Electronic supplementary information

Sensitivity of a classic DNAzyme to Pb^{2+} modulated by cations, anions and buffers

Wei Ren[1,2,3], Po-Jung Jimmy Huang[3], Meilin He[1,5], Mingsheng Lyu[2,4], Changhai Wang[1,5]*, Shujun Wang[2,4]*, Juewen Liu[3]*

1 Jiangsu Provincial Key Laboratory of Marine Biology, College of Resources and Environmental Sciences, Nanjing Agricultural University, Nanjing, Jiangsu 210095, China. Email: chwang@njau.edu.cn
2 Jiangsu Key Laboratory of Marine Bioresources and Environment/Jiangsu Key Laboratory of Marine Biotechnology, Ocean University of Jiangsu, Lianyungang, 222005, China. Email: shujunwang86@163.com
3 Department of Chemistry, University of Waterloo, Waterloo, Ontario, N2L 3G1, Canada. Email: liujw@uwaterloo.ca
4 Co-Innovation Center of Jiangsu Marine Bio-industry Technology, Ocean University of Jiangsu, Lianyungang, Jiangsu 222005, China
5 Jiangsu Collaborative Innovation Center for Solid Organic Waste Resource Utilization, Nanjing Agricultural University, Nanjing, Jiangsu 210095, China.

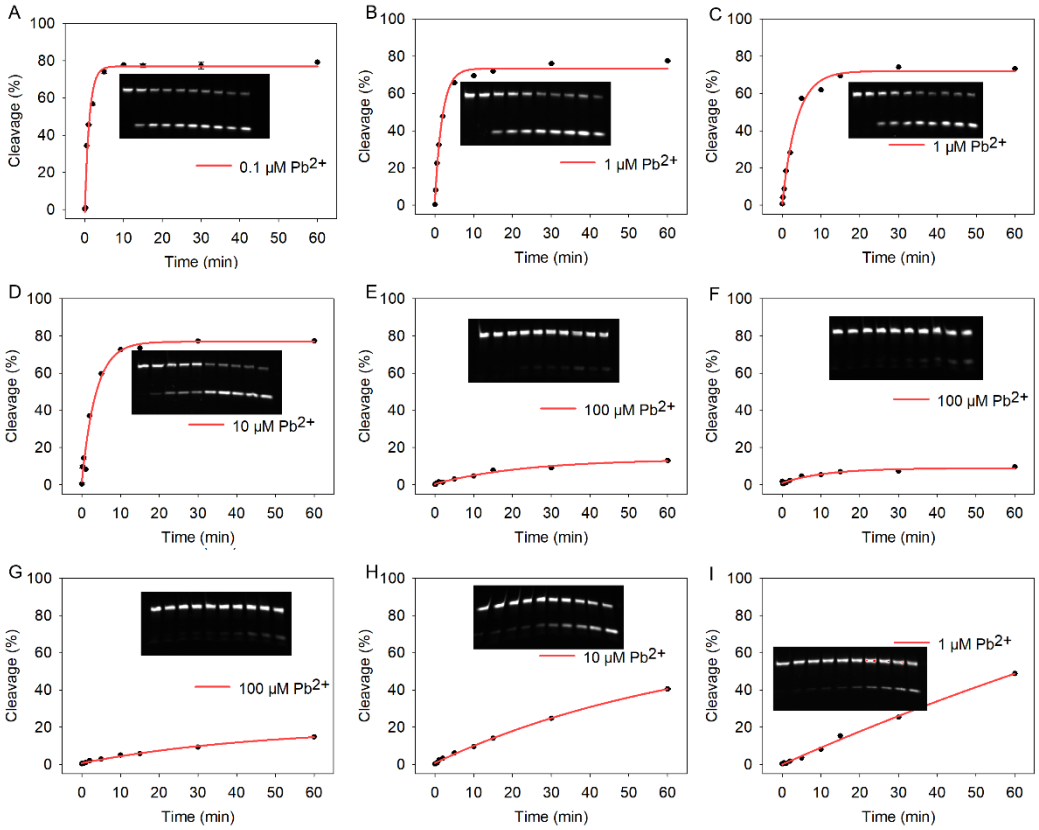

Figure S1. The kinetics of cleavage of the mutants based on GR5 in the presence of Pb^{2+}, namely (A) GR5, (B) M1, (C) M2, (D) M3, (E) R1, (F) R2, (G) R3, (H) R4, and (I) R5 after reacting with Pb^{2+} for 1 h. For the slow mutants, the Pb^{2+} concentration was raised up to 100 μM Pb^{2+}. Inset: the corresponding gel micrographs. The time points in each gel are 0 min, 0.17 min, 0.5 min, 1 min, 2 min, 5, min 10 min, 15 min, 30 min, and 60 min, respectively, from left to right.

