

Mukesh Kumar Gupta, Ph.D.

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A versatile PhD in hardcore organic polymer chemistry with a substantial research experience in area of smart polymeric biomaterials for tissue engineering, drug delivery and regenerative medicine.

RESEARCH AREAS/ INTERESTS

Smart Polymeric Biomaterials (Micelles/scaffolds/Hydrogels/SMPs), Polymerization Methods (Cationic, ROP, Anionic, Step growth, and RAFT), Organic Synthesis, Biopolymers, Medicine, Targeted Drug/Gene Delivery.

EDUCATION

Doctor of Philosophy, Polymer Science & Engineering 2008

National Chemical Laboratory (NCL), Pune University, India

Dissertation Title: Photo and Thermo Latent Initiators for Cationic Polymerization

Master of Science, Organic Chemistry 2001

Mohan Lal Sukhadia (MLS) University, Udaipur, Rajasthan, India

PROFESSIONAL RESEARCH EXPERIENCE

Postdoctoral Research Scholar 02/2010-Present
Vanderbilt University Nashville, TN

Supervisor: Dr. Hak-Joon Sung and Dr. Craig L. Duvall

- A hand-on experience with homo/co-polymerization (Cationic, ROP, RAFT, Anionic, and Condensation) methods (solution/melt) to prepare various polymeric materials and characterization of their chemical, physical, mechanical and biological properties using modern characterization techniques.
- Mentored/trained several junior staff members for organic/polymer synthesis and characterization.
- Proven experience in solving challenging, cross-interdisciplinary problems at the interface of organic/polymer chemistry, materials science and biology.
- Engineered a robust oxidation responsive ABC triblock copolymer based physical hydrogels and studied rheology, drug release, degradation, and cellular compatibility in 3D environment.
- Developed and characterized a library of biodegradable/biocompatible shape memory polymers composed of poly(ϵ -caprolactone) based copolymer films.
- Participated in the development of oxidative degradable poly(thioketal-urethane)(PTKs) scaffolds with suitable chemical, physical and mechanical properties for bone tissue engineering.
- Developed an oxidation responsive polymeric micelle drug carrier and characterized for morphology, site-specific degradation and drug release.
- Prepared a library of copolymers and studied structure/property relationship to optimize the chemical and mechanical properties of a combinatorial electrospun meshes for cardiac differentiation of ESCs.
- Developed physiologically relevant ROS cleavable pH responsive peptide conjugated PEGylated polymer based nanoparticle formulation and characterized rigorously for delivery of genetic therapeutics.
- Prepared reports, grant applications, manuscripts, reviewed manuscripts and presented research finding at several polymer and biomaterial focused professional meetings (BMES, SFB, TERMIS and SERMACS).
- Prepared manuscripts, grant applications and presented research finding at several polymer and biomaterial focused conferences (BMES, SFB, TERMIS and SERMACS).

Postdoctoral Research Associate 01/2009-12/2009
ENSIC, Nancy University Nancy, France

Supervisor: Jean-Luc SIX

- Prepared and characterized a library of copolymers of DLLA and ϵ -caprolactone using controlled ring opening polymerization.
- Studied kinetics of solution and bulk copolymerization of DLLA and ϵ -caprolactone to optimize polymerization conditions (catalyst/temperature/solvent/reaction time).
- Determined reactivity ratio of monomer and studied transesterification by ¹³C NMR analysis.
- Used electro spinning technique for fabrication of highly aligned nano/microfiber scaffolds with different architecture and studied their degradation and mechanical properties.
- Collaborated and coordinated with postdoc and graduate students from other research groups.

Graduate Research Fellow
National Chemical Laboratory, Pune University
Supervisor: Dr. Raj Pal Singh

02/2003-11/2008
Pune, India

- Developed efficient thermo latent initiators and used for cationic polymerization of epoxy monomers for thermal curing applications.
- Investigated capability of benzophenone based allylic ammonium salt as one component addition-fragmentation-agent (cationic initiator cum free radical source) in photopolymerization ($\lambda > 290$ nm) of cyclohexene oxide, vinyl ethers and n-vinyl carbazole.
- Developed allylic amide based phosphonium salts as new curing agent in conjugation with photo- and thermal radical initiators in free radical promoted cationic polymerization.
- Studied thermal curing of bisphenol-A-type epoxides by differential scanning calorimetry (DSC) with a variety of thermolatent phosphonium salts.
- Demonstrated versatility in developing organic synthetic methodologies using synthetic/organic techniques (such as reflux, distillation, crystallization, isolation, purification, and characterization of products), optimization of reaction conditions, and handling of photo/air sensitive compounds.

ANALYTICALSKILLS

GPC, NMR, TGA, DSC, DMA, FT-IR, SEM, TEM, DLS, UV, LC-MS, HPLC, Rheometer, PS-3 peptide synthesizer, IVIS (fluorescence/luminescence), RT-PCR, gel electrophoresis, Bose Instron mechanical testing, flow cytometry, fluorescence spectroscopy, optical/confocal microscopy, electro spinning etc.

