

Professor M. Santappa Award Lectures - 2025

AWARD LECTURE 1

Synthesis of High-Performance Norborene-Based Polymers via Cationic Polymerization

by
Prof. Priyadarsi De
IISER, Kolkata

Date: December 15, 2025 | Time: 11.50 am

Venue : MACRO-2025 at Staudinger Hall
IIT Kharagpur Research Park, Newtown, Kolkata

AWARD LECTURE 2

Biodegradable Block Copolymer Nanoarchitectures for Cancer Treatment

by
Prof. Manickam Jayakannan
IISER Pune

Date: December 15, 2025 | Time: 12.20 pm

Venue : MACRO-2025 at Staudinger Hall
IIT Kharagpur Research Park, Newtown, Kolkata

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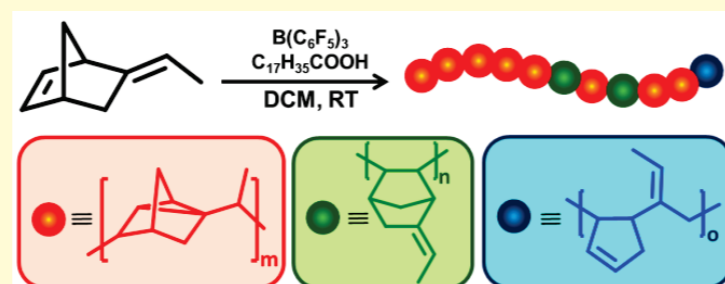


The Society for Polymer Science, India

AWARD LECTURE 1

Abstract

In recent years, norbornene-derived polymers have garnered increasing attention in both academic and industrial settings due to their excellent mechanical strength, thermal stability, low birefringence, desirable membrane characteristics, and high optical transparency.¹ These polymers can be synthesized through various pathways,² among which cationic polymerization remains relatively underexplored.³ In this study, we investigate the cationic polymerization of norbornene derivatives, catalyzed by $B(C_6F_5)_3$ under modified reaction conditions (see Scheme). While previous reports commonly employed toluene as the solvent and octanoic acid as the co-initiator, our approach utilizes dichloromethane (DCM) and stearic acid, leading to a marked improvement in monomer conversion and polymer yield. The superior performance observed in DCM is likely due to enhanced stabilization of the active cationic species, while the increased steric bulk of stearic acid appears to reduce chain transfer and termination, enabling more controlled polymer growth.⁴ These findings highlight the critical influence of solvent polarity and co-initiator structure on the efficiency of cationic polymerization and present a promising strategy for optimizing the synthesis of high-performance norbornene-based polymers.



References:

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About the speaker

Dr. Priyadarsi De is a Professor in the Department of Chemical Sciences at the Indian Institute of Science Education and Research (IISER) Kolkata, with affiliations to the Polymer Research Centre and the Centre for Advanced Functional Materials. He obtained his Ph.D. in Polymer Chemistry from the Indian Institute of Science (IISc), Bangalore, and carried out postdoctoral research in the United States before joining IISER Kolkata, where he has progressed through Assistant and Associate Professor roles to full Professorship. His research interests encompass controlled and living polymerization (including RAFT), functional and stimuli-responsive polymers, polymeric sensors, nanomaterials, and bio-related polymeric systems, with applications in sensing, healthcare, and advanced materials. Dr. De has published extensively in high-impact international journals, authored book chapters, holds patents, and has been recognized as a highly cited researcher in polymer science. He is a Fellow of the Indian Academy of Sciences (IACS), has received several prestigious national and international awards, serves on editorial and advisory boards of reputed journals, and has been the recipient of competitive research grants. An active mentor, he has supervised numerous Ph.D. and postgraduate students and continues to contribute significantly to the advancement of polymer science through research, teaching, and professional service.



