# Dr. G. Anilkumar

**Professor (Organic Chemistry)**
**School of Chemical Sciences**
**Mahatma Gandhi University, Kottayam**
**Kerala 686560 INDIA** + 91 9496722065
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## Academic profile

**Ph. D** CSIR-NIIST Trivandrum

**M. Phil** CUSAT

**M. Sc** University of Kerala

## Professional experience

**Scientist**, Leibniz-Institüt für Katalyse, (LIKAT), Rostock, Germany

**Leibniz Fellow**, Leibniz-Institüt für Katalyse, (LIKAT), Rostock, Germany

**Senior Scientist**, AstraZeneca, India

**MvP State Fellow**, Leibniz-Institüt für Organische Katalyse (IfOK), Germany

**NIH Fellow**, Temple University, Philadelphia, USA

**JSPS Fellow**, Osaka University, Osaka, Japan

**NSR Fellow**, Katholike Universitat Nijmegen, The Netherlands

## Research highlight

**H-index- 25**

**Publications- 76**

**Patents-7 (granted), 2 (filed)**

**Citations-2561**

## Teaching areas

**Stereochemistry**

**Reaction Mechanism**

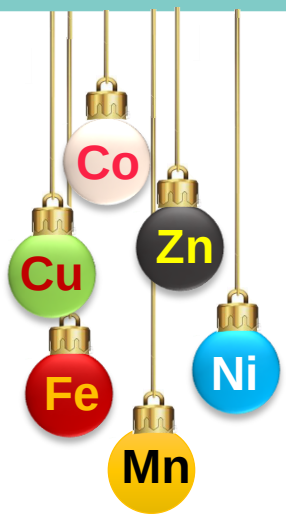
**Reactions and Reagents**

**Organic Synthesis**

**Medicinal Chemistry**

**Asymmetric Catalysis**

# Research areas



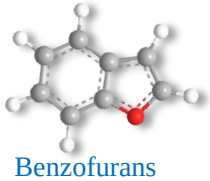

## ★ Transition metal catalysis

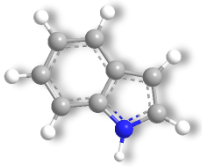
Exploring 3d series active transition metals in catalysis and particularly for

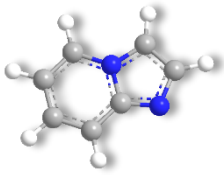
- Coupling reactions
- C-H activation

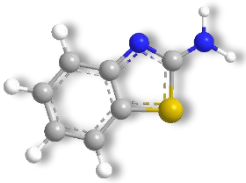
## ★ Heterocycle synthesis

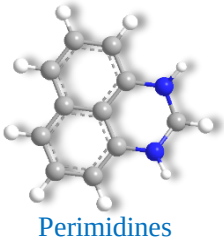
Synthesis of nitrogen, oxygen and sulphur containing heterocycles by catalytic and non catalytic green methods.


Benzofurans


Indoles

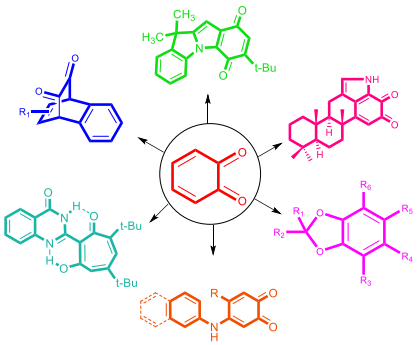

Imidazopyridines


Benzothiazoles


Perimidines

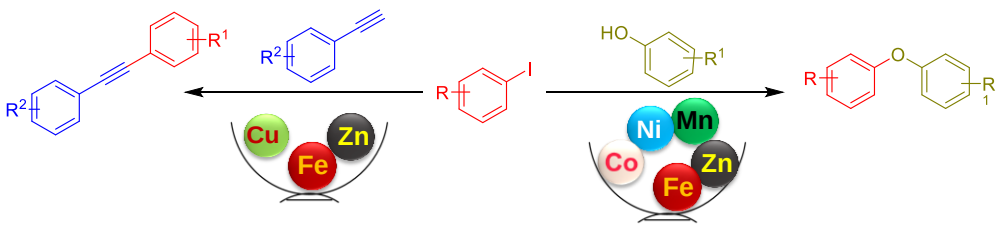
## ★ Organic synthesis

Chemistry of *o*-benzoquinones and its applications.



