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Publications from the research work

- **Malik AK,** Singh C, Tiwari P, Verma D, Mehata AK, Setia A, Mukherjee A, Muthu MS. Nanofibers of N, N, N-trimethyl chitosan capped bimetallic nanoparticles: Preparation, characterization, wound dressing and in vivo treatment of MDR microbial infection and tracking by optical and photoacoustic imaging. International Journal of Biological Macromolecules. 2024 Apr 1;263:130154**.**
- **Malik AK,** Setia A, Verma D, Viswanadh MK, Mukherjee A, Muthu MS. Carboxymethyl Chitosan Capped Bimetallic Nanoparticles Entrapped in Theranostic Nanofibers: Antimicrobial Peptide Coating, In Vitro, In Vivo Characterization for MDR Microbial Infection and Photoacoustic/Optical Imaging. ACS Applied Bio Materials. 2025 May 19.8(5):3762-3782.

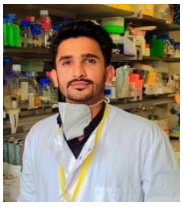
Other publications

- **Malik AK,** Setia A, Mehata AK, Priya V, Nikitha Lakshmi Suseela M, Gokul P, Jac Fredo AR, Jain SK, Selvin J, Muthu MS. Green analytical chemistry: Experimental and chemometric methods for the detection of therapeutics using liquid chromatography in wastewater samples. Analytical Chemistry Letters. 2024 Jan 2;14(1):1-28.
- Badgujar P, **Malik AK**, Mehata AK, Setia A, Verma N, Randhave N, Shukla VN, Kande V, Singh P, Tiwari P, Mahto SK. Polyvinyl alcohol-chitosan based oleanolic acid nanofibers against bacterial infection: In vitro studies and in vivo evaluation by optical and laser Doppler imaging modalities. International Journal of Biological Macromolecules. 2024 Nov 1;279:135532.
- Rani K, **Malik AK**, Setia A, Randhave NV, Verma N, Kumar V, Deshmukh K, Muthu MS. Chitosan and its derivatives as nanotheranostics in multiple diseases management: a clinical perspective. Carbohydrate Polymers. 2025 Jun 7:123852.

- Vikas, Mehata AK, Viswanadh MK, **Malik AK**, Setia A, Kumari P, Mahto SK, Muthu MS. EGFR targeted redox sensitive chitosan nanoparticles of cabazitaxel: dual-targeted cancer therapy, lung distribution, and targeting studies by photoacoustic and optical imaging. Biomacromolecules. 2023 Oct 23;24(11):4989-5003.
- Verma N, Setia A, Mehata AK, Randhave N, Badgujar P, **Malik AK**, Muthu MS. Recent advancement of indocyanine green based nanotheranostics for imaging and therapy of coronary atherosclerosis. Molecular Pharmaceutics. 2024 Sep 3;21(10):4804-26.
- Singh C, Mehata AK, Tiwari P, Setia A, **Malik AK**, Singh SK, Tilak R, Muthu MS. Design of novel bioadhesive chitosan film loaded with bimetallic gold-silver nanoparticles for antibiofilm and wound healing activity. Biomedical Materials. 2023 Feb 15;18(2):025014.
- Setia A, Kumari P, Mehata AK, **Malik AK**, Mahto SK, Muthu MS. Cetuximab decorated redox sensitive D-alpha-tocopheryl-polyethyleneglycol-1000-succinate based nanoparticles for cabazitaxel delivery: Formulation, lung targeting and enhanced anti-cancer effects. International journal of pharmaceutics. 2024 Mar 25;653:123881.
- Mehata AK, Bonlawar J, Tamang R, **Malik AK**, Setia A, Kumar S, Challa RR, Vallamkonda B, Koch B, Muthu MS. PLGA Nanoplatform for the Hypoxic Tumor Delivery: Folate Targeting, Therapy, and Ultrasound/Photoacoustic Imaging. ACS Applied Bio Materials. 2024 Aug 8;7(8):5754-70.
- Dhamija P, Mehata AK, Tamang R, Bonlawar J, Vaishali, **Malik AK**, Setia A, Kumar S, Challa RR, Koch B, Muthu MS. Redox-sensitive poly (lactic-co-glycolic acid) nanoparticles of palbociclib: development, ultrasound/photoacoustic imaging, and smart breast cancer therapy. Molecular Pharmaceutics. 2024 May 6;21(6):2713-26.

