



Industrial Consultancy & Sponsored Research (IC&SR)

SYNTHESIS OF PROTEIN PROTECTED LUMINESCENT METAL CLUSTERS AND RETAINING THE BIOACTIVITY OF THE PROTEIN

IITM Technology Available for Licensing

PROBLEM STATEMENT

- **Protein-protected noble metal nanoclusters (NCs)** are a new class of biohybrid materials due to their **intense luminescence**, high quantum yield, stability, and biocompatibility.
- NCs have potential applications in sensing, biology, and multimodal imaging.
- **Protein-directed cluster synthesis** has been explored for therapeutic applications, targeted biolabeling, and protein-protected clusters.
- **Large proteins with high molecular weight**, small proteins with low molecular weight, and gold are commonly used.
- **Bioactivity loss** due to irreversible conformational changes limits their widespread use in biomedical research.
- **A new class of atomically precise silver nanoclusters** co-protected by hydride and phosphines as ligands has been reported

TECHNOLOGY CATEGORY MARKET

Technology: Internalization of silver cluster by proteins and luminescent retaining bioactivity

Category: Chemistry & Chemical analysis

Industry: Chemical/Pharmaceutical

Application: Biomedical

Market: The global market size was valued at **USD 1.55 trillion in 2023** and is projected to grow at a compound annual growth rate (CAGR) of **13.96% from 2024 to 2030**.

INTELLECTUAL PROPERTY

IITM IDF Ref. 1779

Patent No: IN 495343

TRL (Technology Readiness Level)

TRL- 4, Experimentally validated in Lab;

Research Lab

Prof. Pradeep T,
Dept. of Chemistry

TECHNOLOGY

A method of synthesizing protein protected luminescent metal clusters, the said method comprises;

a preformed ligand protected atomically precise metal cluster as a precursor;

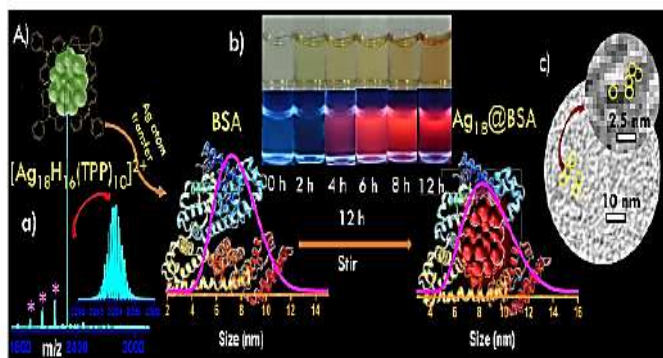
a protein, mixed with the metal cluster precursor

at pH 7.1 under continuous magnetic stirring for 12h at room temperature;

wherein the reaction mixture gradually change the color during the course of reaction, accompanied by the evolution of red luminescence of the solution upon continuous stirring,

which leads to the formation of red luminescent metal cluster indicating that the cluster core is incorporated in a single protein moiety without altering the secondary structure of the protein and its bioactivity