PUBLICATIONS

Peer Reviewed Journal Publications

1. MJ Uddin, TA Werfel, **MK Gupta**, LJ Marnett, and CL Duvall Targeted Visualization of Cyclooxygenase-2 in Inflammation and Cancer by Fluorocoxib A Encapsulating Nanoparticles, **2015**, (*Under communication*).
2. **MK Gupta**, SH. Lee, SW Crowder, CE. Nelson, CL Duvall, and HJ Sung, Oligoproline-Derived Nanocarrier for Dual Stimuli-Responsive Gene Delivery, *Journal of Materials Chemistry B*, **2015**, **3**, 7271 – 7280.
3. TC Boire*, **MK Gupta***, AL Zachman, SH Lee, DA Balikov, AP Marshall, R J Guzman, K Kim, and HJ Sung Tuning of Pendant allyl crosslinking as a tunable shape memory actuator for vascular applications, *Acta Biomaterialia* **2015**, **24**, 53-63 (***equal contribution**).
4. H Li, M Miteva, KC Kirkbride, MJ Cheng, CE Nelson, EM Simpson, **MK Gupta**, CL Duvall, and TD Giorgio Dual MMP7-Proximity-Activated and Folate Receptor-Targeted Nanoparticles for siRNA Delivery, *2014 Biomacromolecules* **2015**, **16** (1), 192-201.
5. M Miteva, KC Kirkbride, KV Kilchrist, TA Werfel, H Li, CE Nelson, **MK Gupta**, TD Giorgio, CL Duvall, Tuning PEGylation of Mixed Micelles to Overcome Intracellular and Systemic siRNA Delivery Barrier, *Biomaterials*, **2015**, **38**, 97-107.
6. KM Poole, RV Joshi, CE Nelson, JR Martin, **MK Gupta**, SC Haws, TE Kavanaugh, MC Skala, CL Duvall, ROS-Responsive Microspheres for On Demand Antioxidant Therapy in a Model of Diabetic Peripheral Arterial Disease, *Biomaterials* **2015**, **41**, 166-175.
7. **MK Gupta**, JR Martin, TA Werfel, T Shen, JM Page, and CL Duvall, Cell Protective, ABC Triblock Polymer-Based Thermoresponsive Hydrogels with ROS-Triggered Degradation and Drug Release *Journal of the American Chemical Society* **2014**, **136**, 14896–14902.
8. SH Lee, TC Boire, JB Lee, **MK Gupta**, AL Zachman, R Rath and HJ Sung, ROS-cleavable proline oligomer crosslinking of polycaprolactone for pro-angiogenic host response, *Journal of Material Chemistry B*, **2014**, **2**, 7109-16.
9. JR Martin, **MK Gupta**, A. Elizabeth, S Guelcher, CL Duvall, A Porous Tissue Engineering Scaffold Selectively Degraded by Cell-Generated ROS. *Biomaterials*, **2014**, **35**, 3766-3776.
10. CE Nelson, AJ Kim, EJ Adolph, **MK Gupta**, F Yu, KM Hocking, JM Davidson, SA Guelcher, CL Duvall. Tunable delivery of sirna from a biodegradable scaffold to promote angiogenesis in vivo. *Advanced Materials*, **2014**, **26**, 607–614.
11. CE Nelson, JR Kintzing, A Hanna, JM Shannon, **MK Gupta**, and CL Duvall Balancing Cationic and Hydrophobic Content of PEGylated siRNA Polyplexes Enhances Endosome Escape, Stability, Blood Circulation Time, and Bioactivity In Vivo, *ACS Nano*, **2013**, **7**, 8870–8880.
12. CE Nelson, **MK Gupta**, EJ Adolph, SA Guelcher, and CL Duvall. siRNA Delivery from an Injectable Scaffold for Wound Therapy, *Advances in Wound Care* **2013**, **2**(3), 93-99.
13. Sue Lee, **MK Gupta**, Hojae Bae and HJ Sung Current Progress in Reactive Oxygen Species (ROS)-Responsive Materials for Biomedical Applications *Advanced Healthcare Materials*, **2013**, **2**, 908–915.