Book chapters

- Setia A, Mehata AK, **Malik AK**, Muthu MS. Synthesis of gold nanoparticles using physical and chemical methods: Strategies for stabilization, controlling shape, size and morphology. InGold Nanoparticles, Nanomaterials and Nanocomposites 2025 Jan 1 (pp. 41-79). Elsevier.
- Mehata AK, Singh C, **Malik AK,** Viswanadh MK, Setia A, Muthu MS. Chitosan nanoparticles in wound healing and dressing application. InFundamentals and Biomedical Applications of Chitosan Nanoparticles 2025 Jan 1 (pp. 527-580). Woodhead Publishing.
- Setia A, Mehata AK, Priya V, **Malik AK**, Muthu MS. Synthesis and processing methods of magnetic nanosystems for diagnostic tools and devices: Design strategies and physicochemical aspects. InFunctionalized Magnetic Nanosystems for Diagnostic Tools and Devices 2024 Jan 1 (pp. 43-78). Elsevier.



Ankit Kumar Malik

Prime Minister's Research Fellow, Ph.D., IIT (BHU)
Varanasi, UP, India

ankitkumarmalik.rs.phe21@iitbhu.ac.in https://sites.google.com/itbhu.ac.in/ankitmalik/home/

I am currently a doctoral research fellow at IIT (BHU) in the department of Pharmaceutical Engineering, specializing in Pharmaceutics. My research focuses on nanomedicine, biomaterials, tissue engineering and antimicrobial resistance. By deepening our understanding of the nanotechnology, my work aims to make a meaningful impact on global health challenges.

Research Interests

- Nanomedicine
- Wound healing
- Biomaterials
- Antimicrobial resistance
- Tissue engineering
- Novel drug delivery systems

Scientometric profile

Citations : 477
h-index : 12
*i*10-index : 13
(as on August 2025) (source: google scholar)

Total number of publications: 29 Publications

Total number of patents: 01 Patent

Research Experience

PMRF Fellow- Indian Institute of Technology, BHU (IIT-BHU)

Varanasi, India
Jan 2022 - July 2025

- Prime Minister's Research Fellow (PMRF) at the IIT-BHU for AMR research funded by Government of India
- Currently working on an PMRF-funded project titled "Tri-methyl chitosan derived gold-silver nanoparticles for potential treatment against antimicrobial resistant bacteria".
- Acquired expertise in synthesis and characterization of nanoparticles and nanofibers, isolation of AMR bacteria, tissue engineering, wound healing, IVIS and ultrasound/photoacoustic imaging at IIT.
- Successfully completed data acquisition from this project, and the preliminary findings were presented at various international conferences and symposium.
- Awarded Best Poster Presentation Award at Indo-Japan Symposium on Nanotheranostics (InJaNa) 2024 held from 23 April-25 April 2024 organized by IIT Roorkee for presenting this research work.

JRF Fellow (DBT)- Indian Institute of Technology, BHU (IIT-BHU)

Varanasi, India
Feb 2021 - Jan 2022

- Junior Research Fellow (JRF) at the IIT-BHU for AMRWATCH research in INDO-UK collaborative project funded by Government of India.
- Project entitled "Defining the AMR burden of antimicrobial manufacturing waste in Puducherry and Chennai"
- Quantified the levels of antimicrobial pollution from AMW coming from antimicrobials of different production processes in major manufacturing settings.
- Developed analytical methods to monitor the levels of antibiotics AMR bacteria and mobile genetic elements in receiving environment.
- Visited Prof. Nick Voulvoulis's lab at the Centre for Environmental Policy and Prof. Shiranee Sriskandan's lab at the Department of Infectious Disease, Imperial College London under the INDO-UK for 14 days (09/03/2022 to 22/03/2022).
- During this visit, I participated in various meetings with AMRWATCH UK-based researchers and participated in knowledge exchange activities including training in LC-MS-MS analysis techniques, in molecular biology techniques and metagenomics data analysis.

