N. D. PRADEEP SINGH

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PERSONAL PERFORMA

Date of Birth: 05/08/1974

Sex: Male

Nationality: Indian

ACADEMIC POSTIONS

- Jul 2013- Present: **Associate Professor**, Department of Chemistry, Indian Institute of Technology Kharagpur, India
- Jul 2007- Jun 2013: **Assistant Professor,** Department of Chemistry, Indian Institute of Technology Kharagpur, India
- Nov 2005-May 2007: **Postdoctoral Fellow**, University of Leeds, Leeds, UK
- Jan 2002-Jan 2005: **Postdoctoral Fellow,** University of Cincinnati, Ohio, US

EDUCATION

- Ph.D. in Chemistry, University of Madras, Chennai, 1997- 2001.
  Thesis title: Photochemical Studies on Azadirachtins and Related Bioactive Limonoids.

  Advisor: Dr. Geetha Gopalakrishnan.

- M.Sc. in Chemistry, University of Madras, Chennai, 1994-1996.
  Thesis title: Studies on Baylis-Hillman reaction.

  Advisor: Dr. A. Anandhan.

- B.Sc. in Chemistry, University of Madras, Chennai, 1991-1994.

RESERCH INTEREST

- Fluorescent photoresponsive nanocarriers for simultaneous cell imaging and drug delivery
- Functional group photolithograhy and its applications for biosensing

- Photoinduced DNA cleaving agents
- Development of new photoacid generators for surface modification
- Development of novel light induced formulation for controlled release of agrochemicals

RESEARCH EXPERIENCE

Postdoctoral Research: Self Organising Molecular Systems (SOMS), Chemistry Department, University of Leeds, Leeds, UK. (Research advisor: Prof. Richard Bushby)

- Showed photopatterning of self assembled monolayers (SAMs) can be achieved using soft UV light by incorporating photoremovable protecting groups.

- Demonstrated the applications of the above templates for attaching DNA, for controlled calcite crystal formation, and to produce molecular functional group gradient using a variable density filter.

- Created supported bilayer lipid membrane arrays on photopatterned SAMs of cholesterol derivatives.

- Generated SAMs of three component surface functionalities by combining microcontact print and soft UV photopatterning technologies.

***Postdoctoral Research*:** Jan 2002-Jan 2005 Organic Division, Chemistry Department, University of Cincinnati, Ohio, US. (Research advisor: Prof. Anna D. Gudmundsdottir)

- Designed and synthesized azido carbonyl compounds, vinyl azides and azido formates to study the formation, detection and stability of triplet alkyl nitrene intermediates by photolysis using intra and inter molecular energy transfer.

- Experienced in directly detecting triplet alkyl nitrenes using laser flash photolysis and further characterization with argon matrix isolations including isotope labeling and molecular modelling studies.

- Showed crystal lattice facilitates the formation of triplet alkyl nitrenes on irradiating crystals of azides, further it has been studied how the distance and angles between reaction centers in crystals affect the rate of solid state reactions.

- Succeeded in designing photoremovable protecting groups that will release alcohols slowly upon exposure to light, making them ideal for slow fragrance release, Further the reaction mechanism for the release of the alcohol has been elucidated by the time-resolved laser flash photolysis.

***Doctoral Research*:** Center for Natural Products, Spic Science Foundation, University of Madras, Chennai, India, 1997-2001 (research advisor: Dr. Geetha Gopalakrishnan.)

- Showed selective photo-oxidation of tetranortriterpenoid involving singlet oxygen resulted in enhanced insecticidal activity and interestingly found that tetranortriterpenoid itself can act as singlet oxygen sensitizer.

- Systematic study on photodegradation of potent antifeedant from neem, Azadirachtin-A, in the presence of sunlight and UV light under different pH and organic solvents were carried out. The studies revealed that Azadirachtin-A is stable in neutral pH and in alcoholic solvents.

- Knowledge in selection of suitable ultraviolet stabilizer for natural products formulations and succeeded in process development and preparation of ultraviolet stabilizer for insecticidal-based neem formulations.

