

SURENDRA KUMAR VERMA

(C/o Prof. Jayesh Bellare, Institute Chair Professor)

M.Sc., Ph.D., Department of Bioscience and Bioengineering,
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ACADEMIC QUALIFICATIONS

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| Ph.D. (Biomedical Engineering) | 2014-2019 |
| <ul style="list-style-type: none">▪ Institute: Indian Institute of Technology Bombay▪ Thesis title: ‘Hollow fiber membrane-based substrates for hemodialysis and bioartificial liver applications’▪ Supervisor: Prof. Jayesh Bellare | |
| Master of Science (Biotechnology) | 2011-2013 |
| <ul style="list-style-type: none">▪ Institute: Indian Institute of Technology Bombay▪ Dissertation title: Cloning, over-expression, purification and crystallization of arginase from <i>Aspergillus niger</i>▪ Supervisors: Prof. Narayan S. Puneekar and Prof. Prasenjit Bhaumik | |
| Bachelor of Science (Biotechnology) | 2007-2010 |
| <ul style="list-style-type: none">▪ Institute: University of Rajasthan | |

KEY ACADEMIC PROJECTS

- 1. Ph.D. Thesis:** ‘Hollow fiber membranes and substrates based on them for hemodialysis and bioartificial liver applications’

Thesis supervisor: Prof. Jayesh Bellare, Institute Chair Professor, Department of Chemical Engineering, IIT Bombay, Mumbai, India

Overview:

- Worked on different biomaterials with different technologies for regenerative medicine
- Developed lab scale Bioartificial organs viz. bioartificial liver and Haemodialysis bioreactor
- Patented and published the research in different prestigious journals

1. **Kidney assist device (Hemodialysis):** Nanocomposite hollow fiber membranes were prepared, characterized and studied for hemocompatibility and separation performance. The toxin separation performance of the developed lab scale dialyzer was ~ 5 times better than the commercial membrane
 2. **Bioartificial liver:** Hollow fiber membrane surface was modified by physical and chemical means to promote liver cell attachment. The prepared biomaterial studied to develop bioartificial liver support system. The liver cells exhibited the characteristics features of liver functions detoxification enzyme (P450) synthesis
 3. **Electro-spun nanofiber** deposited hollow fiber membrane for mass cell culture: A novel approach was applied to deposit the nanofibers on hollow fiber membrane surface. The developed 3-D matrix was studied for the fibroblast and liver cell mass culture
 4. **Cryogel based 3-D substrate:** Super-macroporous cryogel based hollow fiber membrane substrate was prepared and lab scale liver cell bioreactor developed
 5. **Carbon nanotube (CNT)-polymer composite** membrane were prepared and studied for the biocompatibility and cytocompatibility
 6. **Bioartificial pancreas study:** *In vivo* study in mice to cure diabetes. Stem cell differentiated pancreatic cells encapsulated in hollow fiber membranes were implanted in mice model. The reversal of diabetes was observed in mice: a collaboration study with MS University, Baroda, India is going on
 7. **Current work:** Animal trial in large animal model (goat), to check the performance of the hemodialysis membrane developed by our group. We have got the permission from Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA) to conduct the animal study.
2. **M. Sc. Dissertation:** “Cloning, over-expression, purification and crystallization of arginase from *Aspergillus niger*” (July 2012-April 2013)

Dissertation Supervisor: Prof. N. S. Punekar and Co-supervisor: Prof. P. Bhaumik, Department of Biosciences and Bioengineering, Indian Institute of Technology Bombay, Mumbai.