Professional Experience

Drug Safety Associate-I, Parexel International

Chandigarh, India

Aug 2020 - March 2021

- Management of ICSRs of various case types (spontaneous, clinical studies and solicited programs
- International drug safety regulations (including International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use (ICH) guidelines on safety and efficacy, United States Food and Drug Administration (FDA) guidelines, Council for International Organizations of Medical Sciences (CIOMS) and European Union Good-Pharmacovigilance Practice (EU GVP) guidelines).
- Medical Dictionary for Regulatory Activity (MedDRA) coding in accordance with "MedDRA" Term Selection.
- Triage of ICSRs to determine whether they qualify for expedited reporting or not and the timelines within which they need to be submitted to the regulatory authorities
- Maintained an awareness of global regulatory reporting obligations and organizing workload to ensure compliance with internal and regulatory timelines for adverse event reporting

Education

Indian Institute of Technology (IIT) BHU

Varanasi, India

July 2021 - June 2025

- **Ph.D.** at the Department of Pharmaceutical Engineering and Technology at Indian Institute of Technology (IIT-BHU) with 9.25/10 CGPA.
- Recipient of the prestigious **Prime Minister's Research Fellowship (PMRF)**, awarded to the country's excellent doctoral candidates for pursuing their research.
- My dissertation "**Chitosan derived gold-silver nanoparticles for potential treatment against antimicrobial resistant bacteria**" is structured around two poles: nanotechnology and a fundamental wound healing.
- **Nanotechnology:** Treating microbial resistant wounds with low or no adverse effects has proven to be a challenging task. In an effort to address this issue, I have worked on developing novel electrospun nanofibers laded with bimetallic nanoparticles. I have characterized nanomaterials for particle size, zeta potential, PDI, HR-SEM, HR-TEM, AFM, FT-IR, TGA, DSC, XRD, contact angle, antimicrobial efficacy, *in vitro* release, *in vitro* toxicological analysis, and efflux pump gene expression profiling.
- **Fundamental wound healing:** Wound dressings, integrated with nanotechnology, have garnered considerable attention recently due to their ability to synergistically combine antimicrobial efficacy with wound healing properties, while also supporting adherence to standardized wound care protocols. Nanofiber's structure enables the efficient transport of vital nutrients and metabolites required for cellular development. Nanofibers has the ability to provide a favourable setting for cellular adhesion, proliferation, and growth. For wound healing efficacy we have done *in vivo* wound healing study, histopathological study, western blotting study, *in vivo* ultrasound/photoacoustic study and IVIS study.

Jamia Hamdard University,New Delhi

New Delhi, India

July 2018 - July 2020

- **Masters in Pharmacy (Pharmaceutics)** in the School of Pharmaceutical Education and Research with 8.12/10 CGPA.
- Awarded Graduate Pharmacy Aptitude Test **(GPAT-AIR:174)** Fellowship funded by AICTE, Government of India to pursue M. Pharma
- Successfully completed the project entitled "**QbD enabled development and evaluation of nanostructured drug delivery systems of abiraterone acetate for the management of prostate cancer**" and published 2 research paper from data acquisition of this project.
- Exhibited a strong passion for subjects like Molecular Pharmaceutics, Drug Delivery System, Biopharmaceutics & Pharmacokinetics.
- Organized events like international conferences, symposiums and summer school training programs.
- Successfully completed Post Graduate Diploma in Pharmaceutical Drug Regulatory Affairs (PGDPRA) which focused on ensuring that medications meet legal, safety, and quality standards for approval and market release. Where I learned protocols of government agencies, like the FDA or EMA, to navigate compliance requirements and manage drug submissions.

