

Layer-by-layer coating of bacteria with noble metal nanoparticles for surface-enhanced Raman scattering

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Abstract

A simple layer-by-layer method to coat the bacterial cells with gold and silver nanoparticles (AuNPs and AgNPs) for the acquisition of surface-enhanced Raman scattering (SERS) spectra is reported. First, the bacteria cell wall is coated with poly (allylamine hydrochloride) (PAH), a positively charged polymer, and then with citrate reduced Au or AgNPs. In order to increase the stability of the coating, another layer of PAH is prepared on the surface. The SEM and AFM images indicate that the nanoparticles are in the form of both isolated and aggregated nanoparticles on the bacterial wall. The coating of bacterial cells with AgNPs or AuNPs not only serves for their preparation for SERS measurement but also helps to visualize the coated bacterial cells under the ordinary white-light microscope objective due to efficient light-scattering properties of Au and AgNPs. A comparative study single versus aggregates of bacterial cells is also demonstrated for possible single bacterial detection with SERS. The two bacteria that differ in shape and cell wall biochemical structure, *Escherichia coli* and *Staphylococcus cohnii*, Gram-negative and -positive, respectively, are used as models. The preliminary results reveal that the approach could be used for single bacterial cell identification. © 2009 Springer-Verlag.

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Keywords

Gold and silver nanoparticles, Layer-by-layer, SERS, Single bacterium