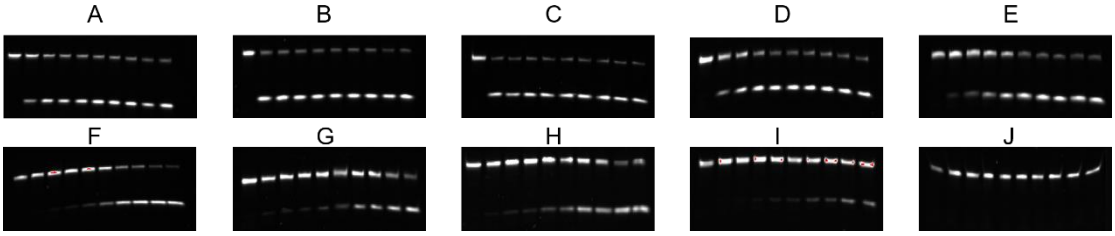

Figure S2. The corresponding gel micrographs for the kinetics of GR5 with 0.1 μM Pb^{2+} in the presence of different concentrations of Mg^{2+} [(A) 0 mM, (B) 0.1 mM, (C) 0.5 mM, (D) 1 mM, (E) 2 mM, (F) 5 mM, (G) 25 mM, (H) 50 mM, (I) 100 mM, and (J) 200 mM]. The buffer was 50 mM MOPS, pH 7.5. The time points in each gel are 0 min, 0.17 min, 0.5 min, 1 min, 2 min, 5, min 10 min, 15 min, 30 min, and 60 min, respectively, from left to right.

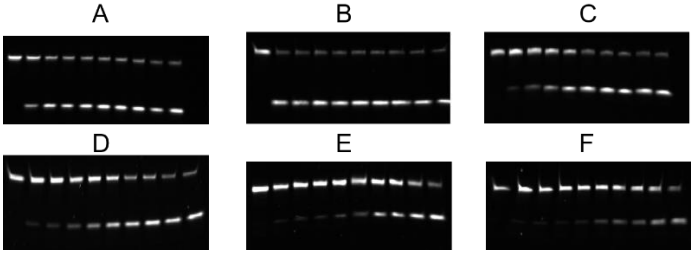

Figure S3. The corresponding gel micrographs for the kinetics of GR5 with 0.1 μM Pb^{2+} in the presence of different concentrations of Na^+ [(A) 0 mM, (B) 25 mM, (C) 50 mM, (D) 100 mM, (E) 200 mM, and (F) 500 mM]. The buffer was 50 mM MOPS, pH 7.5. The time points in each gel are 0 min, 0.17 min, 0.5 min, 1 min, 2 min, 5, min 10 min, 15 min, 30 min, and 60 min, respectively, from left to right.

