CURRICULAM VITAE

DR. UPENDRA SHARMA

Scientist
Natural Product Chemistry and Process Development Division
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PROFESSIONAL EXPERIENCE

Scientist (1st September 2014 onwards) at NPC&PDD, CSIR-IHBT, Palampur

Postdoctral Fellow (14th March 2014- 22nd August) at KAIST, South Korea, working on transition metal catalyzed remote C-H activation.

Young Scientist-DST Fast Track (24th May 2013-11th March 2014) at IIT Bombay, worked on development of catalytic processes for hetrocycle synthesis through multiple C-H activation.

Research Assistant (6th Nov. 2012-22nd May 2013) at IIT Bombay, worked on stereoselective nitration and trifluoromethylation of olefins.

EDUCATION

2007 – 2012	**PhD (Organic Chemistry)** GNDU. Amritsar, Punjab / CSIR-IHBT, Palampur **Mentor**: Dr. Bikram Singh, Chief Scientist & HOD, NPC&PDD, CSIR-IHBT (***defended on 26th Oct. 2012***) entitled "**Phytochemical Investigation of *Tinospora cordifolia, Asparagus racemosus* and Synthesis of Phthalimide Derivatives for Immunomodulatory Active Molecules**"
2005-2006	**Research Scholar** in Panjab University, Chandigarh
2003 - 2005	**M.Sc Chemistry,** DAV collage, Jalandhar, GNDU, Amritsar, 1st Class with 63 %
2002 - 2003	**B.Ed.**, Jammu University, Jammu, 1st Class with 67 %
1999 - 2002	**BSc**, University Govt. College Chowari, HPU, Shimla 1st Class 72%

SKILLS

- **Synthetic methodology development** (C-H activation/functionalization leading to value added molecules)
- **Isolation and structure elucidation of plant secondary metabolites** using modern spectroscopic techniques including NMR (1D & 2D), LC-MS, IR and UV-vis
- **Chemical Profiling** using NMR (1D & 2D) and hyphenated chromatographic techniques such as UPLC-MS/MS and GC-MS
- **Analytical Chemistry** using UPLC, HPLC & GC for standardization of plant extracts through development of quantification method for marker compounds

INSTITUTIONAL RESPONSIBILITIES

- Member of Project Formulation Committee
- Member of Publication Committee
- DAC member of Ph.D students enrolled in AcSIR
- Leading Phytopaharmaceutical Project

PUBLICATIONS

Publications

John Wiley	American Chemical Society	Royal Society of Chemistry	Taylor & Francis
Angew Chem ***2***	*Org Lett* ***1***	*Green Chem* ***3***	*Catal Rev* ***1***
Chem Eur J ***1***	*J Org Chem* ***2***	*Chem Commun* ***2***	
Adv Synth & Catal ***3***		*Catalysis Science & Technology* ***1***	
Eur J Org Chem ***2***		*Org Biomol Chem* ***2***	
Asian J Org Chem ***3***			

