Supporting Information

A DNAzyme sensor that uses chemiluminescence resonance energy transfer for rapid, portable and ratiometric detection of metal ions

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Table of Contents

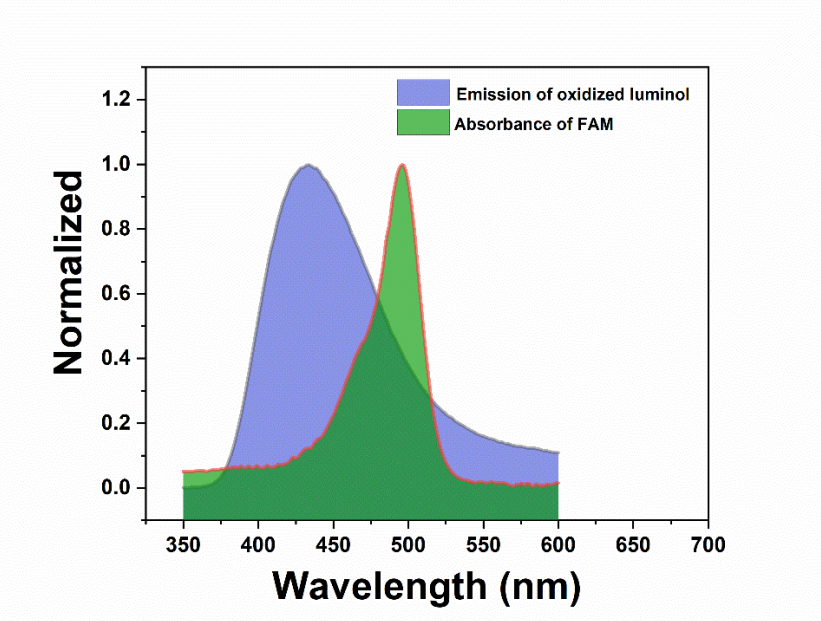

Figure S1. Normalized emission (Em.) spectra of oxidized luminol (donor, blue) and normalized absorbance (Abs.) spectra of fluorescein (acceptor, green) with their spectral overlapping area colored dark green.

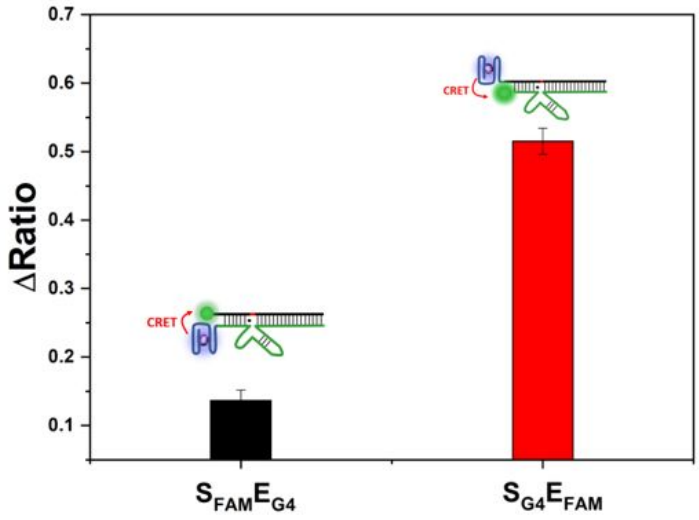

Figure S2. The chemiluminescence intensity of designed DNAzyme-CRET probe before addition of Pb^{2+} ions under varying positions of G4 sequence and fluorescein. Comparing S_{FAM}-E_{G4} probe and S_{G4}-E_{FAM} probe, the CRET signal of the latter combination was drastically increased, suggesting the incompatibility of both G4 sequence and catalytic core sequence to be presented on E strand simultaneously.