## ★ Synthetic methodology

Novel methods for the establishment of C-C and C-Heteroatom bonds.

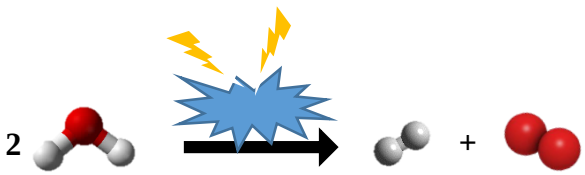


## ★ Phytochemistry

Isolation characterisation and biological screening of bioactive molecules from flora

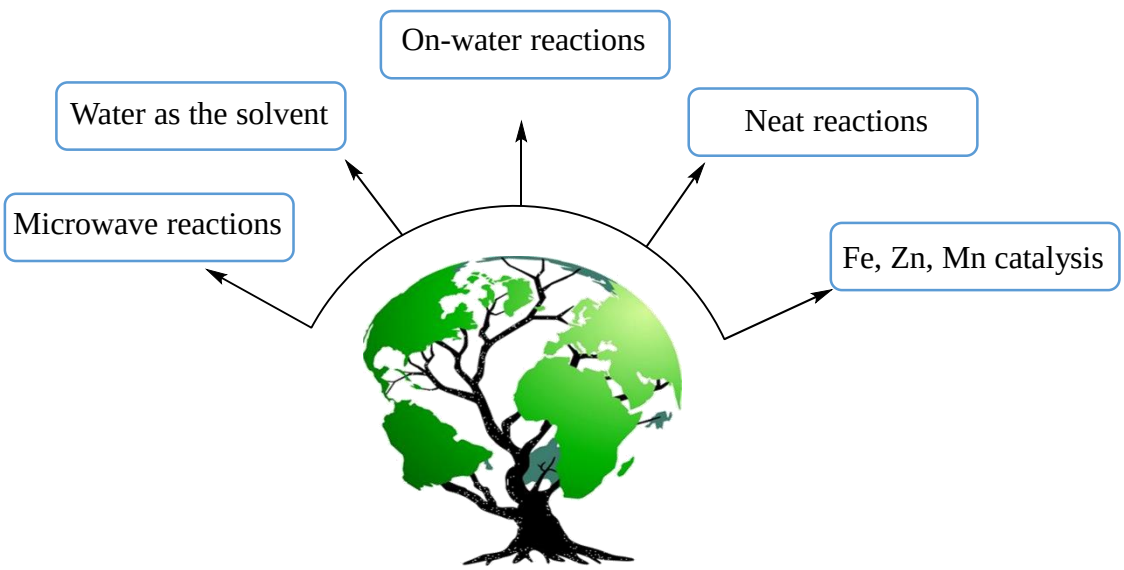
## ★ Hydrogen generation by water splitting

Synthesis and application of sensitizers for water splitting.




## ★ Green chemistry

Synthesising pharmacologically important molecules under microwave, Neat and on-water conditions with out transition metals or by using Fe, Zn or Mn as the eco-friendly catalysts.



# Honors and Awards

**1.** Visiting Professor, Leibniz-Institüt für Katalyse an der Universitat, Rostock, Germany 2018

**2**. Adjunct faculty, International and Interuniversity Centre for Nanoscience and Nanotechnology, Mahatma Gandhi University

**3**. Adjunct faculty, Interuniversity Instrumentation Centre, M G University

**4**. Adjunct faculty, Advanced Molecular Materials Research Centre, M G University

**5.** Selected a paper in Journal of Catalysis (Impact factor 7.35) as a feature article 2017

**6**. Recipient of the Dr. S. Vasudev award from Kerala State Council for Science, Technology and Environment, Govt: of Kerala, for best research in 2016.