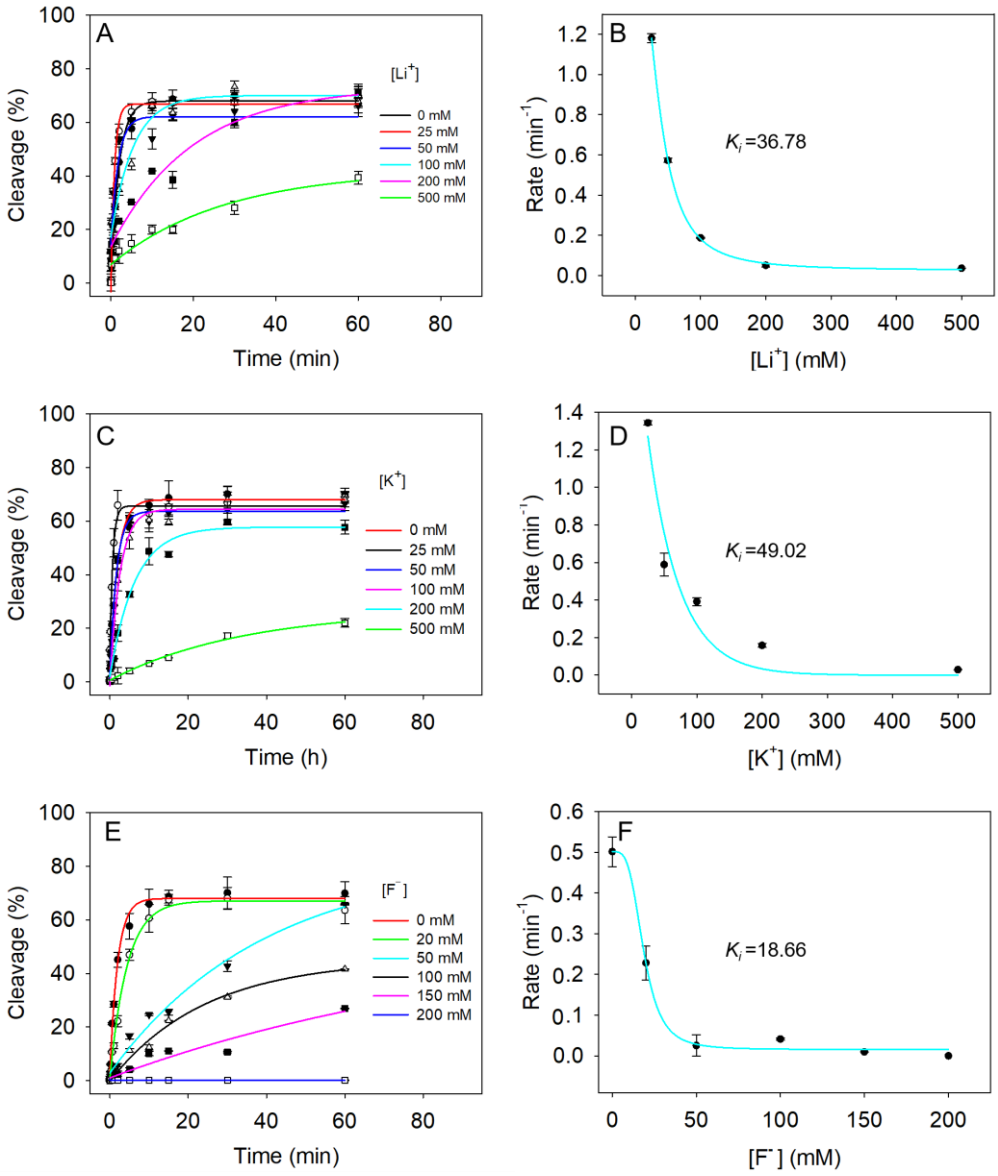

Figure S4. The kinetics (A, C, E) and the cleavage rate (B, D, F) of GR5 with 0.1 μM Pb^{2+} in the presence of different concentrations of (A, B) Li^+ (LiCl); (C, D) K^+ (KNO_3); and (E, F) F^-. The buffer was 50 mM MOPS, pH 7.5.

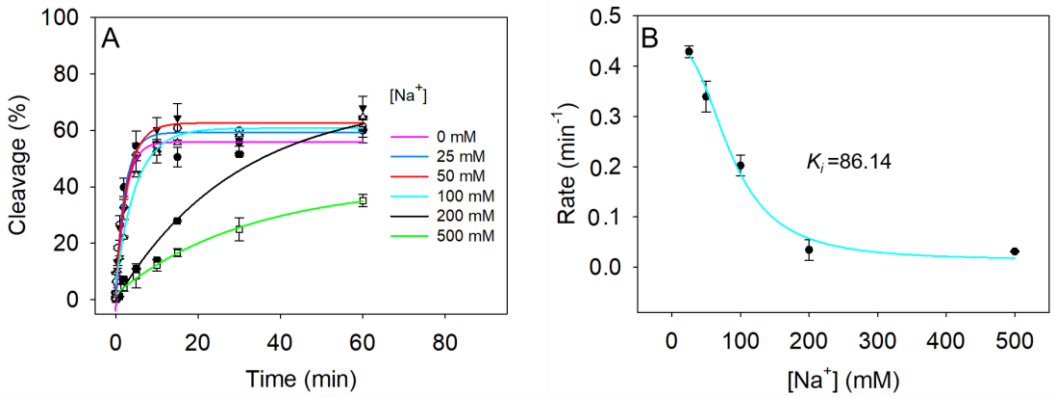

Figure S5. (A) The kinetics and (B) the cleavage rate of 39E with 500 nM UO_2^{2+} (uranyl acetate) in the presence of different concentrations of Na^+. The buffer was 50 mM MES, pH 6.0.