- Experienced in isolation and characterization of triterpenoids such as Azadirachtin-A, B, C, D and E, Salanin, Nimbin, Azadiradione, Epoxyazadiradione from kernels of *Azadirachta indica*. Nimonol and Isomeldinin from leaves of *Azadirachta indica*, Cedrolene from *Toona cilita* and Swietenine from *Switenine mahogany*. (Under the Guidelines of Prof. T. R. Govindachari.).

Awards and Honours

- Associate of the Indian Academy of Sciences (2009)
- Indo-UK Science network Programme (RSC- 2009)
- DST-RSC, Indo-UK Scientific Seminar (2015)

SPONSORED PROJECTS

- Generation and applications of photoaddressed surfaces- DST **(50 lakhs)**
- New Functional group photolithography methods to pattern self assembled monolayers (SAM's) – DST Fast Track Scheme **(17 lakhs)**
- New photoremovable protecting groups for self assembled monolayers (SAM's)-ISIRD, SRIC, IIT-Kharagpur **(5 lakhs)**
- Micro/Nano manufacturing and characterization facility for robotics in Nano-scale manipulation(ARS) ISIRD, SRIC, IIT-Kharagpur **(10 crores)**

GUIDANCE (Ph.D COMPLETED)

Sl	Level	Title of Project	Name of Student	Year
1	Ph.D.	Fluorescent photoremovable protecting groups: Design, development and biological application	Avijit Jana	Aug, 2012
2	Ph.D.	Newly developed non-ionic photoacid generators and their applications	Mohammed Ikbal	Jan, 2013
3	Ph.D.	Design and development of small organic molecules as photoinduced DNA cleaving agents	Nilanjana Chowdhury	Apr, 2013
4	Ph.D.	Photoremovable protecting groups based delivery device for controlled release of agrochemicals	Sanghamitra Atta	Aug, 2013

GUIDANCE (Ph.D in progress)

- **10 Ph.D** students are working

GUIDANCE (M.Sc COMPLETED)

- **10 Master students** Completed

List of Publications

1. Shrabani Barman, Sourav K. Mukhopadhyay, Sandipan Biswas, Surajit Nandi, Moumita Gangopadhyay, Satyahari Dey, Anakuthil Anoop, N. D. Pradeep Singh , A p-Hydroxyphenacyl–Benzothiazole–Chlorambucil Conjugate as a Real-Time-Monitoring Drug-Delivery System Assisted by Excited-State Intramolecular Proton Transfer, ***Angew. Chem. Int. Ed.*** **2016**, 55, 1–6.

2. Moumita Gangopadhyay, Sourav K. Mukhopadhyay, Sree Gayathri, Sandipan Biswas, Shrabani Barman, Satyahari Dey and N. D. Pradeep Singh **,** Fluorene–morpholine-based organic nanoparticles: lysosome-targeted pH-triggered two-photon photodynamic therapy with fluorescence switch on–off, ***J. Mater. Chem. B***, **2016**, 4, 1862-1868.

3. Amrita Paul, Avijit Jana, S. Karthik, Manoranjan Bera, Yanli Zhao and N. D. Pradeep Singh, Photoresponsive real time monitoring silicon quantum dots for regulated delivery of anticancer drugs, ***J. Mater. Chem. B,*** **2016,** 4, 521-528.

4. Sanghamitra Atta, Amrita Paul, Rakesh Banerjee, Manoranjan Bera, Mohammed Ikbal, Dibakar Dhara and N. D. Pradeep Singh, Photoresponsive polymers based on a coumarin moiety for the controlled release of pesticide 2,4- D, ***RSC Adv.,*** **2015**,5, 99968-99975.

5. Sanghamitra Atta, Manoranjan Bera, Tirthartha Chattopadhyay, Amrita Paul, Mohammed Ikbal, Mrinal K. Maiti, N. D. Pradeep Singh**,** Nano-pesticide formulation based on fluorescent organic photoresponsive nanoparticles: for controlled release of 2,4-D and real time monitoring of morphological changes induced by 2,4-D in plant systems, ***RSC Adv.*, 2015**, 5, 86990-86996**.**

6. Sk. Sheriff Shah, S. Karthik and N. D. Pradeep Singh**,** Vis/NIR light driven mild and clean synthesis of disulfides in the presence of $Cu_2(OH)PO_4$ under aerobic conditions, ***RSC Adv.*, 2015**, 5, 45416-45419.