**7.** Recipient of the Evonik Research Proposal Competition, Germany- 2$^{nd}$ Prize 2016

**8.** Recipient of the Leibniz fellowship, Rostock, Germany 2009

**9.** Recipient of the Mecklenburg-Vorpommern state fellowship, Rostock University, Germany 2004-2006.

**10.** Recipient of the National Institute of Health (NIH) Postdoctoral fellowship, Temple University, USA 2002-2004.

**11.** Recipient of the Japan Society for the Promotion of Science (JSPS) Postdoctoral fellowship, Osaka University, Japan 2000-2002.

**12.** Recipient of the *Naturae Species Ratioque* (NSR, The Netherlands) Postdoctoral fellowship, University of Nijmegen, The Netherlands 1997- 2000.

**13.** Recipient of the Council of Scientific & Industrial Research (CSIR, New Delhi) Senior research fellowship 1993-1996.

**14.** Recipient of the Council of Scientific & Industrial Research (CSIR, New Delhi) Junior research fellowship 1991-1993.

**15.** Recipient of the University Grants Commission (UGC, New Delhi) Junior research fellowship 1989-1991.

**16.** Awarded UGC Junior research fellowship in 1989.

**17.** Awarded CSIR Junior research fellowship in 1989.

**18.** Awarded UGC Junior research fellowship in 1990.

**19.** Awarded UGC Junior research fellowship in 1993.

# Group Members

## Ph.D. Students

Anns Maria Thomas

K. Keerthi Krishnan

Ujwaldev S. M.

Nissy Ann Harry

Saranya Salim

Rohit K. R.

Radhika S.

Neetha Mohan

## Post Doc. Fellow

Dr. M. Arun Divakar

No of Ph.D. vacancies = 2

Post Doc. Vacancies = Available

## Alumni

Dr. Amritha P. Thankachan

Dr. Seetha Lakshmi K. C

Dr. Sindhu K. S.

Dr. Asha S.

# List of Publications

**76**. One-Pot Synthesis of Benzofurans via Cu–Catalyzed Tandem Sonogashira Coupling-Cyclization Reactions, A. M. Thomas, S. Asha, R. Menon, **G. Anilkumar**, *ChemistrySelect*, **2019,** *4*, 5544.

**75**. Recent trends in Iron-catalyzed reactions towards the synthesis of nitrogen-containing heterocycles, R. Sreedevi, S. Saranya, K. R. Rohit, **G. Anilkumar**, *Adv. Synth. Catal*, **2019,** *361*, 2236.

**74**. A novel ligand-free manganese-catalyzed C-O coupling protocol for the synthesis of biaryl ethers, K. R. Rohit, S. Saranya, N. A. Harry, **G. Anilkumar**, *ChemistrySelect*. **2019**, *4*, 5150.

**73**. Recent advances and prospects in nickel-catalyzed C-H activation, N. A. Harry, S. Saranya, S. M. Ujwaldev, **G. Anilkumar**, *Catal. Sci. Technol.*, **2019**, *9*, 1726.

**72**. A novel zinc-catalyzed Suzuki-type cross-coupling reaction of aryl boronic acids with alkynyl bromides, K. K. Krishnan, S. Saranya, K. R. Rohit, **G. Anilkumar**, *J. Catal*, **2019**, *372*, 266.

**71**. Recent advances and perspectives in the synthesis of heterocycles via Zinc catalysis, K. K. Krishnan, S. M. Ujwaldev, S. Saranya, **G. Anilkumar**, M. Beller, *Adv. Synth. Catal*, **2019,** *361*, 382.

**70**. Copper-catalysed multicomponent syntheses of heterocycles, R. M. Cherian, N. A. Harry, S. Saranya, K. R. Rohit, **G. Anilkumar**, *Asian J. Org. Chem*, **2019**, *8*, 197.

**69**. A convenient route to 1,3-diynes using ligand-free Cadiot-Chodkiewicz coupling reactions at room temperature under aerobic conditions, S. Asha, S. Anjana, A. M. Thomas, M. E. Thomas, K. R. Rohit, K. K. Krishnan, S. M. Ujwaldev, **G. Anilkumar**, *Synth. Commun*, **2019**, *49*, 256.

