Supplementary Information

Metal Ions Modulate the Conformation and Stability of G-Quadruplex with or without a Small-Molecule Ligand

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Supplementary methods

Absorption spectra study with compound 4

The absorption titration of compound 4 was performed by using a fixed concentration (1 μM) of the ligand in buffer (10 mM Tris-HCl + 100 mM KCl, pH 7.4) and increasing concentrations of the G-quadruplex. The solutions were mixed and incubated for 2 h at room temperature before absorption spectra were recorded. UV absorption spectra were obtained by using a Shimadzu UV-3600 spectrophotometer. UV absorption spectra showed that after adding G-quadruplex, a hypochromic effect as well as a redshift of approximately 7 nm of the characteristic absorption band of compound 4 occurred (Fig. S5), indicating the intercalation of the compound into G-quadruplex. The binding constant of compound 4 with G-quadruplex was $4.84 \times 10^8$ M$^{-1}$. The binding constant has been calculated from the equation.\(^1\)

$$\frac{C_\text{G4}}{(\varepsilon_a - \varepsilon_f)} = \frac{C_\text{G4}}{(\varepsilon_b - \varepsilon_f)} + \frac{1}{K(\varepsilon_b - \varepsilon_f)}$$

Where $\varepsilon_a$ corresponds to $A_{\text{obsd}}/C_{\text{compound 4}}$, $\varepsilon_f$ corresponds to extinction coefficient for the free compound 4, $\varepsilon_b$ corresponds the extinction coefficient for the compound 4 complex in the fully bound form.

References

Fig. S1 CD spectra of Na\(^+\)-induced G-quadruplex (1 µM) with increasing concentrations of Ca\(^{2+}\), Cr\(^{3+}\), Cs\(^+\), K\(^+\), Mg\(^{2+}\), Mn\(^{2+}\), or Zn\(^{2+}\) in 50 mM NaAc and 10mM Tris-HAc buffer, pH 7.4.
Fig. S2 CD spectra of Na⁺-induced G-quadruplex (1 µM) with increasing concentrations of Ag⁺, Al³⁺, Cd²⁺, Co²⁺, Fe²⁺, Hg²⁺, Ni²⁺, or Pb²⁺ in 50 mM NaAc and 10mM Tris-HAc buffer, pH 7.4.
Fig. S3 CD spectra of Na\(^+\)-induced G-quadruplex (1 µM) with 100 µM of Al\(^{3+}\), Cd\(^{2+}\), Co\(^{2+}\), or Fe\(^{2+}\) and increasing concentrations of Ba\(^{2+}\) in 50 mM NaAc and 10 mM Tris-HAc buffer, pH 7.4.
**Fig. S4** CD spectra of Na\(^+\)-induced G-quadruplex (1 \(\mu\)M) with Ag\(^+\), Hg\(^{2+}\), or Ni\(^{2+}\) and increasing concentrations of Ba\(^{2+}\) in 50 mM NaAc and 10 mM Tris-HAc buffer, pH 7.4.
Fig. S5 UV absorption spectra of compound 4 (1 µM) with increasing concentrations of G-quadruplex.
Fig. S6 CD spectra of Na\(^+\)-induced G-quadruplex with compound 4 (3 µM) and increasing concentrations of Ag\(^+\), Al\(^3+\), Ba\(^2+\), Cd\(^2+\), Co\(^2+\), Fe\(^2+\), Hg\(^2+\), or Ni\(^2+\) in 50 mM NaAc and 10 mM Tris-HAc buffer, pH 7.4.
Fig. S7 CD spectra of Na\textsuperscript{+}-induced G-quadruplex in the presence of compound 4 (3 µM) and 100 µM of Al\textsuperscript{3+}, Cd\textsuperscript{2+}, Co\textsuperscript{2+}, Fe\textsuperscript{2+}, Ni\textsuperscript{2+}, or 10 µM of Ag\textsuperscript{+} or Hg\textsuperscript{2+}, and increasing concentrations of Ba\textsuperscript{2+} in 50 mM NaAc and 10 mM Tris-HAc buffer, pH 7.4.
Fig. S8 CD spectra of Na⁺-induced G-quadruplex in the presence of compound 4 (3 µM) and 0.1, 1 or 10 µM of Cu²⁺, with increasing concentrations of Ba²⁺ in 50 mM NaAc and 10 mM Tris-HAc buffer, pH 7.4.
Fig. S9 CD spectra of Na⁺-induced G-quadruplex in the presence of compound 4 (3 μM) and 100 μM of Al³⁺, Cd²⁺, Co²⁺, Fe²⁺, Ni²⁺, or 10 μM of Ag⁺ or Hg²⁺, with increasing concentrations of EDTA in 50 mM NaAc and 10 mM Tris-HAc buffer, pH 7.4.