7. Sandipan Biswas, Moumita Gangopadhyay, Shrabani Barman, Jit Sarkar, N.D. Pradeep Singh, Simple and efficient coumarin-based colorimetric and fluorescent chemosensor for F- detection: An ON1-OFF-ON2 fluorescent assay, ***Sensors and Actuators B: Chemical*, 2015**, 222, 823-828.

8. Moumita Gangopadhyay, Tanya Singh, Krishna Kalyani Behara, S. Karwa, S. K. Ghosh and N. D. Pradeep Singh, Coumarin-containing-star-shaped 4-armpolyethylene glycol: targeted fluorescent organic nanoparticles for dual treatment of photodynamic therapy and chemotherapy**, *Photochem. Photobiol. Sci.*, 2015**, 14, 1329-1336.

9. Shrabani Barman, Sourav K. Mukhopadhyay, Moumita Gangopadhyay, Sandipan Biswas, Satyahari Dey and N. D. Pradeep Singh, Coumarin–benzothiazole–chlorambucil (Cou–Benz–Cbl) conjugate: an ESIPT based pH sensitive photoresponsive drug delivery system, ***J. Mater. Chem. B***, **2015**, 3, 3490-3497.

10. Moumita Gangopadhyay, Sourav K. Mukhopadhyay, Karthik S, Sharabani Barman and Pradeep N.D. Singh, Targeted Photoresponsive TiO_2-Coumarin nanoconjugate for efficient Combination therapy in MDA-MB-231 breast cancer cells: Synergic effect of Photodynamic Therapy (PDT) and Anticancer drug Chlorambucil, ***Med. Chem. Commun.*, 2015,** 6, 769–777.

11. S. Karthik, B. N. Prashanth Kumar, Moumita Gangopadhyay, Mahitosh Mandal and N. D. Pradeep SinghTargeted, Image Guided & Dually Locked Photoresponsive Drug Delivery System, ***J. Mater. Chem. B*, 2015,** 3, 728-732.

12. Sridhar Rajam, Abhijit V. Jadhav, Qian Li, Sujan K. Sarkar, Pradeep N. D. Singh, Ahleah Rohr, Tamara C. S. Pace, Rui Li, Jeanette A. Krause, Cornelia Bohne, Bruce S. Ault, and Anna D. Gudmundsdottir, Triplet Sensitized Photolysis of a Vinyl Azide: Direct Detection of a Triplet Vinyl Azide and Nitrene, ***J. Org. Chem.*, 2014**, 79 (19), 9325-9334**.**

13. S. Karthik, Avijit Jana, Biswajit Saha, B. Krishna Kalyani, Sudip Kumar Ghosh, Yanli Zhao and N. D. Pradeep Singh, Synthesis and *in vitro* evaluation of charge reversal photoresponsive quinoline tethered mesoporous silica for targeted drug delivery, ***J. Mater. Chem. B***, **2014**, 2, 7971-7977.

14. S. Dasgupta, S. Atta, N. D. Pradeep Singh, D. Deb, W. S. Kassel, M. Bhattacharjee, Synthesis and Structure of $[Et_3NH][Fe(HL)_2]$, {H_3L = L-2-(3,5–ditert-butyl-2- hydroxyl benzyl amino)-succinic acid} and its Catalytic Activity Towards Efficient Photodegradation of dyes in presence of H_2O_2, ***Eur.J. Inorg. Chem.*, 2014,** 30, 5125-5134. **citation-1**

15. R. K. Sahoo, S. Atta, N.D.P Singh, C. Jacob, Influence of functional derivatives of an amino-coumarin/MWCNT composite organic hetero-junction on the photovoltaic characteristics, ***Materials Science in Semiconductor Processing*, 2014**, 25, 279-285

16. Shrabani Barman , Sourav K. Mukhopadhyay , Krishna Kalyani Behara , Satyahari Dey , and N. D. Pradeep Singh, 1-AcetylpyreneSalicylic Acid: Photoresponsive Fluorescent Organic Nanoparticles for the Regulated Release of a Natural Antimicrobial Compound, Salicylic Acid, ***ACS Appl. Mater.* Interfaces, 2014,** 6, 7045-7054. **citation-1**

17. Mohammed Ikbal, Rakesh Banerjee, Shrabani Barman, Sanghamitra Atta, DibakarDhara, N. D. Pradeep Singh, 1-Acetylferroceneoxime based Photoacid Generators: Application towards sol-gel transformation and development of photoresponsive polymer for controlled wettability and patterned surfaces, ***Journal of Materials Chemistry C,* 2014,** 2, 4622-4630.