**68**. Ligand-free Copper-catalyzed Suzuki coupling of alkynyl bromides with boronic acids in ethanol under microwave irradiation, S. A. Babu, S. Saranya, K. R. Rohit, **G. Anilkumar**, *ChemistrySelect*, **2019**, *4*, 1019.

**67.** Novel Cobalt-Valine Catalyzed O-Arylation of Phenols with Electron Deficient Aryl iodides, S. M. Ujwaldev, S. Saranya, N. A. Harry, **G. Anilkumar**, *Monatshefte*, **2019**, *150*, 339.

**66**. An efficient protocol for the synthesis of thioethers via iron-catalyzed cross-coupling reactions and its mechanistic investigation. K. S. Sindhu, T. G. Abi, G. Mathai, **G. Anilkumar**, *Polyhedron*, **2019**, *158*, 270.

**65**. Recent advances and perspectives in the asymmetric Reformatsky reaction, J. Sarah, S. Saranya, S. M. Ujwaldev, **G. Anilkumar**, *The Chemist*, **2018**, *91*, 50.

**64**. Recent advances in the creation of asymmetric carbon by generation of carbon-heteroatom bonds using metal-pybox complexes, K. R. Rohit, S. M. Ujwaldev, S. Saranya, **G. Anilkumar**, *Asian J. Org. Chem*, **2018,** *7*, 2338.

# List of Publications

**63**. Cobalt-catalyzed C-H activation: recent progress in heterocyclic chemistry, S. M. Ujwaldev, N. A. Harry, M. A. Divakar, **G. Anilkumar**, *Cat. Sci. Tech*, **2018,** *8*, 5983.

**62**. Applications of Pybox complexes in asymmetric catalysis, S. A. Babu, K. K. Krishnan, S. M. Ujwaldev, **G. Anilkumar**, *Asian J. Org. Chem*, **2018,** *7*, 1033.

**61**. Recent developments and perspectives in the asymmetric Mannich reaction, S. Saranya, N. A. Harry, K. K. Krishnan, **G. Anilkumar**, *Asian J. Org. Chem*, **2018,** *7*, 613.

**60**. Zinc-catalyzed etherification reaction of aryl iodides with phenol, K. K. Krishnan, N. A. Harry, S. M. Ujwaldev, **G. Anilkumar**, *ChemistrySelect*, **2018,** *3*, 3984.

**59**. Recent developments and perspectives in the zinc-catalyzed Michael addition, K. R. Rohit, S. M. Ujwaldev, K. K. Krishnan, **G. Anilkumar**, *Asian J. Org. Chem*, **2018,** *7*, 85.

**58**. Recent advances and perspectives in the zinc-catalyzed nitroaldol (Henry) reaction, S. Saranya, N. A. Harry, S. M. Ujwaldev, **G. Anilkumar**, *Asian J. Org. Chem*, **2017**, *6*, 1349.

**57**. Recent Advances in the Chemistry of Masked Ortho-Benzoquinones and Their Applications in Organic Synthesis, N. A. Harry, S. Saranya, K. K. Krishnan, **G. Anilkumar**, *Asian J. Org. Chem*, **2017**, *6*, 945.

**56**. A novel Zinc-catalyzed Cadiot-Chodkiewicz cross-coupling reaction of terminal alkynes with 1-bromoalkynes in ethanol solvent, K. K. Krishnan, S. M. Ujwaldev, A. P. Thankachan, N. A. Harry, **G. Anilkumar**, *Mol. Catal.* **2017**, *440*, 140.

**55**. A green approach for arylation of phenols using iron catalysis in water under aerobic conditions, K. S. Sindhu, S. M. Ujwaldev, K. K. Krishnan, **G. Anilkumar**, *J. Catal*, **2017**, *348*, 146.

**54**. Synthesis of substituted benzofurans and indoles by Zn-catalyzed tandem Sonogashira-cyclization strategy, A. P. Thankachan, K. S. Sindhu, S. M. Ujwaldev, **G. Anilkumar**, *Tetrahedron Lett*, **2017**, *58*, 536.