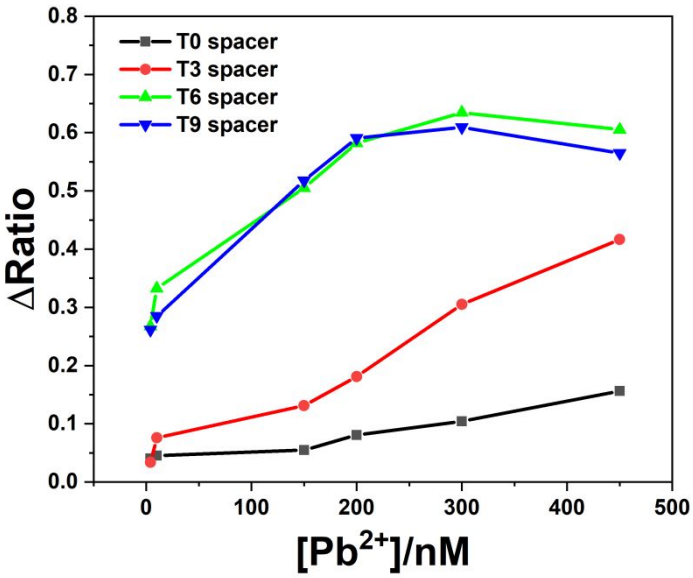

Figure S3. The changes of CRET ratio on DNAzyme-CRET probe in respond to increasing Pb^{2+} concentrations at different lengths of T-spacer. By increasing the T-spacer from 0 to 9 nucleotides, the CRET signal was drastically increased until a stable ΔRatio was reached, indicating that the proximity of G4 could interfere with the subsequent sensitivity towards Pb^{2+} ions.

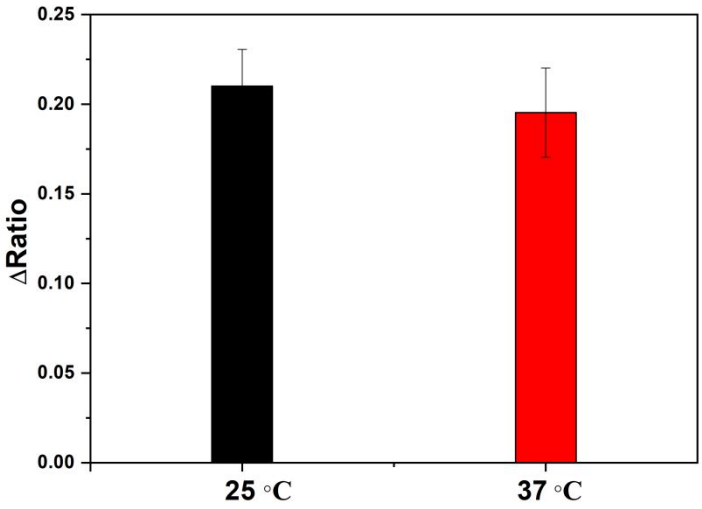

Figure S4. The effect of varied reaction temperature on DNAzyme-CRET probe after addition of Pb^{2+} ions. The CRET signals of the DNAzyme-CRET probe obtained either at 25 ^{o}C or 37 ^{o}C were indistinguishable.

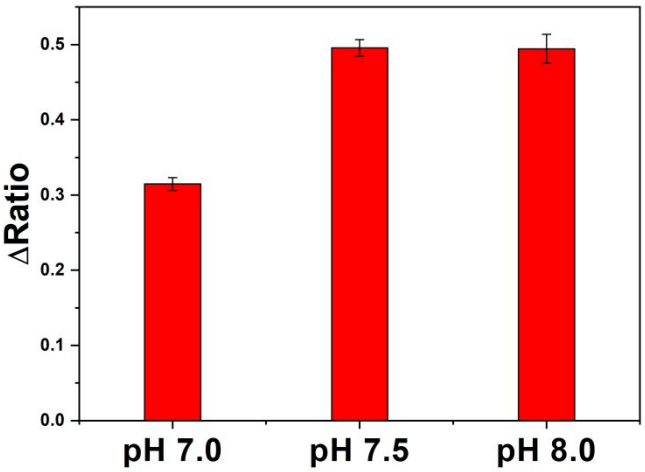

Figure S5. The effect of varying reaction pH on DNAzyme-CRET probe after addition of Pb^{2+} ions. After an initial sharp increase of ΔRatio, there is negligible difference between pH 7.5 and pH 8.0, indicating an optimal reaction pH was achieved at pH 7.5.