Total: **70** Citation: **1080** h-index: **18** i-10 index: **25**

After Independent Research Lab: **24**

Book Chapter: **2** Patent: **2** (filed) Paper presented in conferences: **17**

S. No.	Names of all the authors	Title of the paper	Name of the journal, volume, year and page
74	Rakesh Kumar, Inder Kumar, Ritika Sharma, **Upendra Sharma***	Rhodium-Catalyzed Remote (C-8) alkylation of Quinolines with Activated and Unactivated Olefins: Mechanistic Study and Total Synthesis of EP4 Agonist	*Advanced Synthesis & Catalysis*, 2017, **DOI:** 10.1002/adsc.201700542.
73	Manoranjan Kumar, Vinod Bhatt, Onkar S. Nayal, Sushila Sharma, Vishal Kumar, Maheshwar S. Thakur, Neeraj Kumar, Rajaram Bal,* Bikram Singh* and **Upendra Sharma***	CuI nanoparticles as a recyclable heterogeneous catalyst for C-N bond formation reactions	*Catalysis Science & Technology, 2017,* DOI:10.1039/C7CY00832E
72	Rakesh Kumar, Rakesh Kumar, Ankit Kumar Dhiman and **Upendra Sharma***	Regioselective Metal-free C(2)-H Arylation of Quinoline *N*-oxides with Aryldiazonium Salts/Anilines under Ambient Conditions	*Asian Journal of Organic Chemistry,* 2017, DOI: 10.1002/ajoc.201700267
71	Arti Sharma, Ritika Sharma, Rohit Arora, Saroj Arora, Bikram Singh* and **Upendra Sharma***	Quantitative and Qualitative Analysis of *Eruca sativa* and *Brassica juncea* Seeds by UPLC-DAD and UPLC-ESI-QTOF.	*Natural Product Communications,* 2017, accepted
70	Vinod Bhatt, Sushila Sharma, Neeraj Kumar, **Upendra Sharma** and Bikram Singh	Chemical Composition of Essential Oil among Seven Populations of Zanthoxylum armatum from Himachal Pradesh: Chemotypic and Seasonal Variation	*Natural Product Communications,* 2017, accepted
69	Manoranjan Kumar, Sushila Sharma, Krishna Thakur, Onkar S. Nayal, Vinod Bhatt,[Maheshwar S. Thakur, Neeraj Kumar, Bikram Singh*, and **Upendra Sharma***	Montmorilonite K10 catalyzed microwave assisted direct amidation of unactivated carboxylic acids with amines: Applicable for maintaining chiral integrity of substrates.	*Asian Journal of Organic Chemistry,* 2017, DOI: 10.1002/ajoc.201600590
68	Shruti Sharma, Vinod Bhatt, Neeraj Kumar, Bikram Singh,* and **Upendra Sharma***	Locational Comparison of Essential Oils from Selected Conifers of Himachal Pradesh.	*Natural product Research,* 2017, *31*, 1578-1582.
67	Vinod Bhatta, Sushila Sharmaa, Neeraj Kumar, **Upendra Sharma**, Bikram	Simultaneous quantification and identification of flavonoids, lignans, coumarin and amides in leaves of	*Journal of Pharmaceutical and Biomedical*

	Singh*	Zanthoxylum armatum using UPLC-DAD-ESI-QTOF–MS/MS	*Analysis,* 2017, *132*, 46.
66	Madhu Chandel, Manish Kumar, **Upendra Sharma**, Bikram Singh, Satwinderjeet Kaur	Investigations on antioxidant, antiproliferative and COX-2 inhibitory potential of alkaloids from Anthocephalus Cadamba (Roxb.) Miq. Leaves.	*Chemistry & Biodiversity*, 2017, 14, e1600376.
65	Rajeev Rattan,* Bharat Inder Fozdar, Veena Gautam, Ritika Sharma, Dinesh Kumar* and **Upendra Sharma**,*	Cuspidate A, New Anti-Fungal Triterpenoid Saponin from Lepidagathis cuspidata	*Natural product Research,* 2017, *31*, 773-779.
64	Sushila Sharma, Manoranjan Kumar, Vinod Bhatt, Onkar S. Nayal, Maheshwar S. Thakur, Neeraj Kumar, Bikram Singh,* and **Upendra Sharma***	Vasicine from *Adhatoda vasica* as an organocatalyst for metal-free Henry reaction and reductive heterocyclization of *o*-nitroacylbenzenes.	*Tetrahedron Letter,* 2016, *45*, 5003.
63	Sushila Sharma, Manoranjan Kumar, Onkar S. Nayal, Maheshwar S. Thakur, Vinod Bhatt, Neeraj Kumar, Bikram Singh* and **Upendra Sharma***	Designing of Vasicine Derived Ligands and Their Application for Ruthenium Catalyzed Transfer Hydrogenation Reactions in Water: Synthesis of Amines and Alcohols	*Asian Journal of Organic Chemistry,* 2016, 5, 1471-1479.
62	Sushila Sharma, Manoranjan Kumar, Shruti Sharma, Onkar S. Nayal, Neeraj Kumar, Bikram Singh* and **Upendra Sharma***	Microwave Assisted Vasicine Catalyzed Synthesis of Phenanthridinones via Intramolecular C-H Arylation with Aryl Halides. *(Highlighted in Synfacts 2016, 12(12): 1244)*	*Organic & Biomolecular Chemistry*, 2016, 14, 8536.
61	Onkar S. Nayal, Maheshwar S. Thakur, Vinod Bhatt, Manoranjan Kumar, Neeraj Kumar, Bikram Singh* and **Upendra Sharma***	Synthesis of tertiary arylamines: Lewis acid-catalyzed direct reductive *N*-alkylation of secondary amines with ketones through an alternative pathway	*Chemical Communications*, 2016, 52, 9648.
60	Rakesh Kumar, Inder Kumar, Ritika Sharma, **Upendra Sharma***	Catalyst and Solvent-Free alkylation of Quinoline *N*-oxides with Olefins: Direct Access to Quinoline Substituted α–Hydroxy Carboxylic Derivatives.	*Organic & Biomolecular Chemistry*, 2016, 14, 2613.