**53**. Synthesis of diaryl and arylalkyl sulfides via zinc-catalyzed thioetherification reactions, A. P. Thankachan, K. S. Sindhu, K. K. Krishnan, **G. Anilkumar**, *The Chemist* **2016**, *89 (2)*, 9.

**52.** Recent advances in the transition metal catalyzed etherification reactions, K. K. Krishnan, S. M. Ujwaldev, K. S. Sindhu, **G. Anilkumar**, *Tetrahedron* **2016**, *72*, 7393.

**51**. Recent Developments and Perspectives in the Ruthenium-catalyzed Olefin Epoxidation, S. M. Ujwaldev, K. S. Sindhu, A. P. Thankachan, **G. Anilkumar**, *Tetrahedron* **2016**, 72, 6175.

# List of Publications

**50**. A Novel Protocol for the Cu-Catalyzed Sonogashira Coupling Reaction between Aryl Halides and Terminal Alkynes using *trans*-1,2-Diaminocyclohexane Ligand**,** S**.** Asha, A**.** M. Thomas, S**.** M. Ujwaldev, **G. Anilkumar,** *ChemistrySelect* **2016**, *1*, 3938.

**49.** Experimental and Mechanistic Exploration of Zn-Catalyzed Sonogashira–type Cross-Coupling Reactions, A. P. Thankachan, T. G. Abi, K. S. Sindhu, **G. Anilkumar**, *ChemistrySelect* **2016**, 1, 3405.

**48**. Iron-Catalyzed Sonogashira Type Cross-Coupling Reaction of Aryl Iodides with Terminal Alkynes in Water under Aerobic Conditions, K. S. Sindhu, A. P. Thankachan, A. M. Thomas, **G. Anilkumar**, *ChemistrySelect*, **2016**, *3*, 556

**47**. Structural and optical properties of functionalized multi- carbon nanotubes, S. Yaragalla**, G. Anilkumar**, N. Kalarickal, S. Thomas, *Mater. Science Semiconduct Processing*, **2016**, *41*, 491

**46.** Recent advances and perspectives in the manganese-catalyzed epoxidation reactions K. K. Krishnan, A. M. Thomas, K. S. Sindhu, **G. Anilkumar**, *Tetrahedron*, **2016**, *72*, 1

**45**. A general and inexpensive protocol for the Cu-catalyzed C-S cross-coupling reaction between aryl halides and thiols A. M. Thomas, S. Asha , K. S. Sindhu **G. Anilkumar**, *Tetrahedron Lett*., **2015**, *56*, 6560

**44**. Preparation of epoxy graphene and its structural and optical properties S. Yaragalla, **G. Anilkumar**, T. V. Vineeshkumar ,N. Kalarikkal, S. Thomas, *Adv. Mater. Lett*., **2015**, *6*, 848

**43.** An efficient zinc-catalyzed cross-coupling reaction of aryl iodides with terminal aromatic alkynes A. P. Thankachan, K. S. Sindhu, K. K. Krishnan and **G. Anilkumar**, *Tetrahedron Lett*., **2015**, *56*, 5525

**42.** Recent advances in the syntheses, transformations and applications of 1,1-dihalocyclopropanes A. P. Thankachan, K. S. Sindhu, K. K. Krishnan and **G. Anilkumar**, *Org. Biomol. Chem*., **2015**, *13*, 8780

**41**. An overview of Zn-catalyzed enantioselective Aldol type C-C bond formation A. P. Thankachan, K. K. Krishnan, **G. Anilkumar**, *RSC Adv*., **2015**, *5*, 62179

**40**. An efficient iron-catalyzed S-arylation of aryl and alkylthiols with aryl halides in the presence of water under aerobic conditions K. S. Sindhu, A. P. Thankachan, A. M. Thomas, **G. Anilkumar** *Tetrahedron Lett*., **2015**, *56*, 4923

**39**. Recent developments and applications of Cadiot-Chodkiewicz reaction K. S. Sindhu, A. P. Thankachan, P. S. Sajitha, **G. Anilkumar**, *Org. Biomol. Chem*., **2015**, *13*, 6891

