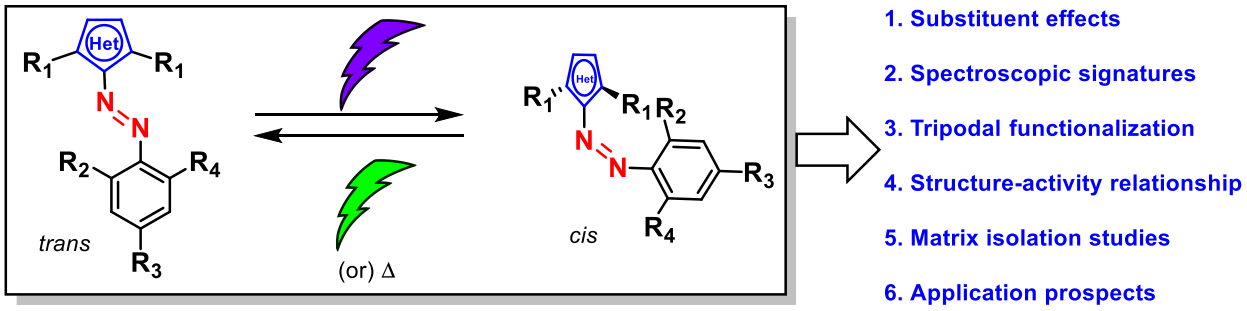
Azoheteroarene Photoswitches: The Challenges, Structure-Property Relationships and Applications Prospects

Sugumar Venkataramani*
Department of Chemical Sciences
Indian Institute of Science Education and Research Mohali
(E-mail: sugumarv@iisermohalia.ac.in)

Abstract:
Azoarenes are interesting molecular systems, which have been known for more than a century. However, their light-driven *trans-cis* isomerization processes, discovered in 1936, transformed the status of these molecules into photoswitches. The *trans* isomer is thermodynamically stable and converted into a *cis*-isomer through irradiation at an appropriate wavelength. However, reverse isomerization can be induced either by light or under thermal conditions. Despite extensive studies on azoarenes through experiments and theory, the introduction of heterocycles, in particular, five-membered in the azoarenes, led to a renaissance in this field.[1] The azoheteroarenes with varying heterocycles show excellent bidirectional photoswitching and tunable thermal half-lives. Taking advantage of such salient features, we have studied the substituent effects at the fundamental point of view,[2,3] and made conceptual designs towards specific application prospects such as tuning reaction rates,[4] on-off properties of liquid crystals,[5] etc. Apart from that, we are also attempting at the structure-property relationship for future designs and bringing tunability.[6] In this regard, the recent progress in our group and significant contributions on azoheteroarene photoswitches will be presented.



Scheme 1. Reversible photoswitng in azoheteroarenes and research activities

References and Notes:

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6. Unpublished results and submitted manuscripts.

Bio-Sketch of Speaker

Dr. Sugumar Venkataramani
Associate Professor

Department of Chemical Sciences
Indian Institute of Science Education and Research Mohali

Contact Number: 9915323141
e-Mail: sugumarv@iisermohalia.ac.in

Homepage: https://sites.google.com/site/sugumarvenkataramani/home

Dr. Sugumar Venkataramani is a physical organic chemist mainly working in photochemistry, reactive intermediates, unstable compounds, and understanding reaction mechanisms using spectroscopy and DFT computations. He has trained in matrix isolation infrared spectroscopy and photochemistry during his doctoral studies. He completed his Ph.D. in 2007 in the group of Prof. Wolfram Sander at Ruhr University Bochum, Germany. Then he had an Alexander von Humboldt postdoctoral stint in the group of Prof. Rainer Herges, University of Kiel, Germany, where he worked on the magnetic spin-state switching. Before joining IISER Mohali, he also had an industrial stint in the development of betalactam based antibiotics at Orchid Pharmaceuticals R&D Centre, Chennai. Subsequently, he joined IISER Mohali in 2013 and started working in the areas of azoheteroarene based photoswitchable systems. Specifically, his group is working on understanding their properties, substituent effects, and tuning photoswitching and stability aspects. Besides, developing a novel functional molecular system with light control is yet another goal. In the meantime, a matrix isolation infrared spectroscopy has been set up, through which investigations on reactive intermediates and unstable compounds are ongoing. Since joining IISER Mohali, the group's research contributions have been published in many journals, including *Chem. Eur. J.*, *J. Org. Chem.*, *Org. Biomol. Chem.*, *ChemPhotoChem*, *J. Phys. Chem. A*, *PCCP*, and *Cat. Sci. Technol.*, and *Chem. Sci.* through independent and collaborative research projects.