Kurukshetra University, Kurukshetra, (KUK) Haryana

Haryana, India

July 2014 - June 2018

- Bachelors in Pharmacy at the Institute of Pharmaceutical Science with 7.0/10 CGPA.
- Scored All India Rank – 174 (Percentile – 99.50) in Graduate Pharmacy Aptitude Test-2018 (GPAT).
- Successfully completed an undergraduate research project on the topic of "Nuclear Targeting of Gold Nanoparticles in Cancer Cells"

Projects

Nanotheranostics Lab: IIT (BHU)

IIT, BHU

Jan 2022 - Present

1. **Trimethyl chitosan coated gold-silver nanoparticles for potential treatment against antimicrobial resistant bacteria**- I have prepared an antimicrobial nanofiber sheet composed of Trimethyl chitosan derived gold-silver nanoparticles within its matrix which specifically addresses the issue of antimicrobial resistance, which is one of the top 10 global public health threats. Given the insufficiency of efficient antibiotics, metallic nanoparticles have been used as an alternative.

2. **Carboxymethyl chitosan capped with peptide derived bi-metallic nanoparticles for potential tissue engineering**- I have developed a useful strategy for treating MDR microbial infection by preparing wound dressing nanofibers composed of Carboxymethyl chitosan capped with peptide derived bi-metallic nanoparticles within its matrix which specifically addresses the issue of antimicrobial resistance, which is one of the top 10 global public health threats. Given the insufficiency of efficient antibiotics, metallic nanoparticles have been used as an alternative.

3. **Trimethyl chitosan derived bi-metallic nanoparticles for potential treatment against diabetic wounds-** I engineered a electrospun nanofiber dressing, incorporating Trimethyl chitosan derived bi-metallic nanoparticles, which contributed to the accelerated healing of diabetic wounds also prevent microbial infections and highlights the translation potential in the management of infected diabetic wounds.

4. **Defining the AMR burden of antimicrobial manufacturing waste in Puducherry and Chennai** – I have quantified the levels of antimicrobial pollution from antimicrobial waste coming from antimicrobials of different production processes in major manufacturing settings. I have also developed analytical methods to monitor the levels of antibiotics AMR bacteria and mobile genetic elements in receiving environment.

5. **Redox-sensitive Poly(lactic-co-glycolic acid) nanoparticles of Palbociclib for smart breast cancer therapy** – We have developed PLGA-based nano-formulation of Palbociclib which has been formulated and evaluated for the first time in breast cancer therapy through ultrasound and photoacoustic imaging. This design capitalizes on the elevated levels of GSH in the tumor microenvironment, triggering the cleavage of disulfide bonds and facilitating the release of the loaded drug, specifically at the tumor site.

6. **Cetuximab decorated redox sensitive nanoparticles for cabazitaxel delivery: Formulation, lung targeting and enhanced anti-cancer effects:** We to fabricate cetuximab (CTX) decorated cabazitaxel (CBZ) loaded redox-sensitive D-alpha-tocopheryl-polyethyleneglycol-1000-succinate (TPGS-SS) nanoparticles (NPs) for epidermal growth factor receptor (EGFR)-targeted lung tumor therapy.

Hammersmith Hospital: Imperial College London

London, UK

March 2022

- **Extraction of the metagenomic DNA** – I have extracted the metagenomic DNA from the proposed sampling site (water samples) and processed for high throughput PCR analysis. Also cultivated streptococcus (Gram positive cocci) and transformation of plasmids into streptococcus using electroporation method. The protein isolations and western blotting were also performed for these cells.