# List of Publications

**38**. A novel and efficient Zn-catalyzed thioetherification of aryl halides A. P. Thankachan, K. S. Sindhu, K. K. Krishnan, **G. Anilkumar**, *RSC Adv.*, **2015**, *5*, 32675

**37**. Recent advances and perspectives in the synthesis of heterocycles via carbenes K. K. Krishnan, A. P. Thankachan, **G. Anilkumar**, *Tetrahedron* **2015**, *71*, 2333

**36.** Goldberg reaction: Development, Mechanistic insights and Applications A. M. Thomas, A. Sujatha, **G. Anilkumar**, *Mini Rev. Org. Chem.*, **2015**, *12*, 3

**35.** Recent Advances in Copper–catalyzed C-S cross-coupling reactions A. Sujatha, A. M. Thomas, A. P. Thankachan, **G. Anilkumar**, *ARKIVOC* **2015**, *i*, 1

**34.** A Novel Intramolecular Homoenolate Annulation leading to the formation of Cyclopentene fused Macrocycles K. C. Seetha Lakshmi, C. R. Sinu, D. V. M. Padmaja, **G. Anilkumar**, E. Suresh, V. Nair, *Org. Lett.*, **2014**, *16*, 5532

**33.** Recent Advances and Applications of Glaser coupling employing greener protocols K. S. Sindhu, **G. Anilkumar**, *RSC Adv.*, **2014**, *4*, 27867.

**32.** Recent Advances and Perspectives in Copper-catalysed Sonogashira Coupling Reactions A. M. Thomas, A. Sujatha, **G. Anilkumar**, *RSC Adv.*, **2014**, *4*, 21688.

**31**. Synthesis, characterisation and application of Iridium (III) photosensitisers for catalytic water reduction F. Gaertner, D. Cozzula, S. Losse, A. Boddien, **G. Anilkumar**, H. Junge, T. Schulz, .N. Marquet, A. Spannenberg, S. Gladiali and M. Beller *Chem. Eur. J* **2011**, *17*, 6998.

**30**. Structure and function of natural and synthetic signaling molecules in parasitic weed germination. B. Zwanenburg, A, S. Mwakaboko, A. Reizelman, **G. Anilkumar**, and D. Sethumadhavan. *Pest Manag Sci.* **2009**, *65*, 478.

**29**. Biomimetic Iron-catalyzed asymmetric epoxidation of aromatic alkenes by using hydrogen peroxide. F. G. Gelalcha, **G. Anilkumar**, M. K. Tse A. Brückner and M. Beller *Chem. Eur J* **2008**, *14*, 7687.

**28**. Iron-catalyzed asymmetric epoxidation of aromatic alkenes using hydrogen peroxide. F. G. Gelalcha, B. Bitterlich, **G. Anilkumar**, M. K. Tse and M. Beller *Angew. Chem. Int. Ed.* **2007**, *46*, 7293. (**Hot paper**)

**27**. Eisen katalysierte asymmetrische epoxidierung von aromatischen alkenen mit wasserstoffperoxid. F. G. Gelalcha, B. Bitterlich, **G. Anilkumar**, M. K. Tse and M. Beller *Angew. Chem*. **2007**, *119*, 7431.

# List of Publications

**26**. New Ruthenium Catalysts for Asymmetric Transfer Hydrogenation of prochiral Ketones. S. Enthaler, B. Hagemann, S. Bhor, **G. Anilkumar**, M. K. Tse, B. Bitterlich, K. Junge, G. Erre and M. Beller *Adv. Synth. Catal*. **2007**, *349*, 853.

**25**. Development of a general and efficient iron-catalyzed epoxidation using hydrogen peroxide as oxidant. B. Bitterlich, **G. Anilkumar**, F. G. Gelalcha, B. Spilker, A. Grotevendt, R. Jackstell, M. K. Tse, and M. Beller *Chem. Asian J*. **2007**, *2*, 521.

**24**. A novel biomimetic Fe-catalyzed epoxidation of olefins using hydrogen peroxide. **G. Anilkumar**, B. Bitterlich, F. G. Gelalcha M. K. Tse and M. Beller *Chem. Commun*. **2007**, 289.

