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Magnetic Iron-Oxide Gold Nanoparticles for the Photothermal Dissolution of Protein Aggregates: Implications in Alzheimer Treatment

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Aggregation of Beta Amyloid ($A\beta$) and Tau peptides are known to cause Alzheimer's Disease. This research proposed a method that can potentially disaggregate the Beta Amyloid peptides and slow the process of neurodegeneration. Since $A\beta$ is dangerous, this research used calcium depleted A-Lactalbumin proteins that possess similar aggregation properties to $A\beta$. A bio-compatible solution consisting of iron-oxide nanoparticles ($Fe_2O_{3(s)}$) coated with gold nanoparticles (AuNPs) was synthesized and localized on A-Lactalbumin proteins. This solution was then subjected to a laser that was calibrated to emit light energy in the AuNP's absorption region. The photo thermal properties of AuNPs dispensed quanta of heat energy that broke the hydrogen bonds between the protein aggregates thus resulting in their disaggregation. TEM images were taken at different stages of the experiment to characterize the process of disaggregation. Future research can exploit the magnetic properties of $Fe_2O_{3(s)}$ to transport the bio-compatible solution through the blood brain barrier.