



विश्वविद्यालय अनुदान आयोग
University Grants Commission
मंत्रालय सहायक निदेशक, मानव संसाधन
Ministry of Human Resource Development, Govt. of India
पश्चिम क्षेत्रीय कार्यालय, गणेशखिंद, पुणे - ४११००७
Western Regional Office, Ganeshkhind, Pune - 411007
Ph: 020 - 25696897, Fax: 020 - 25691477
Website- www.ugc.ac.in
Email: mrpugcwro@gmail.com

November 2019

F. No. 47-1162/14 (WRO)

THE PRINCIPAL,
RAJA SHRIPATRAO BHAGWANTRAO
MAHAVIDYALAYA,
AUNDHKHATAV, SATARA, PIN- 415510.

18 NOV 2019

Subject: NOC/ finalization of Minor Research Project awarded to Dr. Bamane S. R. In the Subject of Chemistry.

Sir/Madam,

Please refer to your letter no. RSBM/786/2019-2020 dated 07.11.19, regarding the Minor Research Project awarded to Dr. Bamane S. R. of your College in the subject of "Chemistry.". I am to inform you that the account of Minor Research Project titled "Synthesis and Characterization of Polymer Capped 5- Fluorouracil Loaded Metal Oxide Core Nanocomposites for drug delivery in anticancer applications" sanctioned by the UGC (WRO). may be treated as finalized and settled as per final report utilization certificates submitted by the College.

Heads	UGC Allocation	I st & II nd Inst. Grants already released	Total Exp. Incurred (as reported by College)	Grants proposed to be released as Final Inst. Adjustment
Non-Rec:				
Books/ Journals	30000	30000	30825	0
Equipment	100000	100000	107257	0
Total- I	130000	130000	138082	0
Rec:				
Contingency	40000	20000	40150	20000
Special Needs	30000	15000	35422	15000
Travel	25000	12500	28800	12500
Chemicals	75000	37500	74986	37486
Other	0	0	0	0
Total- II	170000	85000	179358	84986
All Total I & II	300000	215000	317440	84986*

*As the Audited UC/SE was not submitted within six months from the date of completion of the project. Hence the balance amount is not admissible as per UGC Guidelines.

It would be highly appreciated if you kindly submit the Feedback Form enclosed herewith.

Yours faithfully,

R. Manoj Kumar

(Dr. R. Manoj Kumar)
Joint Secretary

Encl: As Above

Copy to:

1. DR. BAMANE S. R.,
RAJA SHRIPATRAO BHAGWANTRAO MAHAVIDYALAYA, AUNDH
KHATAV, SATARA, PIN- 415510.
2. REGISTRAR, SHIVAJI UNIVERSITY, VIDYA NAGAR,
KOLHAPUR, PIN-416004.
3. DIRECTOR, HIGHER EDUCATION, CENTRAL BUILDING, NEAR PUNE RAILWAY
STATION, PUNE, PIN- 411001.
4. ACCOUNTANT GENERAL, MAHARASHTRA STATE, 101, MAHARSHI KARVE
MARG, MUMBAI- 400020
5. GUARD FILE

Sr. No.	74
P.T.	NIL

Vinod Singh Yadav
(Vinod Singh Yadav)
Education Officer

Aundh-Shikshan Mandal's

**RAJA SHRIPATRAO BHAGWANTRAO
MAHAVIDYALAYA, AUNDH, DIST. SATARA**



(Art & Science)

(Affiliated to Shivaji University, Kolhapur)
Reaccredited by NAAC with 'B' Grade

President

Hon'ble Ajitdada Pawar Saheb
Former Deputy Chief Minister, Maharashtra State

Principal Dr. S.R. Bamane (M.Sc., Ph.D.)

Cell : 9860441417 Phone : 02161-262324 / 262475
Web : www.rsmaundh.org Email : aundhcollege@gmail.com

Chairman

Shrimant Gayatridevi Bhagwantrao Pantpratinidhi
Ranisaheb- Aundh

Ref.No.: RSBM / 55 / 2018 - 2019

Date : 11/6/2018

To,
The Joint Secretary,
UGC, (WRO) Pune

Sub - Re- Submission of Annual and Completion Report
MRP XII plan Dr. Bamane S.R.

