

Anisotropic Gold Nanoparticles for Sensors, Protein Conformation Studies and Sustained Drug Release

A Thesis

Submitted

by

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DEDICATED TO
My beloved Parents

Declaration by the Research Scholar

I hereby declare that the entire work embodied in this Thesis is the result of investigations carried out by me in the (*School of Basic Sciences*), Indian Institute of Technology Mandi, under the supervision of (*Dr. Chayan Kanti Nandi*), and that it has not been submitted elsewhere for any degree or diploma. In keeping with the general practice, due acknowledgements have been made wherever the work described is based on finding of other investigators.

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Thesis Certificate

This is to certify that the thesis entitled “**Anisotropic Gold Nanoparticle for Sensor, Protein Conformation studies and Sustained Drug Release**” submitted by Mr. Abhishek Chaudhary to the Indian Institute of Technology, Mandi for the award of the degree of Doctor of Philosophy is a bonafide record of research work carried out by him under my supervision. The contents of this thesis, in full or in parts, have not been submitted to any other Institute or University for the award of any degree or diploma. In keeping with the general practice of reporting scientific observation, due acknowledgements have been made wherever the work described is based on the findings of other investigators.

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Research Guide

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Abbreviations

GNP	Gold nanoparticle
GNR	Gold nanorod
SPR	Surface Plasmon Resonance
CTAB	Cetyltrimethylammonium Bromide
CTAC	Cetyltrimethylammonium Chloride
DTT	Dithiothritol
PEDOT:PSS	Poly(3,4-ethylenedioxythiophene) Polystyrene Sulfonate
GO _x	Glucose Oxidase
BSA	Bovine Serum Albumin
HSA	Human Serum Albumin
FBS	Fetal Bovine Serum
Lys	Lysine
MTT	3-(4,5-Dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide
EPR	Enhanced Permeability and Retention
EPA	Environmental Protection Agency
DL	Detection Limit
IC ₅₀	Half Maximal Inhibitory Concentration
μM	Micromolar
nM	Nanomolar
TEM	Transmission Electron Microscopy
SEM	Scanning Electron Microscopy
XRD	X-ray powder diffraction
DLS	Dynamic Light Scattering

CD	Circular Dichroism
TRFS	Time Resolved Fluorescence Spectroscopy
UV-vis	Ultraviolet-Visible spectroscopy
UV-vis-NIR	Ultraviolet-Visible-Near-infrared Spectroscopy
HRMS	High Resolution Mass Spectroscopy
FTIR	Fourier Transform Infrared Spectroscopy

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Anisotropic Gold Nanoparticle for Sensor, Protein Conformation studies and Sustained Drug Release

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Abstract:

Anisotropic gold nanoparticle (GNP), because of the presence of different surface energies that arise from large fractions of edges, corners and vertices, has become increasingly important for various applications in the field of chemistry, physics, biology and material sciences. The focus of the present research work is mainly concerned with the use of anisotropic gold nanoparticles (GNP) for ultrasensitive detection of toxic heavy metal ions and small biomolecules and understanding the conformational changes of proteins while adsorbed onto the GNP surface to prevent several misfolding diseases. It has further been extended to a novel synthetic approach for ease drug loading and its delivery where the drug molecule directly loaded onto the synthesized GNP without using multistep surface functionalization processes. We have shown that the specific surface functionalization along with the anisotropic nature of GNP can enhance the sensing ability dramatically compared to spherical GNP.