18. Mohammed Ikbal,Biswajit Saha,Sharabani Barman,Sanghamitra Atta,Debranjan Banerjee,Sudip Ghosh, N.D.Pradeep Singh, Benzo[a]acridinyl methyl esters as pH Sensitive Fluorescent Photoactive precursors: Synthesis, Photophysical, Photochemical and Biological Application, ***Org. Biomol. Chem.*, 2014**, 12, 3459-3469.

19. Nilanjana Chowdhury, Moumita Gangopadhyay, S. Karthik, Mithu Baidya, S.K. Ghosh, N.D. Pradeep Singh, Synthesis, photochemistry, DNA cleavage/binding and cytotoxic properties of fluorescent quinoxaline and quinoline hydroperoxides, ***Journal of Photochemistry and Photobiology B,* 2014,** 130, 188-198. **citation: 3**

20. Avijit Jana, Biswajit Saha, Deb Ranjan Banerjee, Sudip Kumar Ghosh, Kim Truc Nguyen, Xing Ma, Qu Qiuyu, and Yanli Zhao, N. D. Pradeep Singh, Photocontrolled Nuclear-Targeted Drug Delivery by Single Component Photoresponsive Fluorescent Organic Nanoparticles of Acridin–9–methanol**,** ***Bioconjugate Chem.*, 2013**,24 (11), 1828-1839. **citation: 3**

21. **S.** Karthik, Biswajit Saha, Sudip Kumar Ghosh and N. D. Pradeep Singh. Photoresponsive quinoline tethered fluorescent carbon dots for regulated anticancer drug delivery, ***Chem. Commun.***, **2013**, 49, 10471-10473. **citation: 14**

22. S. Karthik, Nagaprasad Puvvada, B. N. Prashanth Kumar, Shashi Rajput, Amita Pathak Mahanty, Mahitosh Mandal, and N. D. Pradeep Singh. Photoresponsive Coumarin-Tethered Multifunctional Magnetic Nanoparticles for Release of Anticancer drug**.** ***ACS Appl. Mater. Interfaces,* 2013**, 5,5232-5238 **,citation: 8**

23. Avijit Jana , Biswajit Saha , Karthik S , Sharabani Barman , Mohammed Ikbal , Sudip Ghosh and Pradeep N.D. Singh Fluorescent Photoremovable precursors (acridin-9-ylmethyl)ester: Synthesis, Photophysical, Photochemical and Biological applications. ***Photochemical & Photobiological Sciences***, **2013**, 12, 1041–1052. **citation: 3**

24. Partha Sarathi Addy, Baisakhee Saha , N. D. Pradeep Singh , Amit K. Das , Jacob T. Bush , Clarisse Lejeune , Christopher J. Schofield and Amit Basak 1,3,5-Trisubstituted benzenes as fluorescent photoaffinity probes for human carbonic anhydrase II capture. ***Chem Comm,* 2013**, 49, 1930-1932. **citation:6**

25. Sanghamitra Atta, Mohammed Ikbal , Nishitha Boda , Samiran S. Gauri and N. D. Pradeep Singh, Photoremovable protecting groups as controlled-release device for sex pheromone ***Photochem. Photobiol. Sci***, **2013**, 2, 393-403 **citation-1**

26. Avijit Jana, K. Sanjana P. Devi, Tapas K. Maiti, and N. D. Pradeep Singh. Perylene-3-ylmethanol: Fluorescent Organic Nanoparticles as a Single-Component Photoresponsive Nanocarrier with Real-Time Monitoring of Anticancer Drug Release. ***J.Am.Chem.Soc.*** **2012,** 134 (18), 7656-7659, **citation:41**

27. Mohammed Ikbal, Rakesh Banerjee, Dibakar Dhara, Anakuthil Anoop, N. D. Pradeep Singh.Synthesis, Photophysical and Photochemical Properties of Photoacid Generators Based on N-Hydroxyanthracene-1,9-dicarboxyimide and Their Application toward Modification of Silicon Surfaces. ***J. Org. Chem, 2012****, 77, 10557-10567*, **citation: 5**