Ref. No. F.47-1162/14(WRO) date :- 28/12/2015

Respected Sir,

With reference to above mentioned subject, our discussion dated 08/06/2018, regarding the incompleteness of annual report.

We are resubmitting herewith corrected annual report and date of completion of MRP.

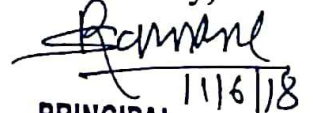
Please accept it and do needful for the same.

Thanking You and oblige

Enc: Annual Report

- 2) Completion report
- 3) Booklet spiral

Yours Sincerely,


11/6/18

PRINCIPAL

Raja Shripatrao Bhagwantrao
Mahavidyalaya, Aundh (Satara)



14-6-18
P.D.P.



REPORT

Minor Research Project

Entitled

**SYNTHESIS AND CHARACTERIZATION OF POLYMER
CAPPED 5-FLUOROURACIL LOADED METAL OXIDE
CORE NANOCOMPOSITES FOR DRUG DELIVERY AND
ANTICANCER APPLICATIONS**

Submitted
to
UGC, WRO, Pune

Principal Investigator : Prin. Dr.Sambhaji Rau Bamane
Department of Chemistry
Raja ShripatraoBhagwantraoMahavidyalaya
Aundh, Tal:-Khatav(Satara), Maharashtra

Subject area :Nanobiotechnology.

Tenure of work: 2015-2017 [XII Plan]
F-47-1162/14-Dt.-28 Dec. 2015 (WRO), Pune



University Grants Commission
सर्वोच्च शिक्षण विकास समिती, भारत सरकार
Ministry of Human Resource Development, Govt. of India
पश्चिम विभागीय कार्यालय मण्यकखिंद, पुणे- ४११००७
Western Regional Office, Ganeshkhind, Pune - 411007.
Ph.: 25696897 Fax: 020 - 25691477
Website- www.ugc.ac.in
Email: mrpugcwro@gmail.com

File No: 47-1162/14(WRO)

28 DEC 2015

✓ The Principal,
Raja Shripatrao Bhagwantrao
Mahavidyalaya,
Aundh, Khatav,
Satara- 415510.

Subject: Approval for Minor Research Project during XII Plan.

Sir/Madam,

I am to convey the approval of the UGC for Minor Research Project in the subject of Chemistry, entitled "Synthesis and Characterization of Polymer Capped 5- Fluorouracil Loaded Metal Oxide Core Nanocomposites for drug dilevery to anticancer applications" to be undertaken by Dr. Bamane S. R. of Raja Shripatrao Bhagwantrao Mahavidyalaya, Aundh, Khatav, Satara - 415510.

Non-Recurring Grant (For Two years)	Amount (Rs.)	Recurring grant (For Two years)	1st Year grant (Rs.)	2nd Year grant (Rs.)
Books & Journals	30000	Contingency	20000	20000
Equipment	100000	Special Need	15000	15000
		Travel/Field work	12500	12500
		Chemicals & Glassware	37500	37500
		Others	0	0
Total (Rs.)	130000		85000	85000

Total allocated amount for the project: Rs. 300000/-

You are requested to send the Acceptance Certificate as per Annexure-II (Copy enclosed) duly forwarded by the Principal of the College, alongwith acceptance of the conditions governing the research project, to this office or email at mrpugcwro@gmail.com immediately.

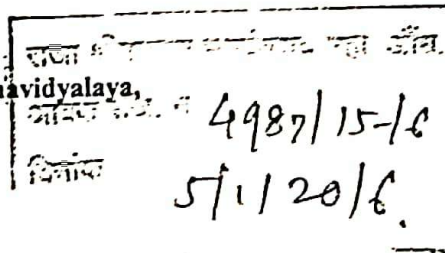
It may be noted that grants to College will be temporarily withheld including for Minor Research Project till the settlement of grants up to XI plan is finalized under the UGC schemes.

