Electronic Supplementary Material (ESI) for Analytical Methods.

Supporting Information

A label-free fluorescent biosensor based on catalyzed hairpin assembly for HIV DNA and lead detection

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Table S1 The sequences of DNA used in the experiments

DNA name	DNA sequences (5' to 3')
H1 for HIV DNA	GCTAGAGATTTTCCACACTGACTTGTTGGGTTTTGGGAGTCAGTGTGGAAA
H2 for HIV DNA	ACTGACTCCCAAAACCCAACAAGTCAGTGTGGAAAATCTTGTTGGGTTTTGGGTTTTGGGTTTTGGG
Substrate strand (A)	GTATGTTTTGGGTTGGACCACTATrAGGAAGAGATGATGTCTGT
Enzyme Strand (B)	ACAGACATCATCTCTGAAGTAGCGCCGCCGTATAGTGGT
H1 for Pb^{2+}	TAGTGGTCCAACCCAAAACATACTGTTGGGTTTTGGGGTATGTTTTGGGTTG
H2 for Pb^{2+}	AACATACCCCAAAACCCAACAGTATGTTTTGGGTTGGACTGTTGGGTTTTGGGTTTTGGGTTTTGGG
HIV target DNA	AGTCAGTGTGGAAAATCTCTAGC
Deleted Target	AGTCAGTGTG_AAAATCTCTAGC
One Mismatched Target	AGTCAGTGTGCAAAATCTCTAGC
Two Mismatched Target	AGTCAATGTGGAAAAACTCTAGC

Table S2 Different approaches for HIV DNA detection.

Strategy	Signal readout	Detection limit	Detection time	Ref.
G-quadruplex/ThT/DNA biosensor	Fluorescence	2.4 nM	90 min	1
DNA-Ag nanoclusters	Fluorescence	3.18 nM	> 3 h	2
Mismatch C-C/Ag^{+}/CHA	Colorimetric	7.8 nM	60 min	3
DNA/Ag/carbon nanoparticles	Fluorescence	0.4 nM	2 h	4
G-triplexes /CHA	Fluorescence	33 pM	50 min	5
G-quadruplex/ThT/CHA	Fluorescence	56 pM	40 min	This work

Table S3 Recovery experiments of HIV DNA in serum samples.

Sample	Added/nM	Founded/nM	Recovery/%	RSD/%
serum	5.0	5.4	102.5	2.9
	10.0	9.5	97.5	1.0
	20.0	18.8	96.2	2.5

Table S4 Comparison of several assays for Pb^{2+} detection.

Strategy	Signal readout	Detection limit	Detection time	Ref.
DNA-catalyzed porphyrin metalation	Fluorescence	23.5 nM	3 h	6
Aptamer-functionalized (UCNPs)	Fluorescence	5.7 nM	>3 h	7
MnCoPBAs-PDANCs-mediated GR-5/GC-rich DNAzyme	Fluorescence	1.6 nM	> 3 h	8
Gold nanoparticles/dsDNA/ exonuclease	Colorimetric	2.4 nM	80 min	9
G-quadruplex/SRCHA	Colorimetric	2.6 nM	20 min	10
G-Quadruplex/ThT/CHA	Fluorescence	1.5 nM	40 min	This work

Table S5 Recovery experiments of Pb^{2+} in Jinjiang river water.

Sample	Added/nM	Founded/nM	Recovery/%	RSD/%
River water	30.0	39.1	106.1	4.2
	60.0	60.2	100.1	2.5
	90.0	79.2	94.8	2.2