28. Mohammed Ikbal, Rakesh Banerjee, Dibakar Dhara, Anakuthil Anoop, N. D. Pradeep Singh."Development of 1-Hydroxy-2(1H)-quinolone based photoacid generators and photoresponsive polymer surfaces "***Chemistry - A European Journal*****, 2012,** 18(38), 11968, **citation: 7**

29. Avijit Jana, Biswajit Saha, Mohammed Ikbal and Sudip Ghosh, N.D. Pradeep Singh.1-(Hydroxyacetyl)pyrene a new fluorescent phototrigger for cell imaging and caging of alcohols, phenol and adenosine. ***Photochem. Photobiol. Sci,*** **2012**, 11, 1558-1566, **citation: 2**

30. Nilanjana Chowdhury, Sansa Dutta, S.karthik, Swagata Dasgupta, Anakuthil Anoop, N.D. Pradeep Singh.Azido carbonyl compounds as DNA cleaving agents. ***Journal of Photochemistry and Photobiology B: Biology***, **2012,** 115, 25-34

31. Nilanjana Chowdhury, Swagata Dasgupta, N.D. Pradeep Singh. Photoinduced DNA cleavage by anthracene based hydroxamic acids, ***Bioorganic & Medicinal Chemistry Letters,*** **2012**, 22 (14), 4668-4671. **citation: 3**

32. Nilanjana Chowdhury, Anakuthil Anoop, N. D. Pradeep Singh.O-alkyl-N-acyl-N-phenylhydroxylamines as photochemical alkoxy radical precursors. ***Synthesis,*** **2012**, 44 000A—000J.

33. Nilanjana Chowdhury, Sansa Dutta, Swagatha dasgupta, Mithu baidya, S.K. Ghosh, N. D. Pradeep Singh. Synthesis, photophysical, photochemical, DNA cleavage/binding and cytotoxic properties of pyrene oxime ester conjugate. ***Photochem. Photobiol. Sci***, **2012**, 11,1239-50. **citation-6**

34. Sangamithra Atta, Mohammed Ikbal, Ashutosh Kumar, N. D. Pradeep Singh. Application of photoremovable protecting group for controlled release of plant growth regulators by sunlight. ***Journal of Photochemistry and Photobiology B: Biology***, **2012**, *111, 39-49*. **citation: 2**

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36. Mohammed Ikbal, Avijit Jana, N.D.Pradeep Singh, Rakesh Banerjee, Dibakar Dhara Photoacid generators (PAGs) based on N-acyl-N-phenylhydroxylamines for carboxylic and sulfonic acids. ***Tetrahedron*****, 2011,** 67, 20, 3733-3742. **citation: 6**

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38. Atta, S.; Jana, A.; Rajakumar, A.; Singh, Pradeep N. D. Fluorescent Caged Compounds of 2,4-Dichlorophenoxyacetic Acid (2,4-D): Photorelease Technology for Controlled Release of 2,4-D. ***J. Agric. Food Chem*** , **2010,** 58, 11844–11851. **citation: 5**

39. Gazi, S.; Rajakumar, A.; Singh, Pradeep N.D. Photodegradation of organic dyes in the presence of [Fe(III)-salen]Cl complex and H2O2 under visible light irradiation. ***Journal of Hazardous Materials,*** **2010,** 183,894-901.**citation-25**

40. Chowdhury, N.; Dutta, S.; Nishitha, B.; Dasgupta, S.; Singh, Pradeep N. D. N,O-Diacyl-4-benzoyl-N-phenylhydroxylamines as photoinduced DNAcleaving agents. ***Bioorganic & Medicinal Chemistry Letters***, **2010,** 20, 5414-5417. **citation-8**

41. Sengupta, J.; Jana, A.; Singh, Pradeep N. D.; Mitra, C.; Jacob, C. Site-selective synthesis of in situ Ni-filled multi-walled carbon nanotubes using Ni(salen) as a catalyst source. ***Nanotechnology***, **2010**, 21,415605. **citation: 10**