Yours sincerely,

Dha
(Dr. Devender Kawday)
Joint Secretary

Copy to:

1. Dr. Bamane S. R.,
Head, Dept. of Chemistry,
Raja Shripatrao Bhagwantrao Mahavidyalaya,
Aundh,
Khatav, Satara- 415510.
2. Director (BCUD),
Shivaji University, Vidya Nagar,
Kolhapur- 416004.
3. Guard File.



L.N. Sahu
(L. N. Sahu)
Section Officer

PROGRESS REPORT
UGC, W R O, PUNE 411007
MINOR RESEARCH PROJECT
UNDER XII PLAN, UGC-WRO, PUNE

- **Project Report**
- **Name and address of principal investigator :** Dr. Sambhaji Rau Bamane ,
M.Sc.,Ph.D.,DIT
Raja Shripatrao Bhagwantrao Mahavidyalaya,
Aundh, Satara (M.S.) PIN 415510
Name and address of Institution: Department of Chemistyr,
Raja Shripatrao Bhagwantrao Mahavidyalaya,
Aundh, Satara (M.S.)
[Affiliated to Shivaji University, Kolhapur]
- **UGC approval No. and date** : UGC-WRO, F.No.-...47-1162 / 14 (WRO)
XII Plan Dt 28/12/2015
- **Date of Implementation** : 1st Jan.2016....
- **Tenure of the project** : 2 years [1 /1 /2016 up to 1/1/2018]
- **Total Grant allocated** : [...Rs. 3,00000/]
- **Total Grant received** : Rs 2,15000 /- only first installment
- **Final expenditure** : 3,17440 /-
- **Title of the project** : “Synthesis and Characterization of 5-fluorouracil loaded polymer functionalized metal oxide nanoparticles for drug delivery and anticancer applications”

- **Objectives of the project:** The aim of present investigation is the synthesis and physicochemical characterization of anticancer drug loaded biodegradable polymer capped metal oxide core nanocomposites for enhancement of drug therapeutic impacts on tumor and cancer cells. The project has theme of Nano therapy of cancer with the main objectives as,
 - 1) Synthesis of anticancer drug 5-fluorouracil loaded polymer coated magnetic metal oxide core nanocomposites
 - 2) The physicochemical characterizations of these nanocomposites for estimation of their morphology, shapes, structure and bonding interactions, sizes and magnetic properties for biomedical properties.
 - 3) Study of their drug delivery, biocompatibility and anticancer applications in biomedical fields by *in vitro* biological testing.

- **Whether the objectives were achieved:** Yes, Up to the points .
 - **Achievements of the project :** Synthesis, characterizations and anticancer with drug delivery biomedical applications:
 - Simple wet chemical synthesis of core-shell polymer coated metal oxide nanocomposites
 - Hydrophobic drug loading and enhancement in drug delivery and anticancer potential
 - Future biomedical applications
 - Higher drug delivery and anticancer effects based on pH sensitive physiological environment in anticancer nano therapy treatments.

- **Summary of the findings :**
 - 1) **Materials and Methods:**

Materials : All the chemicals required for the synthesis of 5-fluorouracil loaded polymer capped metal oxide[CoFe₂O₄ and ZnFe₂O₄] nanoparticles, such as Zinc nitrate hexa-hydrate, Cobalt nitrate, Ferric nitrate, Ammonia, polymers PEG-8000,

Chitosan were purchased with A.R. grade from S.D. Fine chem.. Ltd., Mumbai, India. The cell culture medium such as fetal bovine serum 10%, MTT reagents, Trypsin medium, agar medium, phosphate buffer were purchased from Himedia. The cancer cell lines as MCF-7 breast cancer cells were purchased from NCCS Centre, SPPU University, and Pune. KBr for FTIR spectral analysis with pallet technique on Perkin elmer series spectrometer, Cu grid for TEM electron microscopy and double distilled water used for synthesis and *in vitro* biomedical analysis were obtained from standard sources.

