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Detection of mycobacterium tuberculosis using gold nanoparticles conjugated to TB antibodies

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Abstract

In recent years, conjugated nanoparticles have gained significant applications in diagnostics, particularly gold nanoparticles (AuNPs). When functionalized with antibodies, AuNPs can selectively interact with cells and biomolecules. The conjugation of biomolecules to AuNPs has been achieved using a variety of techniques, one such approach is the covalent coupling method used in the current study. Generally, in diagnostics, the conjugation of different moieties such as antibodies to the AuNPs widens their applications and provides them with new or enhanced properties. Due to their high specificity and diversity, antibodies are widely used to provide specificity and bioactivity to AuNPs, particularly for biosensor applications. Localized surface plasmon resonance (LSPR) has emerged as a leader among label-free biosensing techniques because it offers sensitive, robust, and rapid detection of biological analytes. Biomolecular adsorptions on AuNPs surface increases the dielectric constant and change the intensities and the wavelengths of the LSPR band associated with AuNPs. As a result, the adsorptions of biomolecules onto surfaces of this AuNPs can be monitored by measuring the absorption spectra of the AuNPs. In this study, TB antibodies were covalently conjugated to AuNPs and used to detect mycolic acid TB antigens at various concentrations. Characterization of the AuNPs was done using transmission electron microscopy (TEM) while the biomolecular interaction between TB antibodies and the antigen was measured using LSPR. From our findings, it was realised that the use of antibodyconjugated AuNPs enhanced the detection of the analyte even at low concentrations of the analyte.