Gold nanoparticles as biosensors for DNA detection

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Gold nanoparticles (AuNPs) exhibit compelling nanoscale characteristics, including a high surface area-to-volume ratio, excellent colloidal stability, ease of functionalization, and efficient absorption and scattering of visible light. These attributes make them highly advantageous for applications in biomedicine, particularly in detection/diagnostics and treatment. DNA-functionalized AuNPs, referred to as Au nanoprobes, are utilized for the colorimetric detection of DNA mutations. This detection relies on the aggregation behavior of Au nanoprobes when interacting with specific DNA sequences. Upon exposure to the target DNA, complementary strands hybridize, leading to AuNP aggregation, resulting in a noticeable shift in the solution's color. This colorimetric response serves as a straightforward and rapid indicator of the presence or absence of the targeted mutation. The research explores optimal conditions for obtaining stable Au nanoprobes and investigates the relationship between AuNP size and sensitivity. The study also examines the potential advantages of larger nanoparticles in reducing assay costs. Additionally, the optimization of assay conditions, such as salt concentration and probe design, is explored to achieve optimal sensitivity and specificity. Successful discrimination among distinct DNA targets highlights the potential of these nanoprobes for the diagnostic detection of single nucleotide polymorphisms (SNPs). Examples include the application of this approach in identifying mutations associated with Lactose intolerance and deletion mutation in exon 19 linked to small cell lung cancer, demonstrating the versatility of the method.

Overall, the research focus on the development of accessible and user-friendly colorimetric assays for DNA mutation detection. The findings hold promise for advancing point-of-care diagnostics and personalized medicine approaches.

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