Methods: The drug loaded polymer functionalized metal oxide core nanocomposites were synthesized by wet co precipitation method and nanobiomaterials were characterized by FTIR spectroscopy, XRD analysis and TEM microscopy for physicochemical analysis for the study of bonding, loading of drug 5-fluorouracil and formation of nanostructures. The drug delivery and anticancer potential biomedical applications of these two nanocomposites were elaborated using *in vitro* MTT assay and compared with UV-Vis. Spectrometric drug release assay of nanocomposites.

2) Results and discussions:

Structure, morphology and sizes of nanomaterials :

The structure and formation of 5-fluorouracil [a hydrophobic anticancer drug] loaded PEG coated cobalt ferrite and Chitisan coated zinc ferrite core shell type nanocomposites were confirmed by FTIR analysis and XRD patterns. Bare metal oxide nanoparticles shown FTIR peaks at below 1700 cm^{-1} , at 495 cm^{-1} for Zn-O-Zn stretching, at 560 cm^{-1} for Co-O-Co stretching, while PEG coated cobalt ferrite nanoparticles exhibited extra peak at 1648 cm^{-1} for PEG-C-O-metal bonding, and Chitosan coated zinc ferrite nanoparticles exhibited extra peaks for $-\text{NH}_2$ coating over metal oxide nanoparticles, whereas 5-fluorouracil loaded functionalized metal oxide nanocomposites shown extra peaks in FTIR spectrum at 1886 cm^{-1} for fluorine withdrawn azine group of drug over nanoparticles. These evidences proved formation and weak bonding structures of nanocomposites with good stability.

The sizes and packing of core metal oxide nanoparticles with drug loading had proved on the basis of XRD analysis. As per fig.1 pattern of PEG coated cobalt ferrite

nanoparticles it had been proved that, PEG polymer functionalizes surface of nanoparticles for loading of drug 5-fluorouracil. In the spectrum main peak at 35.5 degree for 2 theta used for determination of size of these PEG coated cobalt ferrite nanoparticles using Debye- Scherer's formula equal to 34 nm. The Chitosan coated zinc ferrite nanohybrids had shown size of 32 nm. While after drug loading sizes decreased to 3 nm. Due to loading interactions. Hence lesser than 50 nm. Sizes had been observed for these nanocomposites by use of XRD analysis.

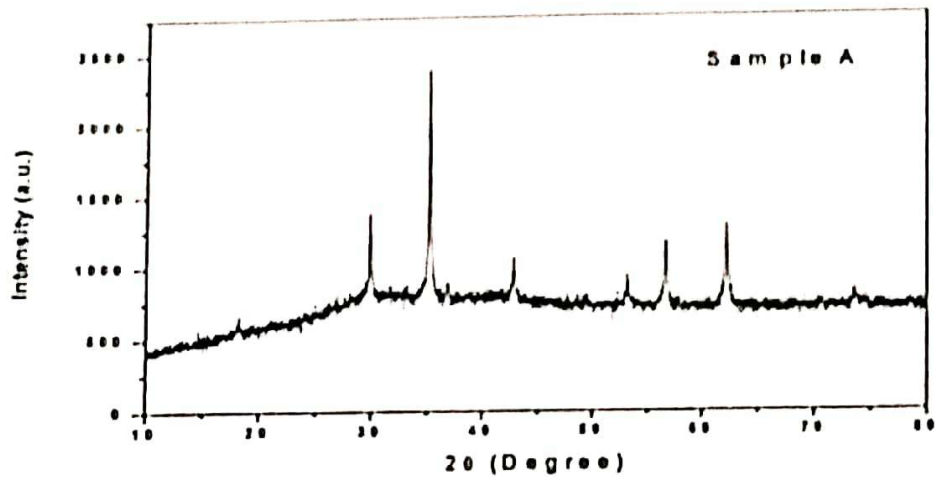


Fig. 1: XRD pattern of PEG coated CoFe_2O_4 , cobalt ferrite nanoparticles.