**23**. Synthetic, spectral and catalytic activity studies of some ruthenium bi- and ter-pyridine complexes: implications on the mechanism of ruthenium(pyridine-2,6-bisoxazoline)(pyridine-2,6-dicarboxylate) catalyzed asymmetric epoxidation of olefins utilizing $H_2O_2$. M. K. Tse, H. Jiao, **G. Anilkumar**, B. Bitterlich, F. G. Gelalcha and M. Beller *J. Organomet. Chem*. **2006**, *691*, 4419.

**22**. Ruthenium Catalyzed Asymmetric Epoxidation of Olefins using $H_2O_2$ part I: Synthesis of New N,N,N-Tridentate Ligands-Pybox, pyboxazine and their Ruthenium Complexes. M. K. Tse, S. Bhor, M. Klawonn, **G. Anilkumar**, H. Jiao, C. Dobler, A. Spannenberg, W. Magerlein, H. Hugl and M. Beller *Chem. Eur. J.* **2006**, *12*, 1855.

**21**. Ruthenium Catalyzed Asymmetric Epoxidation of Olefins using $H_2O_2$ part II: Catalysis and Mechanistic Studies. M. K. Tse, S. Bhor, M. Klawonn, **G. Anilkumar**, H. Jiao, A. Spannenberg, C. Dobler, W. Magerlein, H. Hugl and M. Beller *Chem. Eur. J.* **2006**, *12*, 1875.

**20**. Synthesis of a novel class of chiral *N*,*N*,*N*-tridentate pyridinebisimidazoline ligands and their application in Ru-catalyzed asymmetric epoxidations. **G. Anilkumar**, S. Bhor, M. K. Tse, M. Klawonn, B. Bitterlich and M. Beller *Tetrahedron Asymmetry* **2005**, *16*, 3536.

**19**. Synthesis of New Chiral *N*,*N*,*N*-tridentate Pyridinebisimidazoline Ligands and their Application in Ruthenium-catalyzed Asymmetric Epoxidations. S. Bhor, **G. Anilkumar**, M. K. Tse, M. Klawonn, C. Dobler, B. Bitterlich, A. Grotevendt and M. Beller *Org. Lett.*, **2005**, *7*, 3393.

**18**. A Convenient Method for Epoxidation of Alkenes using Aqueous Hydrogen Peroxide. M. K. Tse, M. Klawonn, S. Bhor, C. Dobler, **G. Anilkumar** and M. Beller, *Org. Lett*., **2005**, *7*, 987.

**17.** Asymmetric Synthesis Using Sulfinimines (N-Sulfinyl Imines) (Review). F. A. Davis, B. Yang, J. Deng, Y. Wu, Y. Zhang, A. Rao, T. Fang, R. Goswami, K. R. Prasad, M. B. Nolt, G. Anilkumar Phosphorus, Sulfur, and Silicon, 2005, 180, 1109.

# List of Publications

**16**. Asymmetric Synthesis of the Quinolizidine Alkaloid (-)-Epimyrtine using Intramolecular Mannich Cyclization and N-Sulfinyl d-amino b-ketoesters. F. A. Davis, Y. Zhang and **G. Anilkumar**, *J. Org. Chem*. **2003**, *68*, 8061.

**15**. An Efficient methodology for the C-C Bond-forming Radical Cyclization of Hydrophobic Substrates in water: Effect of Additives on Radical Reaction in water. H. Nambu, **G. Anilkumar**, M. Matsugi and Y. Kita, *Tetrahedron* **2003**, *59*, 77.

**14**. A Novel and Useful Oxidative Intramolecular Coupling Reaction of Phenol Ether Derivatives on Treatment with a Combination of Hypervalent Iodine(III) Reagent and Heteropoly Acid. H. Hamamoto, **G. Anilkumar**, H. Tohma and Y. Kita, *Chem. Eur. J.*, **2002**, *8*, 5377.

**13**. A Novel and Efficient Oxidative Biaryl Coupling Reaction of Phenol Ether Derivatives Using a Combination of Hypervalent Iodine(III) Reagent and Heteropoly Acid. H. Hamamoto, **G. Anilkumar**, H. Tohma and Y. Kita, *Chem. Commun.*, **2002**, 450.