Work Highlights:

1. An expression plasmid construct to express *A. niger* arginase with His tag was prepared
2. Recombinant plasmid construct was transformed into E. coli XL1-Blue cells and cloned
3. Expressed His-arginase enzyme was purified by chromatography viz. Ni-NTA affinity, DEAE anion exchange, and Gel filtration

KNOWLEDGE DEVELOPMENT

1. **Course work during Ph.D.** (Total 44 credits): Introduction to Bio-nanotechnology, Proteomics- Principles and Techniques, Biomaterials, Research Proposal, Topics in Biotechnology II, Biological enquiry: History and Philosophy, Experimental Methods, Communication and Presentation Skills

2. **Course work during M.Sc. Biotechnology** (Total 146 credits): Cell biology, Molecular Cell Signalling, Molecular Enzymology, Molecular Immunology, Analytical Biochemistry, Metabolism and Bioenergetics, Genetic Engineering, Bioinformatics, Microbiology Course seminar)
3. **Course work during B.Sc. Biotechnology** (Total 2250 marks): Biochemistry, Cell structure and function, Genetics, Microbiology, Molecular biology and Genetic Engineering, Immunology, Developmental biology, Bioinformatics, Environmental biology

TECHNICAL SKILLS

1. **Animal Cell culture:** Primary cell/tissue culture, isolation of liver hepatocyte, adipocyte, splenocyte, cancer cell line culture, cryopreservation, cytotoxicity assays and pancreatic/umbilical cord stem cells culture
2. **Hollow fiber membrane spinning pilot Plant:** Indigenously developed plant, operating, manufacturing of HFM
3. **Biomaterial characterization:** With sophisticated instruments such as scanning Electron Microscope, Transmission Electron microscope, FTIR spectroscopy, Confocal spectroscopy, atomic force microscopy
4. **Biochemistry:** Protein purification, Chromatography (Gel Filtration, Ion Exchange Chromatography, Affinity Chromatography), Protein electrophoresis
5. **Molecular biology:** PCR, Gene cloning, Recombinant DNA techniques, Bacterial Transformations and DNA electrophoresis
6. **Microbiological techniques:** Isolation, cultivation, identification and quantification of bacteria and fungus, Antibiotic sensitivity tests

RESEARCH PAPERS PUBLISHED

1. **Surendra Kumar Verma**, Akshay Modi, Jayesh Bellare (2018). Three-dimensional multiscale fiber matrices: Development and characterization for increased HepG2 functional maintenance for bio-artificial liver application. *Biomaterials Science*. (6): 280-291. *[Featured as an issue cover article]*
2. **Surendra Kumar Verma**, Akshay Modi, Ashwin Dravid, Jayesh Bellare (2018). Lactobionic acid-functionalized polyethersulfone hollow fiber membranes promote HepG2 attachment and functions. *RSC Advances*, 8 (51) 29078-29088.
3. **Surendra Kumar Verma**, Atul K Singh, Akshay Modi, Rohit Teotia, Jayesh Bellare (2018). Functionally coated polyethersulfone hollow fiber membranes: A substrate for enhanced HepG2/C3A functions. *Colloids and Surfaces B: Biointerfaces*, 164, 358-369.
4. **Surendra Kumar Verma**, Akshay Modi, Atul Kumar Singh, Rohit Teotia, Jayesh Bellare (2017). Improved hemodialysis with hemocompatible polyethersulfone hollow fiber membranes: In vitro performance. *Journal of Biomedical Materials Research Part B: Applied Biomaterials*, 106B, 1286–1298.
5. **Surendra Kumar Verma**, Akshay Modi, Jayesh Bellare (2019). Polyethersulfone-carbon nanotubes composite hollow fiber membranes with improved biocompatibility

for bioartificial liver. *Colloids and Surfaces B: Biointerfaces*. (doi.org/10.1016/j.colsurfb.2019.06.051)