Roger Perry Laboratory: South Kensington Campus: Imperial College London

London, UK

March 2022

- **Gas and liquid chromatography** – I have undergone hands-on training with major instruments- Perkin Elmer model 8420 Gas Chromatography system with liquid auto sampler. Electron capture Detector and Flame Ionisation Detectors fitted, Water Wisp 712 HPLC with 50 place autosampler, 2x gradient pumps and Fluorescence, UV and conductivity detectors and Dhormann DC80 Total organic carbon analyser for liquid samples. Analysis uses persulphate / oxygen/UV oxidation method with infrared detection of the carbon dioxide produced.

Nanotechnology Lab: Jamia Hamdard University

New Delhi, India

July 2018-July 2020

- **Development of solid lipid nanoparticles** – I have systematically developed the solid lipid nanoparticles of Abiraterone Acetate with improved oral bioavailability and anticancer activity for prostate carcinoma treatment. Solid lipid nanoparticles were developed using the quality by design (QbD) principles and evaluated through in vitro, ex vivo, and in vivo studies.

Conferences, workshops & Invited Talks

2025 Delivered a talk on "Bimetallic Au-Ag Nanoparticles Loaded Nanofibers for the Potential Treatment Against Antimicrobial Resistance Bacteria" held from 16 March to 17 March 2025 at **IIT Hyderabad**

2025 Delivered a talk on "Bimetallic Au-Ag Nanoparticles Loaded Nanofibers for the Potential Treatment Against Antimicrobial Resistance Bacteria" at Chemical Nanoscience and Nanotechnology Group **(Royal Society of Chemistry)** held from 13 January to 14 January 2025 at **Burlington House, London, United Kingdom**.

2024 Participated in the **Indo-Japan Symposium on Nanotheranostics (InJaNa)** 2024 held from 23 April-25 April 2024 organized by IIT Roorkee

2024 Participated in the International Conference on **Pharmaceutical Innovations & Spirit: The Annual Techno-Pharma Conclave** at IIT BHU on 6th and 7th April 2024.

2024 Participated in 22nd International Symposium on **Advances in Technology and Business Potential of New Drug Delivery Systems (Controlled Release Society)** at Mumbai, Maharashtra on 29th Feb and 1st March 2024.

2024 Participated in the **Regional Meet Institution's Innovation Council MoE's Innovation Cell** at Varanasi, UP, India on 7 February 2024.

2023 Participated in SERB-sponsored SSR workshop on "**Exploring New Avenues and Innovations in Drug Discovery**" held on 27-28 October 2023 at the Department of Pharmaceutical Engineering & Technology, IIT (BHU), Varanasi.

2023 Participated in hands-on training on "**Particle Size, Shape analysis assisted by AI/ML in Pharmaceutical Formulation and Development**" on 29-Sep-2023 organized by IIT(BHU) Varanasi and SERB.

2023 Participated in "**Intellectual Property Rights and its Management**" on 25-Sep-2023 organized by IPRTT Cell of BHU.

2023 Participated in 2 days hands-on training program on "**Circular Dichroism Spectrophotometer & Photoacoustic Imaging Platform**" during 22-23 September 2023 organized by SATHI at CDC (BHU).

2023 Participated in 2 days hands-on training program on "**High Resolution-Nuclear Magnetic Resonance (HR-NMR-600)"** during 25-26 August 2023 organized by SATHI at CDC (BHU).

2023 Participated in 3 days hands-on training program on "**Synthesis, Characterization and Applications of Nanomaterials**" during 20-22 July 2023 organized by SATHI at CDC (BHU).

2023 Participated in the **G-20/Y20 Summit** at Varanasi, UP, India from 17-20 August 2023.

2023 Participated in the International Conference on **Advanced Materials for Better Tomorrow-II** organized by Department of Physics (BHU) and SIRMB at Banaras Hindu University from 10-13 October 2023.

2023 Participated in the International Conference on **Nanotechnology and Drug Delivery** at Jamia Hamdard University, New Delhi from 09-10 February 2023.