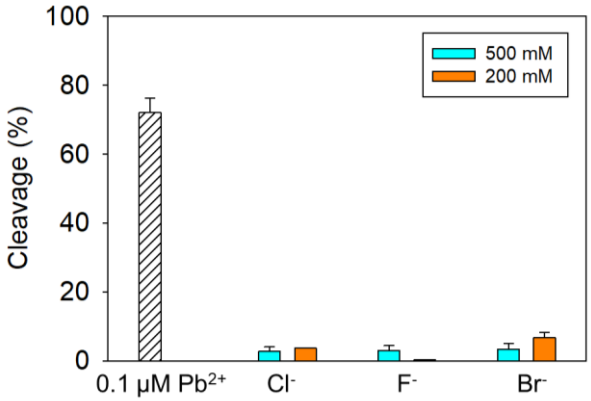

Figure S6. Effect of the sodium salts of monovalent anions (200 mM and 500 mM) on the GR5 cleavage for 1 h in the absent of Pb^{2+}. This indicates that these sodium salts of the halides cannot cleave the DNAzyme.

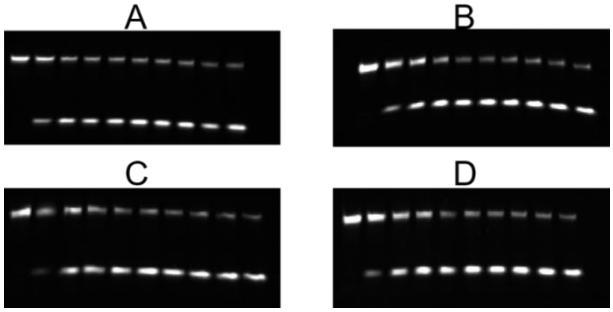

Figure S7. The corresponding gel micrographs for the kinetics of GR5 with 0.1 μM Pb^{2+} in the presence of (A) no additional salt, (B) 20 mM NaCl, (C) 20 mM NaF, and (D) 20 mM NaBr. The buffer was 50 mM MOPS, pH 7.5. The time points in each gel are 0 min, 0.17 min, 0.5 min, 1 min, 2 min, 5, min 10 min, 15 min, 30 min, and 60 min, respectively, from left to right.

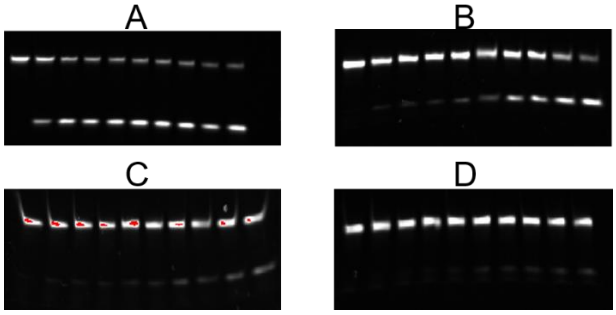

Figure S8. The corresponding gel micrographs for the kinetics of GR5 with 0.1 μM Pb^{2+} in the presence of (A) no additional salt, (B) 200 mM NaCl, (C) 200 mM NaF, and (D) 200 mM NaBr. The buffer was 50 mM MOPS, pH 7.5. The time points in each gel are 0 min, 0.17 min, 0.5 min, 1 min, 2 min, 5, min 10 min, 15 min, 30 min, and 60 min, respectively, from left to right.

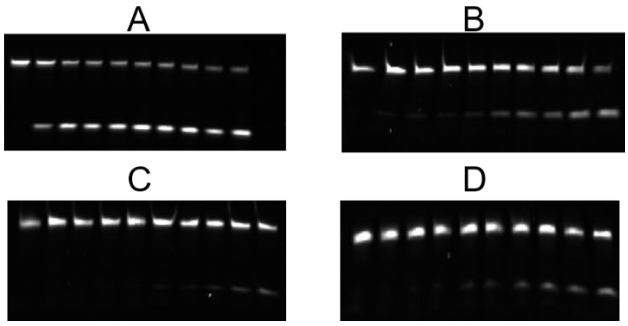

Figure S9. The corresponding gel micrographs for the kinetics of GR5 with 0.1 μM Pb^{2+} in the presence of (A) no additional salt, (B) 500 mM NaCl, (C) 500 mM NaF, and (D) 500 mM NaBr. The buffer was 50 mM MOPS, pH 7.5. The time points in each gel are 0 min, 0.17 min, 0.5 min, 1 min, 2 min, 5, min 10 min, 15 min, 30 min, and 60 min, respectively, from left to right.