Imaging of nanocomposites by TEM electron microscopy :

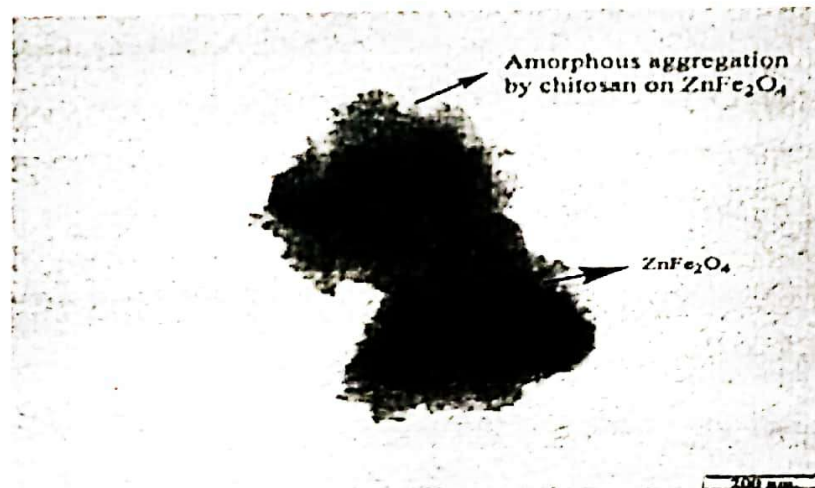


Fig. 2 : TEM image of Chitosan coated drug loaded Zinc ferrite nanocomposites

As like fig.2, the nanocomposites exhibit spherical and oval morphologies for drug loaded polymer coated zinc and cobalt ferrite nanocomposites. After polymer coating core metal oxide nanoparticles become amorphous for easy adsorption of drugs over their surfaces.

Drug delivery and anticancer activities of nanocomposites by *in vitro* MTT cell line assay:

