

KAPIL DEV SAYALA

Address

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Education

- 2017-** Southern Methodist University (SMU), Dallas, USA
Ph.D., Chemistry (Department of Chemistry)
Thesis: "Benziodazolotetrazoles and Benziodoxoles: Applications in Materials Science"
Advisor: Prof. Nicolay V. Tsarevsky
- 2012-2017** Indian Institute of Science Education and Research Kolkata (IISER-K), Mohanpur, India
B.S-M.S., Chemical Sciences (Department of Chemical Sciences)
Thesis: "Water-Soluble Weak-link Polysulfide Polymers via Interfacial Polycondensation Polymerization: Synthesis, Characterization, Thermal Degradation Studies and Applications"
Advisor: Prof. Priyadarsi De

Awards and Honors

- 2021** Department of Chemistry Citizenship Award (in recognition of leadership, character and scholastic achievement), SMU, Dallas, TX
- 2021** First Place, ACS-DFW Meeting in Miniature (Inorganic Division), University of Texas at Dallas, Dallas, TX
- 2019** First Place, ACS-DFW Meeting in Miniature (Polymer/Materials), University of North Texas, Denton, TX
- 2019** Best Poster, Symposium on Polymer Science, Society for Polymer Science India, IISER-K, Mohanpur
- 2016-2017** Undergraduate Teaching Assistanship, Department of Chemical Sciences, IISER-K, Mohanpur
- 2015** Undergraduate Summer Research Internship Grant, Biopharmaceutical Technology Unit, Ghent University
- 2012-2017** Innovation in Science Pursuit for Inspired Research (INSPIRE) Fellowship. Awarded by Government of India to top 1% students in high school from each state to pursue higher education (BS, MS) in basic sciences.

Research Experience

Graduate Researcher in Tsarevsky Research Group 2017 – Present
Department of Chemistry – Southern Methodist University

Benziodazolotetrazoles and Benziodoxoles: Synthesis, Reactivity Studies and Structural Aspects
(in collaboration with Professor Tomce Runcevski and Professor Elfi Kraka, Southern Methodist University)

- Developed a new family of cyclic hypervalent(HV) iodine compounds, including few energetic ones with potential application in defense/military sector and contributed to the understanding behind the stability of novel and historically notorious hypervalent iodine compounds.
- Investigated structure-property relationships of several alkoxy benziodoxoles, benziodazolotetrazoles and assessed their potential to serve as energetic materials with the assistance of thermal (TGA-DSC), X-ray diffraction, vibrational spectroscopy, and density functional theory.

Branched Polyacrylates via Self Condensing Vinyl Polymerization of Cyclic Hypervalent Iodine(III) based Inimers

- Synthesized hydrolytically stable cyclic HV iodine(III) compounds (benziodoxoles), with hydroxyl ethyl methacrylate and acrylate ligands that served as inimers. Conditions that enhanced their efficiency as initiators were discovered, designed through structural (crystal and thermal) analysis.
- Performed photopolymerization (by circumventing the issue of crosslinking/gelation, as in the case of acyclic hypervalent iodine analogs) to prepare branched homo and copolymers.

Functionalization of cis-1,4-Polyisoprene (Natural Rubber) with Hypervalent Iodine(III) Compounds

- Co-developed an efficient functionalization strategy for cis-1,4-Polyisoprene using HV iodine(III) reagents to introduce tetrazole and iodine functionalities onto the backbone. This strategy by-passed the traditional drawbacks involved in rubber functionalization (degradation and crosslinking) and led to an international collaboration with rubber engineers for investigating their potential as adhesives.
- Grafted PEG groups onto rubber backbone by exploiting iodine functionality, click chemistry to make brush copolymers.

- Performed thermal analysis (TGA, DSC) of functionalized natural rubber containing tetrazoles, and fluorine-rich molecules. Studies were extremely useful in interpreting energetic nature (tetrazoles) of functionalized polymers.

Design and Development of Experiments for Undergraduate Teaching Laboratory Course(Advanced Inorganic Chemistry)

- Designed laboratory experiments elucidating the concepts of chemical kinetics and equilibrium through reactivity studies of HV iodine(III) compounds.
- Demonstrated the use of concept and tool, quantitative NMR spectroscopy to sophomore, senior undergraduate students for measuring rate and equilibrium constants.

