SPECIMEN FORMAT FOR THESES OF MONTH

Faculty	:	School of Physical Sciences and Computational Sciences
Department	:	Chemistry
Branch/ Area:	:	Nanochemistry
Sub Subject Heading:	:	Development of Bioactive drug formulations for sustained release using metallic nanoparticles and *in vitro* biomedical applications
Candidate's Name	:	Rajalakshmi. R
Candidate's Address with email	:	C-11, TNAU Staff quarters, TNAU, Coimbatore - 641003; raajichemist@gmail.com
Title of the thesis	:	
(i) In Roman Script (ii) In roman Script		DEVELOPMENT OF BIOACTIVE DRUG FORMULATIONS FOR SUSTAINED RELEASE USING METALLIC NANOPARTICLES AND *IN VITRO* BIOMEDICAL APPLICATIONS Development of Bioactive drug formulations for sustained release using metallic nanoparticles and *in vitro* biomedical applications
Nomenclature of Degree:	:	Doctor of Philosophy in Chemistry
Month & Year of Enrolment:	:	July, 2019
Month & Year of Registration:	:	July, 2019
Month &Year of Submission:	:	December, 2025
Month &Year of Award	:	February, 2026
Name of Supervisor	:	Dr. P. Lalitha
Designation of Supervisor	:	Director Research and Development, Professor of Chemistry
Centre/department/school in which research was conducted	:	Department of Chemistry

University's Name & Address	:	Avinashilingam Institute for Home Science and Higher Education for Women, Bharathi Park Main Road, Coimbatore -641043

Abstract within 300 words:

The present study focuses on developing bioactive nanoencapsulated formulations for sustained drug release. Garlic, widely used as a spice, contains Allicin, a compound with significant medicinal values, but it is unstable due to environmental factors like heat. Conventional organic solvent extraction often results in low yield and degradation. Therefore, using green solvent-based ionic liquids are eco-friendly solvents helps in enhancing the extraction efficiency of bioactive compounds compared with conventional methanolic extract. To stabilise Allicin and achieve controlled release, researchers developed floating tablet and microspheres-based formulations. The tablet optimisation was carried out using over-the-counter medicine-ciprofloxacin. The best formulation containing drug and polymer-excipients exhibited sustained drug release over 120 h. The tablet incorporating fresh garlic juice showed rapid release within 3 h, which may be suitable for ailments requiring an immediate effect. Microsphere-based formulations using fresh garlic juice improved stability and bioavailability. These microspheres have possessed spherical particles with an average size 10.46 µm. Further enhancement was achieved by synthesising eco-friendly metallic nanoparticles (gold and silver) using plant extracts from *Amphilophium paniculatum* (leaves), *Tristellateia australasiae* (leaves), *Haematocarpus validus* (fruits) and *Phoenix dactylifera* (seeds). These nanoparticles were characterised using analytical and microscopic techniques. *In silico* screening of identified bioactive compounds was performed to evaluate their potential as DPP-IV inhibitors. The synthesised nanoparticles were assessed for antioxidant, antibacterial, anticancer, and antidiabetic activities. In particular, APE-assisted silver nanoparticles inhibited *Klebsiella pneumoniae* by 87% and reduced A^{549} cell viability by 35%. Both APE-silver and DSE- gold nanoparticles showed effective α-amylase inhibition and antibacterial properties, indicating their potential for managing type 2 diabetes and bacterial infections. The nanoparticles also exhibited non-genotoxicity. Nanoencapsulated microspheres exhibited 95-97% sustained release, reducing dosage frequency, and improving bioavailability. In addition, the garlic-nano encapsulated microspheres enhanced antibacterial and antidiabetic activity. The use of synthesised nanoparticles in antimicrobial and UV-protective textile applications was also explored. Overall, this research work exhibited the potential of

bioactive nano-encapsulated formulations and eco-friendly synthesised metallic nanoparticles for sustained drug release, biomedical, and textile applications.

i) Major objectives :

The advancement of nanotechnology has led to significant breakthroughs across diverse fields, particularly in biomedical and pharmaceutical research. The primary objective of the study is to develop innovative drug delivery system viz. floating tablet and microspheres, for stable and sustained release of metabolites. Secondary objective includes enhancing the sustained release and selective *in vitro* biomedical applications.

ii) Hypothesis:

Metallic nanoparticles and bioactive drug formulations possess sustained release of metabolites and excellent *in vitro* biomedical applications.

iii) Methodology:

Phase-I: Ionic liquid-based Solvent Extraction of Organo Sulphur Compounds

Phase-II: Sustained Release Floating Tablets and Microspheres for Drug Release Applications

Phase-III: Sustainable Synthesis and Characterisation of Metallic Nanoparticles

Phase-IV: *In silico* Screening of Bioactive Compounds Present in Selected Plants

Phase-V: *In vitro* Selected Biomedical Applications of Plant Extracts and Synthesised Metallic Nanoparticles

Phase-VI: Industrial Applications of Metallic Nanoparticles

iv) Findings:

The developed nanoencapsulated bioactive drug formulations possess sustained drug release pattern. The eco-friendly synthesised metallic nanoparticles possess excellent biological activities and textile applications. The product developed are sustained release floating tablet, microspheres, antimicrobial fabric coated with nanocomposites and UV protective woven fabric.

Examiners

Internal Examiner : Dr. Pooran Koli
Professor, Department of Chemistry,
Jai Narain Vyas University,
Jodhpur (Rajasthan) -342033, India

External Examiner : Dr. Sayed Kenawy Hamed
Professor of Advanced Ceramic and nano Materials
National Research Centre Refractories, Ceramics and Building Materials Dept., Dokki, Giza, Egypt.