Schematic of the formation of Ag₁₈@BSA



CONTACT US

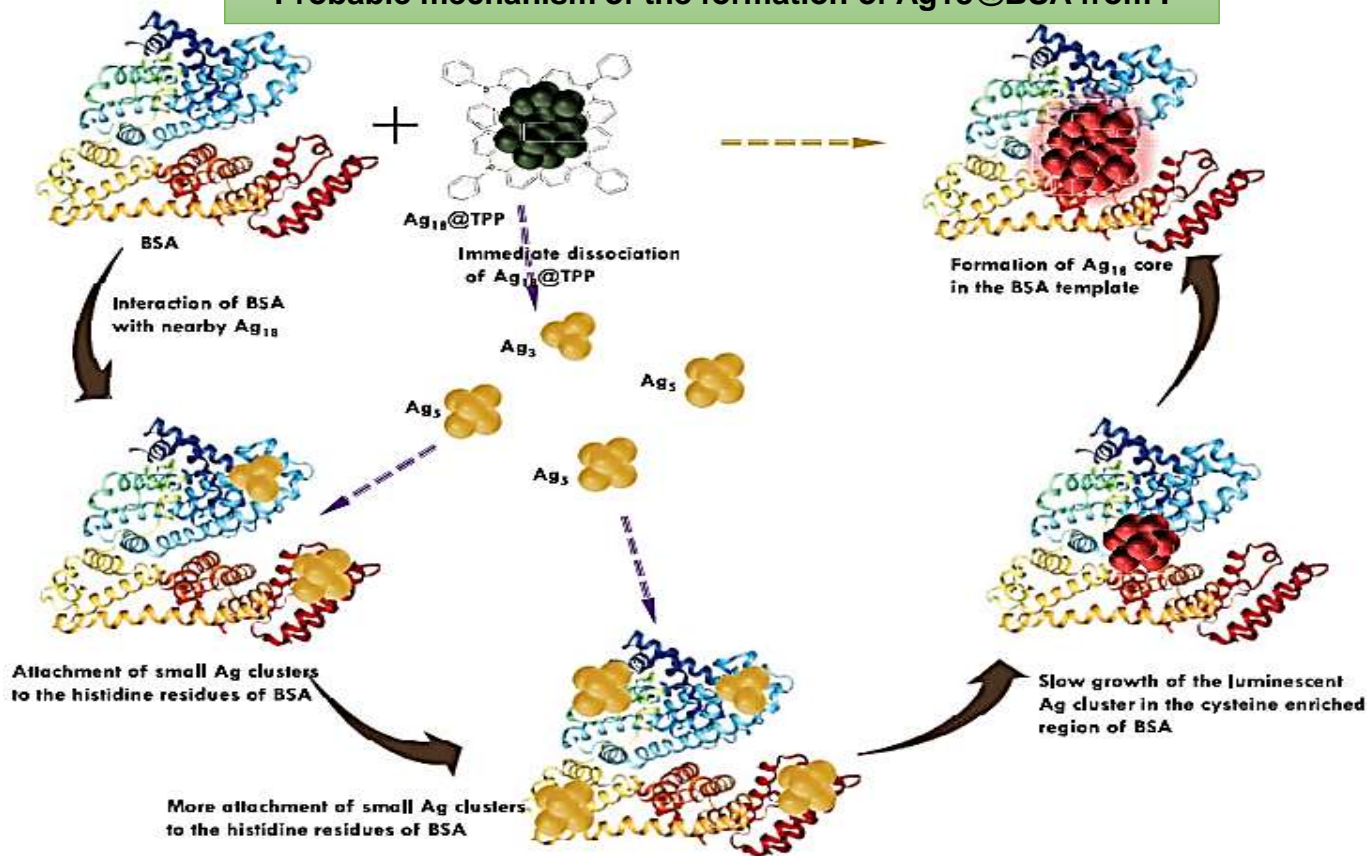
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Probable mechanism of the formation of Ag₁₈@BSA from I



Key Features / Value Proposition

Protein Bioactivity and Cluster Formation

"Stable Ph Method"

- Ph Range: 2-12

Atomically Precise Metal Cluster:

- Triphenylphosphine (Tpp) Protected Ag₁₈h₁₆(tpp)₂⁺ Silver Cluster.

Proteins:

- Bovine Serum Albumin (Bsa), Human Serum Albumin (Hsa), Lactoferrin (Lf).

Formed Luminescent Metal Cluster:

- Ag₁₈@bsa And Ag₁₈@hsa.

Lactoferrin Stabilizes Smaller Cluster:

- Ag₁₃@lf.

Metal Cluster Disintegration

- Phosphine Protection.
- Slow Disintegration.

Stable For Months -When Stored At Room Temperature.

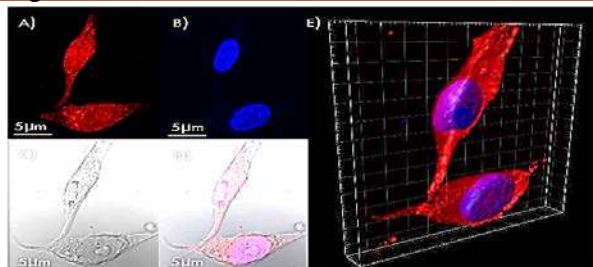
Enhanced Bioactivity.

- Metal Encapsulated Protein Exhibits

Excellent Luminescent Probe

- For Cancer Cell Imaging.

Confocal microscopic images of internalization of ag₁₈@bsa cluster



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