6. **Surendra Kumar Verma**, Akshay Modi, Jayesh Bellare (2019). Hollow fiber membrane bioreactor functionalized with GO-cryogel 3D matrix promotes cell anchoring and functional maintenance. *ACS Biomaterials Science & Engineering*. (Under revision). Manuscript ID: ab-2019-00512k
7. Akshay Modi, **Surendra Kumar Verma**, Jayesh Bellare (2018). Hydrophilic ZIF-8 decorated GO nanosheets improve biocompatibility and separation performance of polyethersulfone hollow fiber membranes: A potential membrane material for bioartificial liver application. *Materials Science and Engineering C*. 91, 524-540.
8. Akshay Modi, **Surendra Kumar Verma**, Jayesh Bellare (2018). Graphene oxide-doping improves the biocompatibility and separation performance of polyethersulfone hollow fiber membranes for bioartificial kidney application. *Journal of Colloid and Interface Science*, 514, 750-759.
9. Akshay Modi, **Surendra Kumar Verma**, Jayesh Bellare (2018). Extracellular matrix-coated polyethersulfone-TPGS hollow fiber membranes showing improved biocompatibility and uremic toxins removal for bioartificial kidney application. *Colloids and Surfaces B: Biointerfaces*, 167, 457–467.
10. Akshay Modi, **Surendra Kumar Verma**, Jayesh Bellare (2018). Carboxylated carbon nanotubes/polyethersulfone hollow fiber mixed matrix membranes: Development and characterization for enhanced gas separation performance. *MRS Advances*, 3(52), 3103-3109.
11. Akshay Modi, **Surendra Kumar Verma**, Jayesh Bellare (2017). Graphene oxide nanosheets and d- α -Tocopheryl polyethylene glycol 1000 succinate (TPGS) doping improves biocompatibility and ultrafiltration in polyethersulfone hollow fiber membranes. *Journal of Colloid and Interface Science*, 504, 86-100.
12. Rohit S. Teotia, **Surendra Kumar Verma**, Dhrubajyoti Kalita, Ganpat J. Dahe, Jayesh Bellare (2017). Porosity and compatibility of novel polysulfone-/vitamin E-TPGS-grafted composite membrane. *Journal of Material Science*, 52: 12513-12523.
13. Sivaiah Areti, **Surendra Kumar Verma**, Jayesh Bellare, Chebrolu Pulla Rao (2016). Selenocysteine vs. cysteine: Tuning the derivatization on benzene sulfonyl moiety of a triazole linked dansyl connected glycoconjugate for selective recognition of selenocysteine and the applicability of the conjugate in buffer, in serum, on silica gel and in HepG2 cells. *Analytical Chemistry* 88, 7259–7267.
14. Rohit S. Teotia, Sachin Kadam, Atul Kumar Singh, **Surendra Kumar Verma**, Ashutosh Bahulekar, Sujata Kanetkar, Jayesh Bellare (2016). Islet Encapsulated Implantable Composite Hollow Fiber Membrane Based Device: A Bioartificial Pancreas. *Materials Science and Engineering: C*. 77: 857-866.
15. Rohit S. Teotia, Dhrubajyoti Kalita, Atul Kumar Singh, **Surendra Kumar Verma**, Sachin Kadam, Jayesh Bellare (2015). Bifunctional chitosan polysulfone composite hollow fiber membrane for bioartificial liver. *ACS Biomaterials Science & Engineering* 1(6): 372-381.

PATENT FILED

1. Jayesh Bellare, **Surendra Kumar Verma**, Atul Kumar Singh, Akshay Modi, “High flux nanocomposite hollow fiber membrane and a process for making the same for hemodialysis” (IPA No. 201721012546)
2. Jayesh Bellare, **Surendra Kumar Verma**, Atul Kumar Singh, Akshay Modi, Rohit Teotia, “Coated hollow fiber membrane material as a substrate for enhanced liver cell attachment and a process for manufacturing the same” (IPA No. 201721012545)
3. Jayesh Bellare, **Surendra Kumar Verma**, Akshay Modi, “Multiscale micro-nanofibers based 3-D scaffold matrix and process for preparation thereof” (IPA No. 201721040357)
4. Jayesh Bellare, **Surendra Kumar Verma**, Akshay Modi, “Cryogel supported on hollow fiber membranes as a supermacroporous substrate: Preparation and applications thereof” (IPA No. 201921015266)
5. Jayesh Bellare, Akshay Modi, **Surendra Kumar Verma**, “Nanocomposite hollow fiber membranes, process of making same, and applications thereof” (IPA No. 201721046576)
6. Jayesh Bellare, Akshay Modi, **Surendra Kumar Verma**, “Biocompatible polymer-based nanocomposite hollow fiber membranes for simultaneous/sequential cell culture and filtration and a process for manufacturing the same” (IPA No. 201721012547)
7. Jayesh Bellare, Rohit S. Teotia, **Surendra Kumar Verma**, Atul Kumar Singh, Sachin Kadam, Hollow fiber based packaging of cells for bio-artificial pancreas (IPA No.: 201623023433)
8. Jayesh Bellare, Preety Kumari, **Surendra Kumar Verma**, Akshay Modi, “High flux antifouling nanocomposite membranes” (IPA No. 201923010194)

