detection of potassium ion. Biosensors and Bioelectronics 25 (2009) 88–93.

II. Fang He et al., Fluorescent Amplifying Recognition for DNA G-Quadruplex Folding with a Cationic Conjugated Polymer: A Platform for Homogeneous Potassium Detection. J. AM. CHEM. SOC. 2005, 127, 12343-12346.

III. Satoru Nagatoishi et al., Fluorescence energy transfer probes based on the guanine quadruplex formation for the fluorometric detection of potassium ion. Analytica Chimica Acta 581 (2007) 125–131.

IV. Method presented in our study.

S1. The effect of pH and temperature to the modified dual-labeled G-quadruplex system.



Figure S1. (a) Fluorescence spectra of the dual labeled TBA when pH changed; (b) Corresponding plot of R vs pH and linear fit; (c) Fluorescence spectra of the dual labeled TBA when temperature changed; (d) Corresponding plot of R vs Temperature and linear fit. Error bars show standard deviation of triplicate measurements.