Undergraduate Researcher in Priyadarsi De Research Group

2015 – 2017

Department of Chemical Sciences - Indian Institute of Science Education and Research Kolkata

Weak-Link Polysulfide Polymers via Interfacial Polycondensation Polymerization (MS thesis)

- Synthesized water-soluble polysulfide polymers by employing phase-transfer catalyst and tested its potential as gold nanoparticle stabilizer.
- Studied the thermal degradation behavior/pattern of the polymers with the help of TGA, DSC and EI-MS.

Miscellaneous Undergraduate Projects

- Synthesized amino acid tethered methacrylate monomers and performed RAFT homo and co-polymerization.
- Synthesized fatty acid and amino acid containing random co-polymer gels by RAFT. Calculated swelling ratios in organic solvents and water.
- Synthesized biodegradable cross-linked polyesters by melt condensation and studied controlled release of salicylic acid. (Summer Internship 2014, IISc Bangalore).
- Synthesized acid-degradable polymer microspheres by spray-drying. (Summer Internship 2015, Ghent University, Belgium).

Leadership, Outreach and Mentoring

- 2021, 2019** Judge, Dallas Regional Science and Engineering Fair
- 2020-** Vice President and Social Media Manager, Chemistry Graduate Council, Department of Chemistry, SMU
- 2020-** Co-organizer of SMU Chemistry Graduate Seminar Series, Department of Chemistry, SMU
- 2020** Established academic collaboration with prestigious chemistry R&D software company Advanced Chemistry Development, Inc., (ACD/Labs)
- 2018** Volunteer, Comet Chemistry Camp, Dept. of Science/Mathematics Education, University of Texas at Dallas
- 2019-** Conducted Undergraduate ATRP and Hypervalent Iodine Labs, Advanced Inorganic Lab Course, SMU
- 2017-** Laboratory, Social Media and Website Manager, Tsarevsky Group, SMU

Courses Taught

1. *Teaching Assistant, Physical Chemistry Lab*: Autumn **2016**, Department of Chemical Sciences, IISER-K
2. *Teaching Assistant, Advanced Physical Chemistry Lab*: Spring **2017**, Department of Chemical Sciences, IISER-K
3. *Teaching Assistant, General Chemistry Lab*: Fall **2017**, Department of Chemistry, SMU
4. *Teaching Assistant, Preparatory Chemistry Lab*: Spring **2018**, Department of Chemistry, SMU
5. *Teaching Assistant, Advanced Inorganic Chemistry Lab*: Fall **2019-Present**

Skills

Areas of interest/research keywords: Polymer chemistry, small molecule synthesis, crystallization, functionalization of natural and synthetic polymers, energetic materials, hypervalent iodine, branched polymers, aqueous-soluble polymers, stimuli-responsive polymers, copolymerization, polymer zwitterions, interfacial polymerization, organo and hydrogels, step-growth polymerization, spray-drying, melt condensation polymerization, controlled release studies, structure-property relationship, Reversible addition-fragmentation chain-transfer polymerization (RAFT), Atom transfer radical polymerization (ATRP), Free radical polymerization (FRP) and Chemical Education.

Spectroscopy: NMR, FT-IR, UV-Vis, GC-MS and ESI-MS

Scattering: DLS, MALS

Diffraction: PXRD (beginner level)

Thermal characterization: TGA and DSC

Chromatography: TLC, PTLC, Column, GC and SEC (GPC)

Software/Computer skills: ChemDraw, SciFinder, OriginPro, Mestre Nova, ACD/Labs Workbook Suite, Mercury, EndNote, Microsoft Office, Web of Science