2023 Participated in the **72nd Indian Pharmaceutical Congress Conference** at Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur, Maharashtra from 20-22 January 2023.

2022 Global Online Certification Course on **Data-Driven Supply Chain Transformation 2022,** conducted during the period 16th July to 21 August 2022 (30 hours online course).

2019 Participated as a resource person in "**Two Week Summer School Training**" organized by SPER, Jamia Hamdard from 10-22 July 2019.

2019 Participated in the **Indian Pharmaceutical Association Convention 2019** as a volunteer and participant, held at Vigyan Bhawan, New Delhi from 11-12 September 2019.

2019 Participated in the **6th World Congress on Nanomedical sciences Conference-ISNSCON 2019** as a organizer committee member, volunteer and as delegate organized by Delhi University and Jamia Hamdard University from 7-9 January 2019 at Vigyan Bhavan, New Delhi, India.

2019 Participated in the 4th International conference on "**Viable Healthcare for all**" as a delegate which was organized by VOH (Voice of Healthcare) on 21st and 22nd February 2019 at Pragati Maidan, New Delhi.

2018 Participated in the **70th Indian Pharmaceutical Congress** organized by IPCA held at Amity University, Noida from 21-23 December 2018.

2016 Participated in the **2nd Annual National Convention Conference of Association of Pharmaceutical Teachers of India**" highlighting the theme "Emerging Scenerio in Human Resource Development for Pharmacy Profession" Organized by APTI (Punjab State Branch) held at GPCG Patiala on 18th and 19th March 2016.

Achievements

2025 Honored with **Recommended with commendation** research work by the **PMRF National Review Panel** (December 2024).

2025 Awarded **International Travel Support** grant from Anusandhan National Research Foundation **(ANRF)**- Science and Engineering Research Board **(SERB)** and to attend international conference at **United Kingdom (January 2025)**.

2025 Awarded **International Travel Support** grant from Council of Scientific and Industrial Research **(CSIR)** and to attend international conference at **London, United Kingdom (January 2025)**.

2024 Awarded **Best Poster Presentation Award** at Indo-Japan Symposium on Nanotheranostics (InJaNa) 2024 held from 23 April-25 April 2024 organized by IIT Roorkee

2022 Awarded **Prime Minister's Research Fellowship** (PMRF 2022- cycle 8) for pursuing doctoral research**.**

2022 Awarded **International travel grant** from **DBT** for collaborative work in **Imperial College London, United Kingdom.**

2021 Awarded **Junior Research Fellowship** (JRF) from **Department of Biotechnology** (DBT) for **Indo-UK project.**

2020 **National Cadet Core (NCC)** '**B**' certificate holder with '**A**' grading.

2018 Awarded **National level AICTE Scholarship** for pursuing M. Pharmacy research project.

2018 Secured **All India Rank- 174** in **GPAT 2018** (Graduate Pharmacy Aptitude Test), administered by the **AICTE**.

2018 Qualified **NIPER JEE 2018** (National Institute of Pharmaceutical Engineering & Research) for **M. Pharmacy** entrance.

2018 **Registered Pharmacist** at Haryana State Pharmacy Council (Regn. No. 34405).

2013 Qualified **National Eligibility cum Entrance Test** (NEET-UG) 2013 for MBBS.

Teaching

Teaching Assistant at NPTEL
(TA deliverables under PMRF scheme)

2024 **Proteins and Gel-Based Proteomics**, noc24-bt40, under Prof. Sanjeeva Srivastava, IIT Bombay
2024 **Bioengineering: An Interface with Biology and Medicine**, noc24-bt14, under Prof. Sanjeeva Srivastava, IIT Bombay
2023 **Biomedical Nanotechnology**, noc23-bt70, under Prof. Gopinath Packirisamy, IIT Roorkee

Teaching Assistant at SHEAT College of Pharmacy, Varanasi
(TA deliverables under PMRF scheme)