14. **MK Gupta**, TA Mayer, CE Nelson, and CL Duvall Poly(PS-b-DMA) Micelles for Reactive Oxygen Species triggered drug release *Journal of Controlled Release*, **2012**, 162(3), 591-598.
15. SW Crowder, **MK Gupta**, LH Hofmeister, AL Zachman and HJ Sung Modular polymer design to regulate phenotype and oxidative response of human coronary artery cells for potential stent coating applications, *Acta Biomaterialia* **2012**, 8(2), 559-569.
16. CE Nelson, **MK Gupta**, EJ Adolph, SA Guelcher, and CL Duvall Sustained Local Delivery of siRNA from an Injectable Scaffold, *Biomaterials* **2012**, 33(4), 1154-61.
17. **MK Gupta**, JM Walthal, R Venkataraman, SW Crowder, DK Jung, SS Yu, X Wang, TD Giorgio, CC Hong, FJ Baudenbacher, AK Hatzopoulos, and HJ Sung Combinatorial Polymer Electrospun Matrices Promote Physiologically-Relevant Cardiomyogenic Stem Cell Differentiation, *PLoS ONE* **2011**, 6(12), e28935.
18. **MK Gupta**, RS Mehare and RP Singh Novel Addition Fragmentation Agent in Photo Cationic Polymerization, *Polymer Bulletin* **2010**, 65, 25-34.
19. **MK. Gupta** and RP Singh Novel dibenzocycloheptenyl phosphonium salts as thermolatent initiator in cationic polymerization, *Journal of Applied Polymer Science* **2009**, 112, 3707-3713.
20. **MK Gupta** and RP Singh, Novel allylic phosphonium salts in free radical accelerated cationic polymerization, *Polymer Bulletin* **2009**, 62, 271-280.
21. **MK. Gupta** and RP Singh Xanthenyl Phosphonium Salts as Thermo Latent Initiator for Cationic Polymerization of GPE, *Macromolecular Research* **2009**, 17(4), 221-226.
22. **MK Gupta** and RP Singh Cationic Polymerization of Epoxides using Novel Xanthenyl Phosphonium Salts as Thermo-latent Initiator, *Polymer Bulletin* **2008**, 60, 755-763.
23. S Fernandes, S Correia, I Matos, MM Marques, S Rana, B Kumar, **MK Gupta** and RP Singh Photodegradation of ethylene/propylene/polar monomers, and terpolymers, *Journal of Applied Polymer Science* **2007**, 104, 1783-1791.
24. **MK Gupta** and RP Singh Diphenyldiselenide as Novel Non-salt Photoinitiator for Photosensitized Cationic Polymerization of N-Vinyl Carbazole, *Macromolecular Symposia* **2006**, 240, 186-93.

Book Chapter/Patents

25. CL Duvall, **MK Gupta**, and JR Martin Injectable hydrogels *Patent Application No. VU12190US1 (2014)* (pending).
26. HJ Sung, TC Boire, **MK Gupta**, AL Zachman, SH Lee - Shape Memory Polymer Compositions and Methods of Use – (pending - US Patent application #61840449). US Provisional Patent Application 11672N/13162P/ VU13162P1.
27. HJ Sung, X Wang, **MK Gupta**, and TC Boire. Temperature-Responsive Polymer Compositions and Method of Use (pending) (PTO application # 62/027,706, July 22, **2014**). US Provisional Patent Application 11672N/13163P/VU13163P1.
28. CL Duvall, S Guelcher, CE Nelson, **MK Gupta**, and EJ Adolph, Delivery of siRNA from Polyurethane Composite *Patent Application No. VU12190US1 (2012)* (pending).
29. CL Duvall, CE Nelson, J Kintzing, JM Shannon, **MK Gupta**, SA Guelcher, EJ Adolph, JM Davidson. Polymeric nanoparticles comprising PEG-methacrylate block copolymers. PCT Int. Appl. (**2014**), WO 2014066912 A1 20140501.
30. CL Duvall, S Guelcher, **MK Gupta**, JR Martin, JM Page, Injectable, Poly(thioketal-urethane) scaffolds, PCT Int. Appl. (**2014**), WO 2014047524 A1 20140327.
31. R. Rath, **MK Gupta**, SW Crowder, and HJ Sung. Shape Memory Polymers for Vascular and Coronary Devices, edited by L'H Yahia and L Overend *Shape Memory Polymers for biomedical applications*, Part 3: Chapter 13, **2015**, 249-265, Woodhead Publishing, UK (In Press).
32. HJ Sung, LH Hofmeister, **MK Gupta**, SW Crowder, AL Zachman, SS Yu, DK Jung, Copolymers and Methods of use Thereof. US Patent Number 9,012,596, April 21, **2015**
33. **MK Gupta** and RP Singh "Cationic initiators in photocuring applications" edited by JP. Fouassier, *Basics and Applications of Photopolymerization Reactions*, Vol.1, Page 23, **2010**, Research Signpost, France.

HONORS

- Five Years Research Fellowship (June 2002) awarded by Council of Scientific and Industrial Research (CSIR), New Delhi, India.
- Best poster award on National Science Day (2008) organized at National Chemical Laboratory, Pune, India.
- Holding life membership of Society of Polymer Science (SPS), India.
- Nominated for prestigious 13th Royan International Research Award (2012) (PLoS ONE paper).
- Served as session moderator for polymer chemistry session III at SERMACS 2014 (An ACS Conference).
- Serving as reviewer for reputed chemistry and biomaterial journals (ACS, Wiley-VCH, Elsevier, RSC, etc.).

GRANT WRITING AND REVISION

NIH Super fund, R01, NSF grants applications.

EDITOR

Open Journal of Organic Chemistry

REVIEWER FOR JOURNALS

- ACS Applied Materials & Interfaces
- RSC Advances
- International Journal of Nanomedicine
- Journal of Applied Polymer Science
- Designed Monomers and Polymers
- Open Journal of Organic Chemistry
- Acta Biomaterialia
- Tissue Engineering Part A
- Nanotechnology, Science and Applications
- Materials Technology: Advanced Functional Materials
- Bioinspired, Biomimetic and Nanobiomaterials

REFERENCES

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