

Enzyme-Free Target-Recycling Hg^{II} Detection Assisted by DNA Dendritic Self-Assembly

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Mercury ion (Hg^{II}) is highly toxic metal ion that might exist in potable water. According to U.S. EPA standard, sub-10nM or sub-2ppb (parts per billion) is required for drinking water. Herein a simple, cost-effective and sensitive method for Hg^{II} detection is proposed.

A two-step detection strategy has been developed. Step1 includes an inactive DNAzyme mutant and an assistant sequence. The existence of Hg^{II} could stabilize T-T mismatches in DNAzyme mutant, converting it into activate status, thus self-hydrolysis reaction is triggered simultaneously. The interaction between degraded DNAzyme and its assistant oligo results in the release of particular single-stranded domain as initiator for dendritic DNA self-assembly reaction in step2. Each double-stranded substrate of step2, which is modified with fluorophore and quencher on different strand, is at quenched status at first. The initiator-dependent DNA dendritic self-assembly behavior is accompanied with fluorescent intensity growth which is real-time monitored with fluorescence spectrophotometer and confirmed by PAGE analysis.

Aiming at leakage inhibition and sensitivity improvement, DNA sequences have been designed carefully and operating conditions for the reaction have been optimized.

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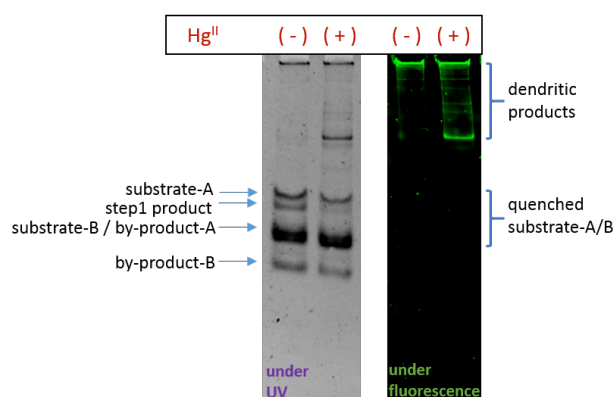


Fig. 1: PAGE analysis under UV and fluorescence exposure, comparing ending products at the absence (lane 1) and presence of Hg^{II} (lane 2).

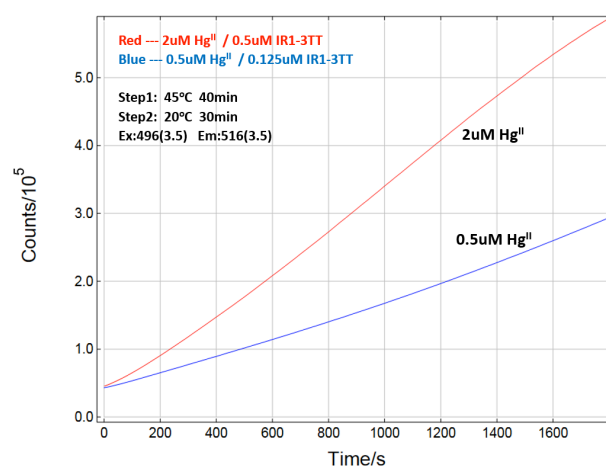


Fig. 2: example of kinetic scans of self-assembly reaction with different Hg^{II} concentrations using fluorescence spectrophotometer

[1] Gu, Hongzhou, et al. "Small, highly active DNAs that hydrolyze DNA." *Journal of the American Chemical Society* 135.24 (2013): 9121-9129.

[2] Xuan, Feng, and I-Ming Hsing. "Triggering hairpin-free chain-branching growth of fluorescent DNA dendrimers for nonlinear hybridization chain reaction." *Journal of the American Chemical Society* 136.28 (2014): 9810-9813.