CONFERENCE PROCEEDINGS/PAPERS

1. **Surendra Kumar Verma**, Akshay Modi, Jayesh Bellare, “Three-dimensional multiscale fiber matrices: Development and characterization for increased HepG2 functional maintenance for bio-artificial liver application”, ChEmference’ 18 organized by Department of Chemical Engineering, IIT Bombay, Mumbai, May 19-20, 2018, Mumbai, India
2. **Surendra Kumar Verma**, Akshay Modi, Jayesh Bellare, “High flux nanocomposite hollow fiber membrane for hemodialysis”, 2018 MRS Spring Meeting organized by Materials Research Society, April 2 – April 6, 2018, Phoenix, Arizona, United States
3. **Surendra Kumar Verma**, Akshay Modi, Atul Kumar Singh, Rohit Teotia, Jayesh Bellare, “High flux nanocomposite hollow fiber membrane for hemodialysis”, OYCE-2018 organized by IChE-Mumbai Regional Chapter, March 24, 2018, Mumbai, India. (Won first prize for best presentation)
4. **Surendra Kumar Verma**, Akshay Modi, Atul Kumar Singh, Rohit Teotia, Jayesh Bellare, “High flux nanocomposite hollow fiber membrane for hemodialysis”, TechConnect Briefs 1 (Advanced Materials: TechConnect Briefs 2017), 291 - 294 (2017)
5. **Surendra Kumar Verma**, Akshay Modi, Jayesh Bellare, “3D multi-scale fiber based cell bioreactor”, Tech Plan demo day in INDIA 2017 organized by Leave a Nest Co. Ltd., Japan, April 29, 2017, New Delhi, India

6. **Surendra Kumar Verma**, Akshay Modi, Jayesh Bellare, “Hemocompatible hollow fiber membrane-based dialyzer for kidney dialysis”, 14th National Conference and Technology Exhibition on Indian Medical Devices & Plastics Disposables/Implants Industry 2017 (IMDI 2017) organized by Classic Computer Services, Ahmedabad, March 17-18, 2017, Ahmedabad, India
7. **Surendra Kumar Verma**, Akshay Modi, Jayesh Bellare, “Hollow fiber membrane based hemodialyzer for kidney dialysis”, Wadhvani Research Centre for Bioengineering (WRCB) 1st Industry day organized by WRCB, IIT Bombay, August 5, 2016, Mumbai, India
8. **Surendra Kumar Verma**, Rohit Teotia, Ganpat Dahe, Jayesh Bellare, “Hollow Fiber Membrane for Hemodialysis” Global business forum-IITBAA, Goa, October 2015, Goa, India

