The Effects of a Silica Coating on the Aggregation of Gold Nanoparticles

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Gold nanoparticles (AuNPs) are a rapidly developing technology with applications in biosensorics, targeted drug delivery, cancer therapy, diagnostics, and purity testing. One of their properties that is often exploited in these applications is their tendency to aggregate in the presence of certain molecules, creating a color change. However, one problem scientists face when using gold nanoparticles is that their aggregation is nonspecific and can be induced by many different molecules. In this study, AuNPs were coated in silica to try to control their aggregation in acidic and basic environments. Regular AuNPs and silica-coated AuNPs were prepared and placed in neutral, acidic, and basic environments, and changes in their light absorbance were measured with a spectrophotometer. The results showed that the absorbance spectrum of the silica-coated AuNPs showed significantly smaller changes in acidic and basic environments, demonstrating that the silica coating significantly reduced the aggregation of the AuNPs. Additionally, the silica-coated AuNPs showed slightly more aggregation over time in the acidic environment than in the basic one. This shows that unlike regular AuNPs, silica-coated AuNPs can be used to distinguish between acidic and basic environments. Because silica is biocompatible, the silica-coated AuNPs have the potential to be used for treatment in vivo, and their stability under conditions of varying pH indicates that they could be used in acidic or basic areas of the human body. Their reduced sensitivity to both acids and bases indicates that they could be used for the detection of other molecules within an acidic or basic environment.

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