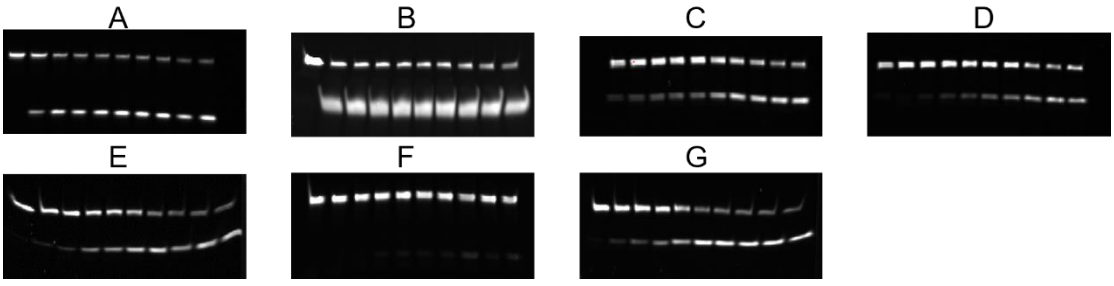

Figure S10. The corresponding gel micrographs for the kinetics of GR5 (prepared in 125 mM NaCl) with 0.1 μM Pb^{2+} in 62.5 mM MOPS (A), HEPES (B), Tris (C), PIPES (D), MES (E), PB (F), and water (G) at pH 7.5, respectively. The time points in each gel are 0 min, 0.17 min, 0.5 min, 1 min, 2 min, 5, min 10 min, 15 min, 30 min, and 60 min, respectively, from left to right.

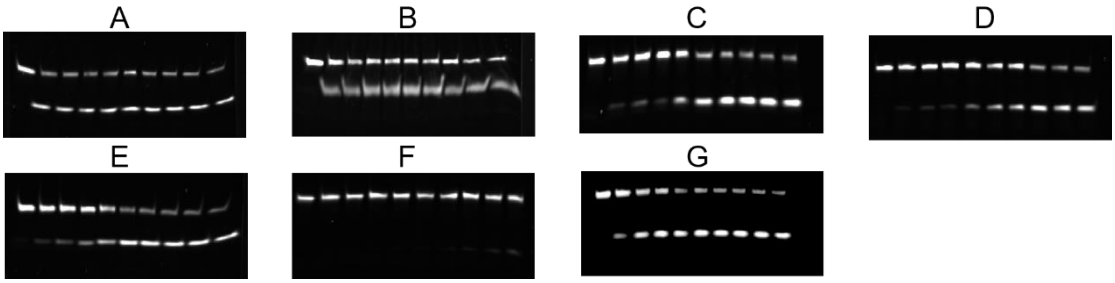

Figure S11. The corresponding gel micrographs for the kinetics of GR5 (prepared in 125 mM NaCl) with 0.1 μM Pb^{2+} [pre-incubated in 123 mM MOPS (A), HEPES (B), Tris (C), PIPES (D), MES (E), PB (F), or water (G) at pH 7.5 overnight]. The final concentrations of salt and buffer in each reaction system were about 18 mM and 36 mM, respectively. The time points in each gel are 0 min, 0.17 min, 0.5 min, 1 min, 2 min, 5, min 10 min, 15 min, 30 min, and 60 min, respectively, from left to right.

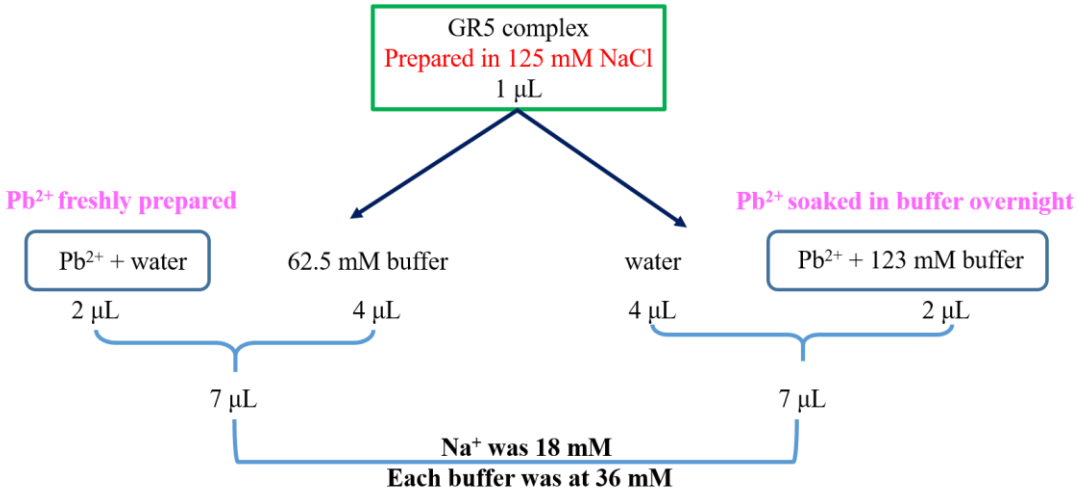

Figure S12. The experimental process of the effects of buffers on the cleavage of GR5 for Pb^{2+}.