2025 **Pharmacology and Pharmaceutical Organic Chemistry**, B. Pharmacy 3rd year
2024 **Pharmaceutics and Pharmaceutical Chemistry**, B. Pharmacy 3rd year
2023 **Pharmaceutics and Medicinal Chemistry**, B. Pharmacy 3rd year
2022 **Physical Pharmacy and Pharmacology**, B. Pharmacy 2nd year

Teaching and Practical Assistant at IIT (BHU), Varanasi

2024 **Nano-pharmaceutics (PH-514)** M. Pharmacy 1st year
2023 **Nanotechnology Drug Delivery (PH-413)**, M. Pharmacy 1st year
2023 **Dosage Form Design (PH-412)**, B. Tech (Pharmacy) 2nd year
2023 **Physical Pharmaceutics (PH-211)**, B. Tech (Pharmacy) 3rd year

Undergraduate and Master Students Thesis Mentor

2025 **Bhima Wagh**, M.Pharm., 2nd year: Doxorubicin loaded nanofibers for wound healing against the bacterial infection
2024 **Paresh Badgujar**, M.Pharm., 2nd year: Oleanolic acid loaded nanofibers for wound healing against the bacterial infection
2023 **Piyush Dhamija**, M.Pharm., 2nd year: Redox-sensitive nanoparticles of Palbociclib nanoparticles for breast cancer therapy
2023 **Ayush Kumar**, B.Tech., 4th year: Bimetallic nanoparticles for anti-bacterial efficacy

Technical Skills

Expertise

- Design and synthesis of natural, synthetic, or hybrid biomaterials.
- Preparation and characterization of nanoparticles, nanofibers and Nanoclusters for anti-cancer and wound healing.
- Molecular and cellular work like western blotting, immunohistochemistry, flow cytometry, RT-PCR, and ELISA etc.
- Laboratory animal handling includes blood sample collection, dosing, and euthanasia according to CPCSEA guidelines.
- Softwares (MATLAB, Design of Expert, Chem Draw, Origin Pro, MestReNova, GraphPad Prism etc).

Hands-on Major Instruments

- **Nanoformulation Development and characterization:** DLS, Zeta sizer, and zeta potential
- **Polymer Synthesis & Characterization:** Synthesis and characterization of polymers such as Tri-methyl chitosan, Chitosan-g-TPGS, and Chitosan-Folate using FTIR, NMR, and Hr-MS/MS.
- **Laboratory Techniques:** UV, FTIR, DSC, TGA, XRD, XPS, NMR, MS/MS, HR-SEM, HR-TEM, and CLSM etc.
- **Analytical & Bioanalytical Method Developments:** HPLC & UPLC
- **Mammalian Cell Culture (2D and 3D spheroid models for cancer research):** MTT assay, cellular uptake, apoptosis study, cell cycle analysis, reactive species generation, and mitochondrial membrane potential assay, comet assay, senescence assay, western blotting etc.
- **Electrospinning machine:** For the preparation of nanofibers.
- **Animal Handling & Preclinical Studies:** Rats, mice, guinea pigs, rabbits, hamsters.
- **In vivo Imaging**: Ultrasound/photoacoustic imaging (USG/PA), IVIS, Photothermal imaging
- **Anticancer Research:** In vitro studies, tumor induction in animals (chemical, syngeneic and xenograft methods)

Patents

1. "Biosynthesis of copper nano complex using fruit juice with copper sulphate and characterization thereof" **Indian Patent. E-1/6179/2024-DEL.**

Publications

INTERNATIONAL JOURNAL

2025 Rani K*, **Malik AK***, Setia A, Randhave N, Verma N, Kumar V, Deshmukh K, Muthu MS. Chitosan and its derivatives as nanotheranostics in multiple diseases management: a clinical perspective **Carbohydrate Polymers**. 2025 June 7 123852. *equally contributed **(IF-12.5)**

