

## SPECIMEN FORMAT FOR THESES OF MONTH

Faculty : Biosciences

Department : Department of Biochemistry, Biotechnology and Bioinformatics

Branch/ Area: : Biochemistry/ Medical biochemistry

Sub Subject Heading: : Nanotechnology

Candidate's Name : B. Nandhini

Candidate's Address with email : 14/152, C.N. Line, Old Aruvankadu,  
Hubbathalai Post, The Nilgiri's 643202  
17phbcf002@avinuty.ac.in

Title of the thesis : Neuroprotective effect of synthesized zinc oxide nanoparticle - capped catechin

(i) In Roman Script -  
(ii) In roman Script

Nomenclature of Degree: : Ph.D

Month & Year of Enrolment: : July 2017

Month & Year of Registration: : July 2017

Month & Year of Submission: : June 2024

Month & Year of Award : January 2025

Name of Supervisor : Dr. Anitha Subash

Designation of Supervisor : Dean School of Biosciences and Professor of Biochemistry

Centre/department/school in which research was conducted : Department of Biochemistry, Biotechnology and Bioinformatics, School of Biosciences

University's Name & Address : Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore - 641 043

## **Abstract within 300 words:**

### **ABSTRACT**

Nanotechnology is a prolonged branch of existing research that involves the fabrication and customization of particle structures with typical sizes of less than 100 nm. A large area of surface-to-volume ratio was related to minimum surface functionalization, resulting in nanostructured metal oxide nanoparticles with outstanding biological activity. The biosynthesis of nanoparticles has become an important research area because of their remarkable environmental friendliness and biocompatibility. Catechin, a group of polyphenolic compounds is widely used as nutraceuticals, Zinc oxide in the form of nanoparticles, can enhance beneficial therapeutic effects to the development of nanotechnology shown to have neurogenic and neuroprotective effects, regeneration and repair of damaged brain tissue, cortical neurons synaptic connection and synaptic plasticity and ultimately promote regeneration. *Camellia sinensis* one of the most popular plants used in green tea production worldwide, which possesses the antioxidant and neuroprotective properties. The aim of this research is the synthesized zinc oxide nanoparticle-capped catechin and investigation of their neuroprotective potential. Zinc oxide nanoparticles synthesized from the *Camellia sinensis* leaf extract by nano precipitation method, then capped with catechin. The nanoparticles were characterized by different techniques, such as UV Vis spectrophotometer, Scanning electron microscopy, Zeta potential, Fourier transform infrared spectroscopy and X-ray diffraction analysis. Synthesized zinc oxide nanoparticle-capped catechin exhibited the antioxidant activity was determined using the DPPH radical scavenging activity. Synthesized zinc oxide nanoparticle-capped catechin has significantly inhibited the acetylcholinesterase activity. A dose-dependent cell viability of synthesized zinc oxide nanoparticle-capped catechin has been observed against Neuro 2a cells. .

**Key words:** Zinc oxide nanoparticles, catechin, *Camellia sinensis*, neuro 2a cells, neuroprotective, antioxidant, acetylcholinesterase

#### **i) Major objectives :**

##### **Objectives**

- To evaluate active compounds against neuroprotective target proteins using molecular docking studies

- To identify active constituents and study the antioxidant activity of *Camellia sinensis*
- To synthesize and characterize zinc oxide nanoparticles from *Camellia sinensis*
- To characterize and study the *in vitro* neuroprotective activity of synthesized zinc oxide nanoparticle-capped catechin to neuro 2a cells

## ii) Hypothesis:

Work has already been carried out with green tea on the role of phytochemicals in neuroprotection, neurorescueing and neurodegenerative disease. Also, the role of zinc oxide nanoparticles in various types of neuronal cell lines have been well researched. But still there is no proper treatment available for several neurodegenerative diseases. Several studies are available on the role of zinc oxide nanoparticles in neuroprotection. However, there is no information available on synthesized zinc oxide nanoparticle-capped catechin in *Camellia sinensis*. Studies have shown that polyphenols help in several neurodegenerative diseases and hence it was decided to exploit green tea rich in polyphenols to study its neuroprotective activity and employ zinc oxide nanoparticle-capped catechin from green tea to study neuroprotection.

## iii) Methodology :

The study entitled ‘**Neuroprotective effect of synthesized zinc oxide nanoparticle-capped catechin**’. The experimental design is divided into five phases.

### **Phase I: Evaluation of active compounds against neuroprotective target proteins using molecular docking studies**

*In silico* assessment of molecular interaction between the drug for neuroprotective and proteins using Maestro Molecular Modeling Environment, (Maestro V: 11.8 Schrodinger\_suite-2019) was carried out.

### **Phase II: Characterization of *Camellia sinensis* and identification of its bioactive compound**

Preliminary phytochemical studies and antioxidant activity were done. Identification was done for an active compound using chromatographic and spectral studies such as Thin Layer Chromatography (TLC), High Performance Thin Layer Chromatography (HPTLC) and spectral studies involving UV-Vis spectrophotometer, Fourier Transform Infra-Red spectroscopy (FTIR), Nuclear Magnetic Resonance spectroscopy (NMR), Gas Chromatography-Mass Spectroscopy (GC-

MS) and Liquid Chromatography Mass Spectrometry (LC-MS).

**Phase III: Characterization of synthesized zinc oxide nanoparticles from *Camellia sinensis***

This was done and characterized using UV Visible Spectroscopy, Scanning Electron Microscope (SEM) with Energy-dispersive X-ray analysis (EDAX), X-ray Diffraction (XRD) analysis, Fourier Transform Infra-Red (FTIR) analysis and Zeta-Potential.

**Phase IV: Synthesized zinc oxide nanoparticle-capped catechin their characterization and *in vitro* neuroprotective activity**

Characterization of synthesized zinc oxide nanoparticle-capped catechin compound by UV Visible Spectroscopy, Scanning electron microscopy (SEM) with Energy Dispersive Spectroscopy (EDAX), X-ray Diffraction (XRD) analysis, Fourier Transform Infra-Red (FTIR) analysis and Zeta-Potential were carried out to evaluate the *in vitro* neuroprotective effect of synthesized zinc oxide nanoparticle-capped catechin.

**Phase V: Assessment *in vitro* neuroprotective activity of synthesized zinc oxide nanoparticle-capped catechin to neuro 2a cells**

Assessment of *in vitro* anti-oxidative role of synthesized zinc oxide nanoparticle-capped catechin cytotoxicity assay and assessment of *in vitro* Neuroprotective activity of CAT synthesized zinc oxide nanoparticle-capped catechin to neuro2a cells neuroblastoma cell lines as carried out.

**iv) Findings:**

**The study concluded that the synthesized zinc oxide nanoparticle-capped catechin can be proposed as a novel therapeutic strategy for neuroprotective effect.**

**Examiners**

**Internal Examiner :** **Latha. P**  
Professor,  
Department of Biochemistry & Molecular Biology,  
Pondicherry University

**External Examiner :**  
**Dr. Deepa Kolaseri,**  
Director  
Masonic Cancer Center,  
University of Minnesota, USA