Ultrasensitive and Closed-Tube Colorimetric Loop-Mediated Isothermal Amplification Assay Using Carboxyl-Modified Gold Nanoparticles

Diagnostics

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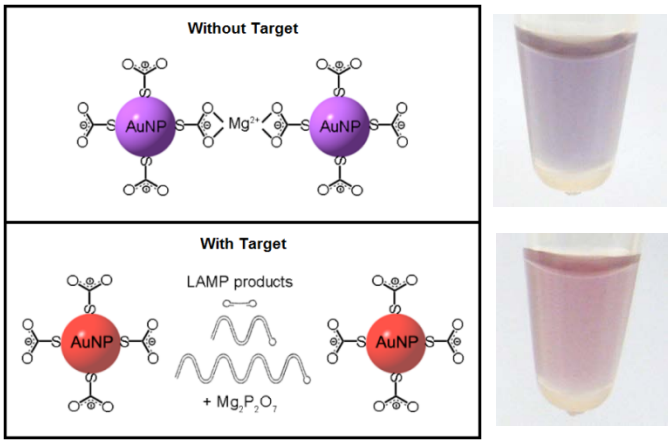
. Point-of-Care Nucleic Acid Detection with Wide Range Applications .
. Clinical Diagnosis . Food Safety Testing . Environmental Monitoring . Biowarfare Agent Detection.

The detection of specific nucleic acid sequence in a simple manner can add great value to point-of-care diagnostics and on-site pathogen testing. Gold nanoparticles have enabled visual readout of solution color change in the presence of a target sequence. However, these previously reported methods did not possess all the essential attributes needed for practical applications, including high sensitivity, simple temperature control, no carryover contamination, and low cost. Here, we demonstrate a new method that possesses all these ideal features by incorporating 11-mercaptoundecanoic acid-modified gold nanoparticles into loop-mediated isothermal amplification (LAMP) reaction, enabling as few as 200 copies of a target DNA sequence to be detected by the naked eye. The color of the reaction mixture is controlled by magnesium ion-templated aggregation of the carboxyl-modified gold nanoparticles, and in the presence of the target, the LAMP reaction by-product pyrophosphate ion leads to particle deaggregation. Our new method could potentially gain wide acceptance for nucleic acid testing in decentralized settings as well as in resource-constrained laboratories.



Representative Publication

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