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43. Sengupta, J.; Jana, A.; Singh, Pradeep N.D.; Jacob, C. Lithographically defined site-selective growth of Fe filled multi-walled carbon nanotubes using a modified photoresist. ***Carbon*** **2010,** 48, 2361-2380

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45. Singh, Pradeep. N. D.; Mandel, S. M.; Sankaranarayanan, J.; Muthukrishnan, S.; Chang, M.; Robinson, R. M.; Lahti, P. M.; Ault, B. S .; Gudmundsdóttir, A. D. "Selective Formation of Triplet Alkyl Nitrenes from Photolysis of ß-Azido-Propiophenone and Their Reactivity". ***J. Am. Chem. Soc.,*** 2007; 129(51); 16263-16272. **citation: 29**

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61. Geetha Gopalakrishnan.; Viswanathan Kasinath.; N.D.Pradeep Singh.; V.P.Santhana Krishnan.; K.Anand Solomon.; S.S.Rajan. "Microwave Assisted Regioselective Bromomethoxylation of Alkenes Using Polymer Supported Bromine Resins". ***Molecules.*** 2002, 7, 412-419. **citation: 8**

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Patents:

1. **Sanghamitra Atta**, Tirthartha Chattopadhyay, Mohammed Ikbal, Mrinal. K. Maiti and N. D. Pradeep Singh.articles: for controlled release of 2,4-D and real time monitoring of morphological changes induced by 2,4-D in plant system" **(555/KOL/2013, date of filing is 15.05.2013)**

2. **Sanghamitra Atta**, Rakesh Banerjee, Mohammed Ikbal, Dibakar dhara, N. D. Pradeep Singh. "Photoresponsive polymers based on coumarin moiety for the controlled release of pesticide 2,4-D" (patent filed)

Technology Transfer

1. Geetha Gopalakrishnan, **Pradeep Singh, N.D**.

A process for neem formulation with stable active ingredient – the terpenoid Azadirachtin was developed using novel, cost-effective and natural-based ultraviolet stabilizer.

Conferences Attended

1. **Singh, Pradeep. N. D**.; Targeted Photoresponsive Nanocarrier as Drug Delivery system, Indo-UK Scientific collaboration on Photoresponsive functional surfaces for bio-nano applications in healthcare, Leeds, February, 2015.
2. **Singh, Pradeep. N. D**.; Fabrication of New Photoresponsive Nano Carriers for Drug Delivery, Frontiers in Chemical Sciences, Guwahati, December, 2014.
3. **Singh, Pradeep. N. D**.; Single Component Photoresponsive Drug Delivery System Based on Fluorescent Organic Nanoparticles, Asian Photochemistry Conference, Kerala, November, 2014.
4. **Singh, Pradeep. N. D**.; Klima, R. F.; Ault, B. S.; Gudmundsdottir, A. D. Photolytic Studies of β -Azido-Propiophenone Derivatives ACS National Meeting: Philadelphia, Pennsylvania, August, 2004.
5. **Singh, Pradeep. N. D.;** Jagadis Sankaranarayanan.; Sarah Mandel.; Ault, B. S.; Gudmundsdottir, A. D. Photolytic studies of β-azido prophiophenone-Direct detection of triplet nitrenes. 3rd Ohio Photochemical Society Meeting, Ohio, May, 2004.
6. **Singh, Pradeep. N. D.;** Ability V. Jadhav.; Gudmundsdottir, A. D. Beta vinyl Azides: Theoretical, Product and Matrix studies and Infrared Isolation Spectroscopy Investigation. Ralph and Helen Oesper symposium, Cincinnati, October, 2003.
7. **Singh, Pradeep . N. D.;** Abhijit Jadhav.; Ault, B. S.; Gudmundsdottir, A. D. Photolytic studies of vinyl azides. 2nd Ohio Photochemical Society Meeting, Ohio, April, 2003.
8. **Singh, Pradeep . N. D.;** Gudmundsdottir, A. D. Environmental Friendly Synthesis Of 2*H*-Azirines.Ralph and Helen Oesper symposium, Cincinnati, October, 2002.
9. **Singh, Pradeep . N. D.;** Christman, R. M.; Ault, B. S.; Gudmundsdottir, A. D. Trapping of Triplet Alkyl Nitrenes using Molecular Oxygen.1st Ohio Photochemical Society Meeting, Ohio, April, 2002.

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