2025 **Malik AK**, Setia A, Verma D, Viswanadh MK, Mukherjee A, Muthu MS. Carboxymethyl Chitosan Capped Bimetallic Nanoparticles Entrapped in Theranostic Nanofibers: Antimicrobial Peptide Coating, In Vitro, In Vivo Characterization for MDR Microbial Infection and Photoacoustic/Optical Imaging**. ACS Applied Bio Materials**. 2025 May 7. **(IF-4.7)**

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INTERNATIONAL CONFERENCE PAPERS

2025	**PMRF Symposium**, **Ankit K Malik**, M S Muthu "Bimetallic Au-Ag Nanoparticles Loaded Nanofibers for the Potential Treatment Against Antimicrobial Resistant Bacteria" held from 16 March to 17 March 2025 a IIT Hyderabad.	*IIT Hyderabad, India*
2025	**Royal Society of Chemistry (RSC)-CNN**, **Ankit K Malik**, M S Muthu "Bimetallic Au-Ag Nanoparticles Loaded Nanofibers for the Potential Treatment Against Antimicrobial Resistant Bacteria" held from 13 January to 14 January 2025 at Burlington House, London, United Kingdom.	*London, UK*
2024	**Indo-Japan**, **Ankit K Malik**, M S Muthu "Nanoparticles-loaded Nanofibers: Synthesis and In-vivo MDR Microbial-infected Wound Healing Effects by Optical and Photoacoustic Imaging" at Indo-Japan Symposium on Nanotheranostics (InJaNa) 2024 held from 23rd April - 25th April 2024.	*IIT Roorkee, India*
2024	**Controlled Release Society (CRS)**, **Ankit K Malik**, M S Muthu "Nanoparticles-loaded Nanofibers: Synthesis and In-vivo MDR Microbial-infected Wound Healing Effects by Optical and Photoacoustic Imaging" at the 22nd International Symposium on Advances in Technology and Business Potential of New Drug Delivery Systems (Controlled Release Society) at Mumbai, Maharashtra on 29th Feb and 1st March 2024.	*Mumbai, India*
2023	**G-20/Y-20 Summit**, **Ankit K Malik**, M S Muthu, "Nanofibers of N,N,N-trimethyl Chitosan-Capped Bimetallic Nanoparticles: Development and In-vivo Wound Healing Effects by Optical and Photoacoustic Imaging" at G-20/Y-20 Summit on 17-August-2023.	*Varanasi, India*
2023	**ICNDD**, **Ankit K Malik**, M S Muthu, "Recent Advances in Nano-drug Delivery Approaches for Antimicrobials" at International Conference on Nanotechnology & Drug Delivery at Jamia Hamdard University, New Delhi from 09-10 February, 2023.	*New Delhi, India*
2023	**ICNDD**, **Ankit K Malik**, M S Muthu, "Synthesis and Characterization of Bimetallic Au-Ag Nanoparticles for the Potential Treatment Against Antimicrobial Resistance Bacteria" at the 72nd Indian Pharmaceutical Congress, Nagpur, Maharashtra on 21-January 2023	*Nagpur, India*

In News

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— "IIT BHU के शोधार्थियों को प्रधानमंत्री रिसर्च फेलोशिप का तोहफा, 19 छात्र-छात्राओं का हुआ चयन" Jagran.
— "पानीपत के अंकित को मिली प्रधानमंत्री रिसर्च फेलोशिप", My city reporter.
— "बी फार्मेसी के 19 विद्यार्थियों ने जीपीएटी पास की, 12 हजार मिलेगा छात्रवृति", Jagran.
— "Kurukshetra University Student Shines with Impressive AIR-174 in GPAT Exam", Got Scholarship for my Master's in Pharmacy
— Several online articles and newspaper clipping in press about me getting a Prime Minister's Research Fellowship (PMRF) at IIT (BHU) for my Ph.D. research work
— With my NPTEL You tube channel, I strive to empower knowledge and inspire students in their journey towards their dream college.
— IIT BHU Press Release.

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References

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