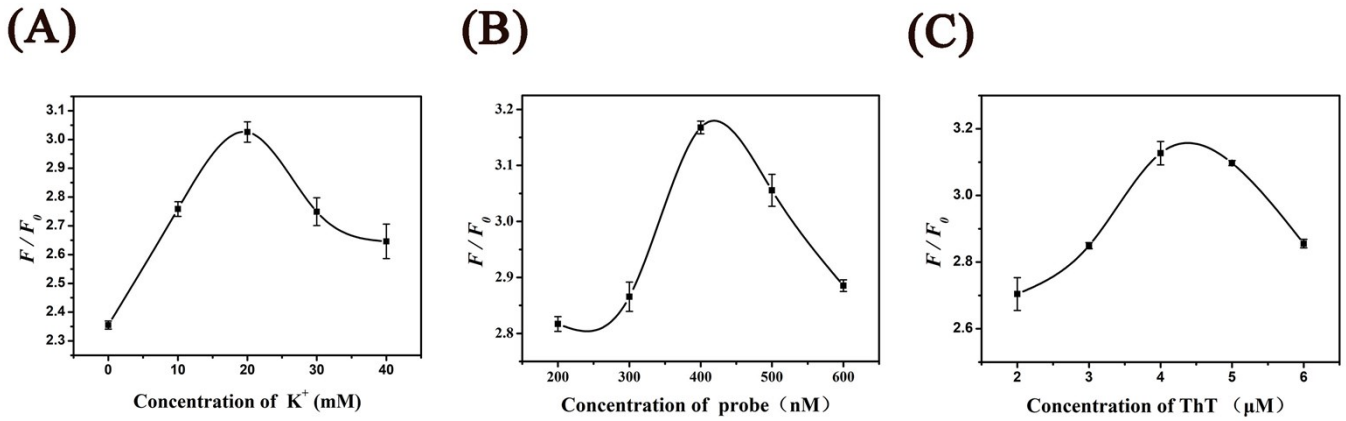

Fig S1 Conditions optimization for the DNA detection: concentration of K^+ (A), hairpin probes (B), and ThT (C). F/F_0: The fluorescence intensity at 490 nm of the strategy in the presence of 50 nM HIV DNA versus the fluorescence intensity at 490 nm of the strategy in the absence of HIV DNA.

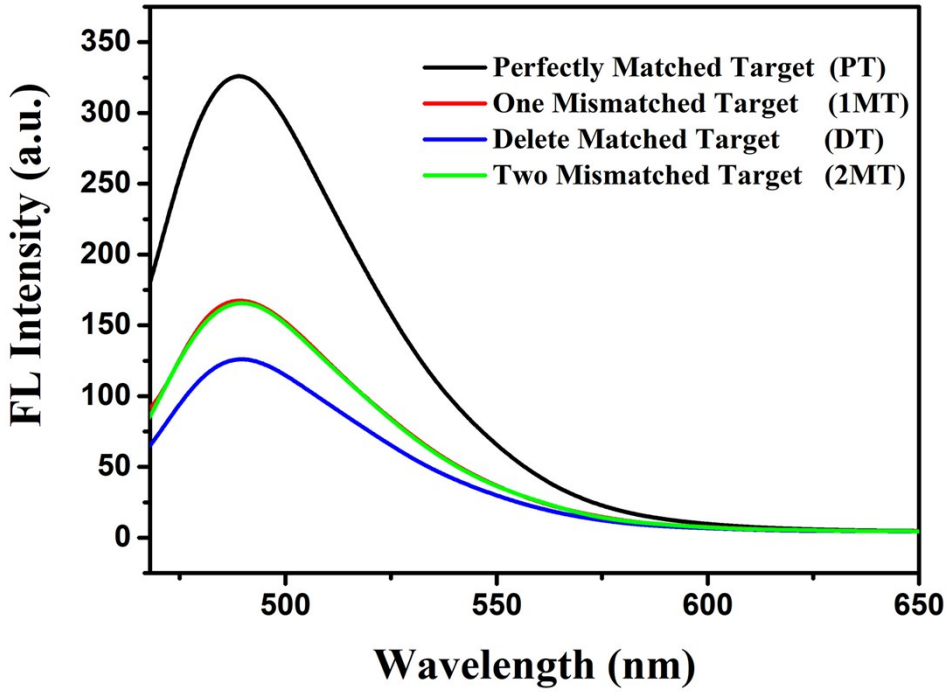

Fig S2 Fluorescence spectra of the system in the presence of deleted target (DT), one base mismatched target (1MT), two bases mismatched target (2MT), and perfectly matched target (PT). H1 and H2 concentration: 400 nM. DT, 1MT, 2MT and PT concentration: 400 nM.