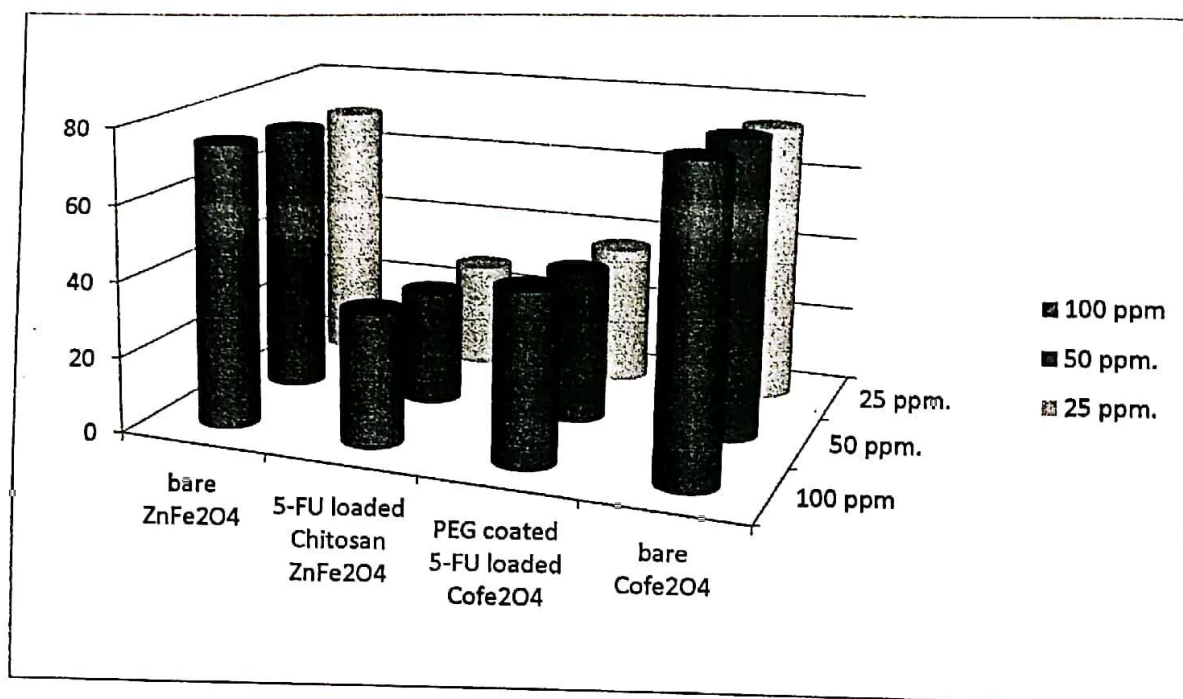


Fig. 3: Cell viability percentage of human breast cancer MCF-7 cell lines after treatment of bare metal oxide, polymer coated and drug loaded nanocomposites against concentrations of doses in ppm.

As per fig.3 graph of MTT assay of nanomaterials on human breast cancer MCF-7 cells, decrease in cell viability of live cancer cells becoming dead, after exposure of nano-drugs, it had proved that nanocomposites release 5-fluorouracil inside cancer cells converting MTT reagent in cell culture to formazan resulting to spectrometric determination from absorbance of cell cultures related to cell viability. Hence anticancer activity and simultaneous release of drug inside cells for nanocomposites had been proved here. So higher drug delivery and anticancer activity up to 86 % destruction of human breast cancer cells were observed for 5-fluorouracil on MCF-7 cells after MTT

biological cell line assay especially for Chitosan coated zinc ferrite nanocomposites. Whereas this activity was lesser of 68 % for PEG coated cobalt ferrite nanocomposites due to aggregation in nanocomposite structures before endocytosis inside cancer cells. But Chitosan coated zinc ferrite nanocomposites had shown higher anticancer low cell viability effects with higher delivery of drug inside MCF-7 cells, as low aggregations were observed for this nanocomposite and chitosan is highly biodegradable inside acidic tumor cell pH, within which drug released from zinc ferrite core inside lysosomes of cancer cell for mitochondrial activation and caspase, cytochromes release for cancer cell membrane damages by production of free radicals ROS – reactive oxygen species from chitosan delivered zinc ferrite nanoparticles inside mitochondria of cancer cells.

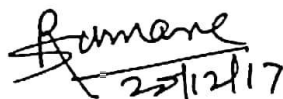
Overall good apoptosis were observed for nanocomposites showing future biomedical applications in healthcare needs as alternative nanoparticle cancer therapy.

- **Contribution to the society :** Simple and easy synthesis of anticancer hydrophobic drug loaded nanocomposites of polymer functionalized metal oxide nanocomposites facilitates their main biomedical applications in social health problems such as cancer, multi drug resistance. These nanocomposites are best alternatives for toxic chemotherapy and radiotherapy treatments of cancers in tomorrow's healthcare needs in clinical trials.
- **Whether any Ph. D. enrolled/ produced :** No
- **No. of publications/ presentations out of the project or outcome:**
5 international papers published as mentioned below

Annexure:

List of publications:

1. *V. J. Sawant, S. R. Bamane, D. G. Kanase, S. B. Patil, J. Ghosh, RSC advances; 2016, 6, 66745.*
2. *V. J. Sawant, S. R. Bamane R. V. Shejwal, Journal of Magnetism and Magnetic materials; 2016, 417, 222.*
3. *V. J. Sawant, S. R. Bamane, International journal of pharmaceutical sciences review and research; 2015, 20 (1), 159.*
4. *V. J. Sawant, S. R. Bamane, D.G.Kanase, Archives of Applied Science Research; 2014, 6(4), 44.*
5. *V. J. Sawant, S. R. Bamane, S. M. Pachchapurkar, Der Chemica Sinica; 2015, 4(5), 67.*


22/12/17

Dr. Sambhaji Rau Bamane
(Principal Investigator)