List of Publications

Peer-reviewed journal research papers

1. Yannacone, S., Sayala, K. D., Freindorf, M., Tsarevsky, N. V., Kraka, E., “Vibrational Analysis of Benziadoxoles and Benziadazolotetrazoles”, *Physchem.*, **2021**, 1, 45-68 (dx.doi.org/10.3390/physchem1010004)
2. Cao, Y., Sayala, K. D., Gamage, P. L., Kumar, R., Tsarevsky, N. V., “Synthesis of Fluorine-Containing Polymers by Functionalization of cis-1,4-Polyisoprene with Hypervalent Iodine Compounds”, *Macromolecules.*, **2020**, 53, 18, 8020-8031 (dx.doi.org/10.1021/acs.macromol.0c00617)
3. Kumar, R., Sayala, K. D., Cao, Y., Tsarevsky, N. V., “Functionalization of Cis-1,4-Polyisoprene Using Hypervalent Iodine Compounds with Tetrazole Ligands”, *J. Polym. Sci.*, **2020**, 58, 172-180 (dx.doi.org/10.1002/pola.29500)
4. Vaish, A., Sayala, K. D., Tsarevsky, N. V., “N-heterocycle (Tetrazole)-Stabilized Pseudocyclic λ^3 -Iodane: Synthesis and Reactivity”, *Tetrahedron Lett.*, **2019**, 60, 150995 (dx.doi.org/10.1016/j.tetlet.2019.150995)
5. Haldar, U., Sayala, K. D., Sivaprakasam, K., Ramakrishnan, L., De, P., “Interfacial polycondensation-derived side-chain poly(ethylene glycol)-containing water-soluble polysulfide weak-link polymers as stabilizer for gold nanoparticles”, *React. Funct. Polym.*, **2017**, 115, 10-17 (dx.doi.org/10.1016/j.reactfunctpolym.2017.03.015)
6. Bauri, K., Sayala, K. D., Roy, R. S., De, P., “Chiral copoly(methacrylate)s carrying amino acid pendants in the side-chains”, *Eur. Polym. J.*, **2015**, 73, 237-246 (doi.org/10.1016/j.eurpolymj.2015.10.017)

Manuscripts in pre-print

1. Kumar, R#, Sayala, K. D#., Camdzic, L., Siegler, M. A., Vaish, A., Tsarevsky, N. V., “Heterocyclic Hypervalent Iodine(III) Compounds with Fused Benziadazole and Tetrazole Rings (I-Substituted Tetrazolo[1,5-b][1,2]Benziadazoles)”, *ChemRxiv.*, **2020**. # co-first author (dx.doi.org/10.26434/chemrxiv.13363496.v1)

Peer-reviewed book chapters

1. McLeod, D. C., Sayala, K. D., Tsarevsky, N. V., “Insights into the Reactivity of Epoxides as Reducing Agents in Low-Catalyst-Concentration ATRP Reactions”, in *Reversible Deactivation Radical Polymerization: Mechanisms and Synthetic Methodologies (ACS Symposium Series 1284)*, Matyjaszewski, K., Gao, H., Sumerlin, B. S., Tsarevsky, N. V., Eds., Washington, D.C., **2018**, Ch. 8, pp. 191-203 (dx.doi.org/10.1021/bk-2018-1284.ch008)

Conferences and Symposia: Presentations and Posters (Selected)

1. Sayala, K. D., Kumar, R., Camdzic, L., Tsarevsky, N. V., “Benziadazolotetrazoles as Novel Class of Energetic Compounds”, 53rd ACS DFW Meeting-in-Miniature, May 1, **2021**, UTD, Dallas, TX (virtual)
2. Sayala, K. D., Tsarevsky, N. V., “Hypervalent Iodine Compounds in Materials Science”, ACD/Labs Academic Symposium, Virtual, April 21, **2021**, *invited talk* (virtual)
3. Sayala, K. D., Kumar, R., Tsarevsky, N. V., “Cyclic Hypervalent Iodine(III) Reagents as Inimers for the Synthesis of Branched Polymers”, Symposium on Polymer Science, July 5-6, **2019**, IISER-K, Mohanpur, India
4. Sayala, K. D., Kumar, R., Cao, Y., Tsarevsky, N. V., “Chemical Modification of Polyisoprene Using Hypervalent Iodine Reagents”, 52nd ACS DFW Meeting-in-Miniature, April 27, **2019**, UNT, Denton, TX
5. Sayala, K. D., Kumar, R., Cao, Y., Tsarevsky, N. V., “Chemical Modification of Polyisoprene Using Hypervalent Iodine Reagents”, 15th International Conference on Polymer Science and Technology SPSI-MACRO-2018, December 19-22, **2018**, Pune, India
6. Sayala, K. D., Haldar, U., De, P., “Water-soluble Polysulfide Weak-link Polymers as Stabilizer for Gold Nanoparticles”, 14th International Conference on Polymer Science and Technology SPSI-MACRO-2017, January **2017**, Trivandrum, India

Membership in Professional Societies

- American Chemical Society (ACS 2018-19)