AWARD LECTURE 2

Abstract

Polymeric nanomaterials are emerging as important platform in biomedical research for drug delivery in cancer treatment. Structural engineering of polymeric biomaterials is still a challenging task specifically to overcome the tightly regulated biological conditions to delivery therapeutic drugs for solid tumor suppression in cancer research. Conventional polymer nanocarriers are predominantly multi-molecular (or many chain) nano-assemblies; thus, their aggregated micelle nanoparticles often exhibit premature disassembly in the bloodstream followed by the dilution imposed on them during IV injections. Further, the nano-assemblies are exposed to stress by the cardiac pumps and also by the renal filtration apparatus in kidney from the point. Therefore, the next generation nanocarriers are mandatorily designed to be substantially stable to evade disassembly in body fluids in vivo, tiny-size sub-nanometer size-objects for penetrating the hard-tumor, high drug loading content, and most importantly biodegradable under physiological conditions for safe administration. Efforts have been taken in our lab to design and develop fully biodegradable polycaprolactone based linear block copolymers for delivering clinically important anticancer drugs DOX and cisplatin in-vitro.1-2 We have noticed that tweaking the topology of the linear and branched macromolecular architectures was found to be very crucial factor in designing the nanocarriers, particularly single polymer chain nano-vectors like unimolecular micelles to impart stability against concentration gradient for their successful action under in-vivo. For this purpose, hydrophobic polycaprolactone (PCL) and carboxylic substituted hydrophilic PCL segments were chosen core and shell, respectively, in star-block copolymer design to get the right polymer geometry for unimolecular micellar self-assembly in water. The tailor-made star-block copolymers provided well-defined core-shell unimolecular micelle nanoparticles for high drug loading (14 %) and also maintain the drug NP against concentration gradient in the bloodstream.3 Auto-degradation or self-immolative polymer concept is also imbibed to maximize the synergistic stimuli-responsiveness at the intracellular level for drug delivery.4 The star unimolecular micelle nanoparticle platform was found to be non-toxic, non-hemolytic and antifouling, and also exhibited excellent drug action in multiple cancer cell lines at substantially low IC50 values. The unimolecular micelle platform is further validated for solid tumor suppression in Pancreatic cancer tumor-bearing mice model.5 Currently efforts are taken to expand the scope of the scaffolds to breach blood brain barrier for the treatment of glioblastoma (brain tumor). Our efforts open new avenues for unimolecular micelle nanopatform in drug delivery, and the presentation will provide detail account on our contribution in this field.

References

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2. B. Surnar, M. Jayakannan, *Biomacromolecules*, 2016, 17, 4075-4085.
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4. S. Pathan, M. Jayakannan, *Advanced Healthcare Materials*, 2024, 13, 2304599
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About the speaker

Manickam Jayakannan (JK) is a professor at the Department of Chemistry, Indian Institute of Science Education and Research, Pune (IISER-Pune). He received his Bachelor and Master degrees in chemistry from Madurai Kamaraj University, and his Ph.D. from Indian Institute of Science, Bangalore (Professor S. Ramakrishnan's group, in Polymer Chemistry). After completing his post-doctoral work (in Prof. Rene A. J. Janssen's group) at Eindhoven University of Technology, The Netherlands; he returned to India and had a short stint as a polymer scientist in the JFWTC-GE Global Research in Bangalore. He began his independent career as a scientist at CSIR-NIIST Trivandrum and then moved to IISER-Pune to embark on the journey in the new academic institute. He held the position of chair, chemistry (HOD) and currently continuing as a Professor in the same institute. His group has immensely contributed to the development of synthetic polymer nanomaterials for biomedical application in cancer and antimicrobial research. His group has published more than 115 papers in reputed international journals. His research contribution has been recognized both at national and international level. He has served as an Editorial Advisory Board member in *Biomacromolecules*, *ACS Applied Polymer Materials*, *ACS Polymers Au* and newly launched journal: *RSC Applied Polymers*.



About Professor M.Santappa

Mushi Santappa born on October 2, 1923, obtained his BA (Chemistry) in 1943 from the University of Madras. He did his MSc (Chemistry) in 1946 from Banaras Hindu University. He obtained PhD (Organic Chemistry) in 1949 from University of London under the guidance of R.W. West followed by a second PhD (1951) in 'physical chemistry of high polymers' from Manchester University. Upon his return to India he joined the University of Madras (1952) as a Reader in Physical Chemistry and became a Professor in 1958. He served as Director, Central Leather Research Institute (CSIR-CLRI) from 1972-78. Subsequently he served as Vice-Chancellor of



SV University, Tirupathi (1979-81) as well as the University of Madras (1981-84). He was conferred honorary DSc from Andhra, Madras, Sri Krishna Devaraya and Madurai Kamaraj Universities and honorary DLitt from Gulbarga University.

