Ultra-fast Colorimetric Determination of Protein Aggregation by Gold Nanoplasmic Particles

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Approximately 20 kind of neurodegenerative diseases are well known that protein aggregation is a main cause of the diseases. However, current protein aggregation assays require time-consuming and labor-intensive steps, which delay the process of drug discovery and understanding the mechanism of protein aggregation medicated neurotoxicity. Here, we suggest a new method for tracking protein aggregation of neurodegenerative diseases by using gold nanoparticles (GNPs). In our study, GNPs play an important dual roles: 1) nucleation cores in protein aggregation process, 2) colorimetric reporters for protein aggregation. As a model demonstration, we carried out observing colorimetric change patterns for protein aggregation, which is implicated in Alzheimer's disease (AD) and Amyotrophic lateral sclerosis (ALS). Without expensive analysis equipment, we can rapidly determine whether the protein aggregating condition or not and monitor the existence (qualitatively) and the amount (quantitatively) of protein aggregation by naked eyes. The proposed methodology can be a powerful alternative method for screening drugs for neurodegenerative diseases as well as studying molecular biophysics of protein aggregations.