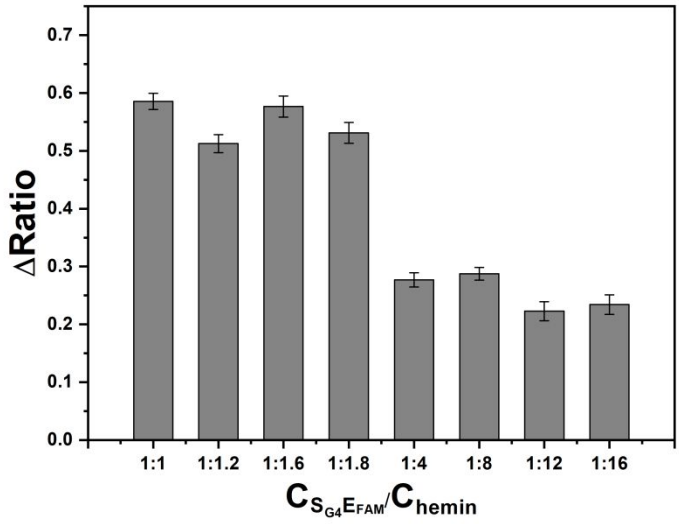

Figure S6. Optimizing catalytic oxidation efficiency of luminol by tuning the concentration of hemin. The effect of varying molar ratio between S_{G4}-E_{FAM} and hemin. With the overall decreasing trend of normalized chemiluminescence intensity, the optimal molar ratio was identified at 1:1.

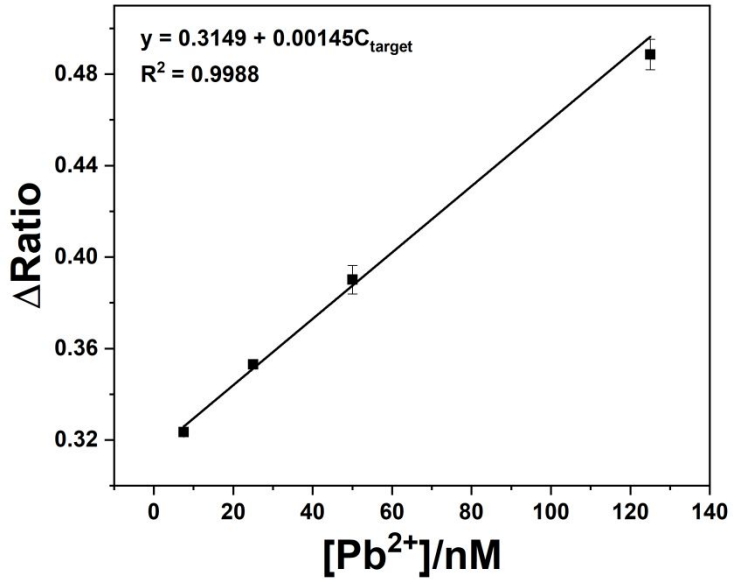

Figure S7. Calibration curve achieved by the DNAzyme-CRET sensor for Pb^{2+} detection in buffer by fluorometer without an excitation light source. The data collecting procedure was conducted according to the manufacturer's protocol. The linear response range for Pb^{2+} is from 7.5 nM to 125 nM.

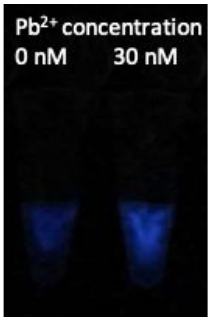

Figure S8. Photographed image for DNAzyme CRET sensor in Tris buffer with addition of 0 and 30 nM Pb^{2+} ions respectively.

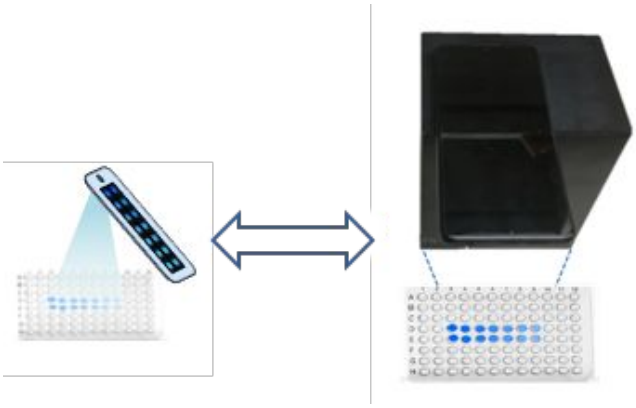

Figure S9. Real working process for smartphone measurement.

Table S1. Comparison of the reported sensors using DNAzymes for Pb^{2+}

NO.	Detection method	Portability	Dynamic range	Limit of detection	Ref.
1	Colorimetric	yes	0.4-2 μM	not mentioned	1
2	FRET	no	1-50 nM	0.2-0.5 nM	2
3	Colorimetric	yes	120 nM-20 μM	3 nM	3
4	Fluorescent	no	1 nM-1 μM	300 pM	4
5	Fluorescent	no	10 nM-4 μM	10 nM	5
6	Photoelectrochemical	no	0.1-50 nM	0.05 nM	6
7	CRET	yes	7.5-125 nM	5 nM	this work

References

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of lead (II) ion. *ACS Appl. Mater. Interfaces*, **2014**, 6, 15991-15997.