Professor Santappa published over 350 papers in peer-reviewed journals and guided 59 PhD students. He was awarded the S.S. Bhatnagar Prize for Chemical Sciences (1967), the Sir JC Ghosh Memorial Medal of Indian Chemical Society (1982), and the FICCI Award for Science and Technology (1985). He was elected Fellow of the Indian Academy of Sciences, Bangalore, National Academy of Sciences (India), Allahabad and the Indian National Science Academy, New Delhi.

Professor Santappa was initiated into the study of kinetics of vinyl polymerization as a PhD student working with Professor Meredith G. Evans, FRS (1904-1952) at the University of Manchester in the years between 1948 and 1951. Professor Evans, an early pioneer in the study of chemical kinetics, turned to the study of electron transfer reactions involving ferrous ions and hydrogen peroxide (Fenton reagent) and their ability to polymerize methyl methacrylate in aqueous emulsions Professor Evans elucidated the kinetics and mechanism of this reaction and further proposed that UV and visible light can promote internal electron transfer and, thus, vinyl monomers can be polymerized under the influence of light (photo polymerization). Professor Santappa's PhD work concerned photo-initiated free radical polymerization of vinyl monomers. Upon his return to India Professor Santappa built an active school of research on the study of kinetics of vinyl polymerization. Beginning in 1955 he published a series of over 150 papers on kinetics and mechanism of vinyl polymerization and determination of initiation rates and chain transfer constants for a host of initiators and vinyl monomers. Along with Professor Santi R. Palit at the Indian Association for the Cultivation of Science, Professor Santappa, established the first rigorous school for polymer science research in India and trained a whole generation of polymer chemists who went on to practice the discipline with great distinction. Professor Santappa brought great visibility to Indian polymer research for about three decades. In 1983, he organized India's first ever IUPAC sponsored International Symposium on Polymers at Madras (Chennai). In 1996 he authored a book which comprehensively reviewed the status of polymer science in India

About Professor M. Santappa Award

The Award was instituted by the Society for Polymer Science, India, in 1988 to honour Professor Mushi Santappa, a distinguished physical chemist and a pioneer in polymer science research in India. Professor Santappa was the founder of the Department of Physical Chemistry, University of Madras. Under his dynamic leadership and erudite scholarship, the Department became of hub of polymer science research in the period 1952-1970.

The award is given biennially by the Society to distinguished scientists for outstanding research contributions made in India during the ten years preceding the year of the award in the field of Polymer Science.

Prof. Santappa Award Winners of The Society for Polymer Science, India

- 1988 Dr. V. M. Nadkarni, National Chemical Laboratory, Pune
- 1988 Dr. S. Sivaram, National Chemical Laboratory, Pune
- 1991 Prof. Ashok Misra, Indian Institute of Technology, New Delhi
- 1998 Prof. B. M. Mandal, IACS, Kolkata
- 2004 Prof. A.K.Nandi, IACS, Kolkata
- 2006 Dr. C. P. Raghunadan Nair, VSSC, Thiruvananthapuram
- 2006 Dr. P. P. Wadgaonkar, National Chemical Laboratory, Pune
- 2010 Dr. Pralay Maiti, Banaras Hindu University, Varanasi
- 2014 Dr. Nikhil K. Singha, Indian Institute of Technology, Kharagpur
- 2017 Prof. Giridhar, Madras Indian Institute of Science, Bangalore
- 2018 Prof. Tarun K. Mandal, IACS, Kolkata, India
- 2020 Prof. Niranjana Karak, Tezpur University
Dr. Prakash D. Trivedi, Gharda Chemicals
- 2023 Prof. Susanta Banerjee, IIT, Kharagpur
Prof. Suhrit Ghosh, IACS Kolkata