AWARDS AND HONOURS/ ACHIEVEMENTS

1. Awarded ‘Outstanding Young Chemical Engineer’ award (**first prize**) from Indian Institute of Chemical Engineering, India, March 24, 2018
2. **Awarded first prize** ‘Sushruta innovation award’ in paper presentation for most innovative medical device idea/prototype at Indian Medical Device Industry conference (IMDI) at AMA Ahmedabad, March 17-18, 2017
3. Got prize Intel Galileo among ~ 350 candidates in Entrepreneurship cell (E- Cell) workshop organized by IIT Bombay for best idea presentation/suggestion, 2014
4. Received education encouragement prize money by **Govt. of Rajasthan** 2011
5. **Research work was featured on front cover of RSC Biomaterials Science journal:** Surendra Kumar Verma, Akshay Modi, Jayesh Bellare “Three-dimensional multiscale fiber matrices: Development and characterization for increased HepG2 functional maintenance for bio-artificial liver application” *Biomaterials Science* 6, 280 – 291 (2018)

SCHOLASTIC ACHIEVEMENTS

1. Awarded fellowship by **UGC Junior Research Fellowship**, Govt. of India (2014-2018)
2. Qualified **CSIR-UGC JRF/NET** June 2013
3. Qualified **DBT-Junior Research Fellowship**-2013
4. Qualified **ICMR-Junior Research Fellowship**-2013
5. Qualified **GATE 2013** in Biotechnology paper with score 321
6. Achieved all India **Rank-85** in **IIT JAM** 2011
7. Qualified **JNU** combined entrance examination for Biotechnology 2011
8. Achieved all India **Rank-85** in **IIT JAM** 2011 (Total number of candidates in exam 4407)
9. Secured all India **Rank-10** in **JNU** combined entrance examination for Biotechnology 2011 (Total number of candidates was over 10,000)
10. Qualified for perusing Ph.D. in **South Asian University** 2011
11. Secured **Rank 3** in Entrance exam for admission into “Molecular and Human Genetics” course conducted by **Banaras Hindu University** 2011

RESEARCH GRANT PRESENTATIONS AND SEMINARS

1. Grant written and presented: Biotechnology Ignition Grant Scheme (**BIG**) DBT-2015, New Delhi
2. Business pitch in 3 minutes at GBF-IITBAA, Goa, October 2015
3. Research grant Written
 - 3.1. Wadhvani research centre for Bioengineering,
 - 3.2. IMPacting Research INnovation and Technology (IMPRINT)
 - 3.3. National Hub for Healthcare Instrumentation Development (NHHID)

RESEARCH WORK EXPERIENCE

Institution: Indian Institute of Technology, Bombay

Position: Research Assistant under **Prof. Jayesh Bellare**, Institute Chair Professor, Department of Chemical Engineering, IIT Bombay

Project: Nanocomposite hollow fiber membranes and biomaterials for hemodialysis and reconstructive medicine

Duration: 18th July 2013 to 2nd January 2014 (six months)

Work Highlights: Worked on hollow fiber membranes (HFM) for regenerative medicine

1. HFM preparation by indigenously built hollow fiber membrane spinning pilot plant
2. Evaluation of hemocompatibility with human blood
3. Isolation of primary cells, liver cell and pancreatic stem cells and study with HFM

TEACHING EXPERIENCE

1. Taught biology to underprivileged school children (class 11th and 12th) nearby IIT Bombay campus at 'Abhyashika' **(September 2017-May 2019)**

POSITION OF RESPONSIBILITY

1. **Computer secretary** of hostel-13 for the year 2014-2015. Involved the coordination and management of the various hostel activities such as internet problem troubleshooting, hostel fest and events, hostel welfare organization, general body meeting.
2. B-certificate of National Cadet Corps (**NCC**) scheme at Maharashtra Regiment, Mumbai, August, 2013
3. Organizer, in Generation (**symbiotech**) 2012, a departmental festival, Department of Biosciences and Bioengineering, IIT Bombay
4. Core team member of **Make in India**, Hackathon, 2016: Presented idea of gas enrichment in gobar gas plant
5. Organizer, in International conference on electron microscopy (**EMSI** Mumbai, 8-10 July 2015)
6. Organizer, in "Research scholar symposium, 2 march 2019 at IIT Bombay
7. Member of "Indian Science Congress"
8. **Volunteered** in Powai lake mega clean-up and Plantation drive, 5 June, 2019

REFERENCES

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