**12**. A Simple and Efficient Iodination of Alcohols on Polymer Supported Triphenylphosphine. **G. Anilkumar**, H. Nambu and Y. Kita, *Org. Proc. Res. Dev.* **2002**, *6*, 190.

**11** Regioselective Nucleophilic Addition of Methoxybenzene Derivatives to the □-carbon of *p*-Benzoquinone mono O,S –Acetal. M. Matsugi, K. Murata, **G. Anilkumar**, H. Nambu and Y. Kita, *Chem. Pharm. Bull.* **2001**, *49*, 1658.

**10**. A Novel and Efficient Methodology for the C-C Bond-forming Radical Cyclization of Hydrophobic Substrates in Water. Y. Kita, H. Nambu. N. G. Ramesh, **G. Anilkumar** and M. Matsugi, *Org. Lett.*, **2001**, *3*, 1157.

**9**. A Facile and Efficient Sulfenylation Method Using Quinone mono-O,S-acetals Under Mild Conditions. M. Matsugi, K. Murata, K. Gotanda, H. Nambu, **G. Anilkumar,** K. Matsumoto and Y. Kita, *J. Org. Chem.*, **2001**, *66*, 2434.

**8**. A Facile Photolytic Approach to the Synthesis of Bicyclo[3.3.0]octa-3,7-diene-2,6-diones. V. Nair, D. Maliakal, **G. Anilkumar** and N. P. Rath、*Synlett*, **2000**, 1139.

**7**. $BF_3$-$OEt_2$ Induced Rearrangement of Bicyclo[2.2.2]octenediones: An Efficient Synthesis of Bicyclo[3.2.1]octenediones. V. Nair, D. Maliakal, P. M. Tresa, **G. Anilkumar,** M. Vairamani and S. Prabhakar, *Tetrahedron* **2000**, *56*, 3735.

**6**. Novel Cycloaddition Reactions of *o*-Benzoquinones and Related Chemistry.
V. Nair, S. Kumar, **G. Anilkumar**, K. V. Radhakrishnan, J. S. Nair, D. Maliakal, K. C. Sheela, B. Mathew, P. M. Tresa, A. U. Vinod, V. Sheeba and A. Thomas, *Proc. Indian Acad. Sci. (Chemical Sci.)* **1998**, *110*, 507.

**5**. Photochemical di-□-methane Rearrangement of Quinoxalinobarrelenes.
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**4**. A Facile Synthesis of Novel Pyrazinobarrelenes from Bicyclo[2.2.2]octenediones. V. Nair, **G. Anilkumar** and G.K. Eigendorf, *Indian J. Chem.* **1997**, *36B*, 65.

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1. Hydrogels, DNA, and RNA polypeptides for the preparation of biomaterials, L. V. Korah, **G. Anilkumar**, S. Thomas in Fundamental Biomaterials: Polymers, S. Thomas, P. Balakrishnan, M. S. Sreekala (Eds.), Elsevier Woodhead Publishing, UK, 2018, pp 85-104. (ISBN: 978-0-08-102194-1)

# Patents

**7**. Photosensitizers and use thereof for generating hydrogen from water. N. Stefan, D. Uwe, B. Jens, H. Sascha, B. Matthias, Z. Horst-Werner, G. Felix, C. Daniela, D. Stefania, **G. Anilkumar**, L. Sebastian, J. Henrik, G. Serafino, B. Matthias US patent. **US 2014/0023582 A1. (2014)**

**6.** Verfahren zur katalytischen oxidation von Wasser. **G. Anilkumar**, S. Losse, S. Gladiali, N. Marquet, F. Gartner, S. Dennura, H. Junge, M. Beller, D. Cozzula, German patent. **DE 10 2011 079424 A1 (2013)**

**5.** Process for catalytic oxidation of water. N. Marquet, **G. Anilkumar**, F. Gartner, S. Losse, S. Dennura, D. Cozzula, S. Gladiali, M. Beller International patent. **WO 2013/010902 A1 (2013)**

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