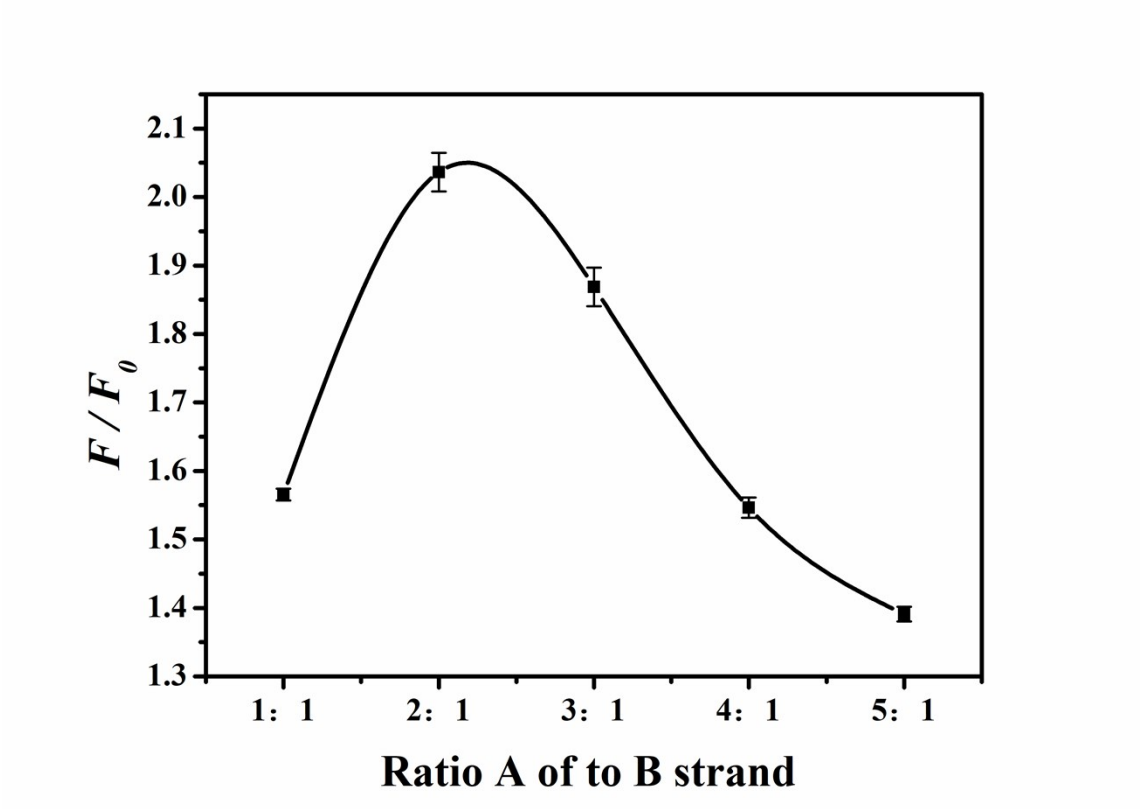

Fig S3 Optimization of the ratio of A and B strand in GR-5 DNAzyme at 1 μM Pb^{2+}. F/F_0: F and F_0 are the fluorescence intensities of the system detected in the presence and absence of 1 μM Pb^{2+}.

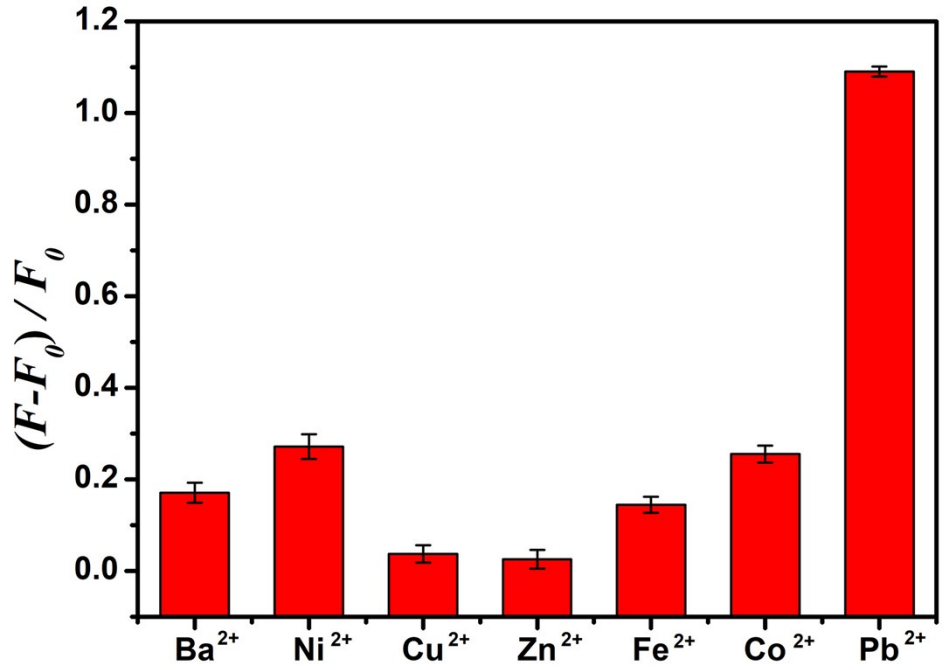

Fig S4 Selectivity investigation of the proposed system for the detection of Pb^{2+} against other control analogous molecules, Ba^{2+}, Ni^{2+}, Cu^{2+}, Zn^{2+}, Fe^{2+} and Co^{2+} at 1 μM. $(F-F_0)/F_0$: F and F_0 are the fluorescence intensities of the system detected in the presence and absence of different metal ions.

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