59	Dinesh Kumar,* Ashu Gulati, **Upendra Sharma***	Determination of Theanine and Catechin in Camellia sinesis (Kangra Tea) Leaves by HPTLC and NMR Techniques.	*Food Analytical Methods*, 2016, 9, 1666.
58	Madhu Chandel, Manish Kumar, Upendra Sharma, Neeraj Kumar, Bikram Singh, Satwinderjeet Kaur	Isolation and characterization of flavanols from Anthocephaluscadamba and evaluation of their antioxidant, antigenotoxic, cytotoxicand COX-2 inhibitory activities	*Brazilian Journal of Pharmacognosy,* 2016, 26, 474.
57	Ashun Chaudhary, Sonika Choudhary, **Upendra Sharma** and Saroj Arora	In vitro evaluation of antioxidant, antiproliferative and apoptotic induction on prostate cancer cell line by non-polar constituents in brassica sprouts extracts.	*Indian J. Pharmaceutical Sciences,* 2016, 78, 615.
56	Rajeev Rattan, Amita Kumari, Veena Gautam, Bharat Inder Fozdar, **Upendra Sharma*** and Dinesh Kumar*	Preliminary Phytochemical Screening, Antioxidant and Antifungal Activity of Lepidagathis cuspidate	*International Journal of Drug Development and Research* 2016, 8, 001-003.
55	Ritika Sharma, Rakesh Kumar, Inder Kumar, **Upendra Sharma***	Rh(III)-Catalyzed Dehydrogenative Coupling of Quinoline *N*-Oxides with Alkenes: *N*-Oxide as Traceless Directing Group for Remote C-H Activation.	*European Journal of Organic Chemistry* 2015, 7519.
54	Ritika Sharma, Rakesh Kumar, Inder Kumar, Bikram Singh, **Upendra Sharma***	Selective C-Si Bond Formation through C-H Functionalization.	*Synthesis*, 2015, *47(16)*, 2347.
53	Ritika Sharma, Kavita Thakur, Rakesh Kumar, Inder Kumar, **Upendra Sharma***	Distant C-H Activation/Functionalization: A New Horizon of Selectivity beyond Proximity.	*Catalysis Reviews: Science and Engineering*, 2015, *57(3)*, 345.
52	Ritika Sharma, Kavita Thakur, **Upendra Sharma***	Olefins as Unprecedented Feedstock for the Synthesis of Valuable Heterocycles: Regioselectivity Remains an Issue**.**	*Synlett,* 2015**,** *26(02)*, 137.
51	Rajeev Rattan*, S. G. Eswara Reddy, Shudh Kirti Dolma, Bharat Inder Fozdar, Veena Gautam, Ritika Sharma, **Upendra Sharma***	Triterpenoid Saponins from *Clematis graveolens* and Evaluation of their Insecticidal Activities.	*Natural Product Communications,* 2015*, 10(9),* 1525-1528.
50	Soumitra Agasti, **Upendra Sharma**, Togati Naveen, Debabrata Maiti	Orthogonal Selectivity with Cinnamic Acids in 3-substituted Benzofuran Synthesis through C–H	*Chemical Communication*, 2015, 51, 5375.

		Olefination of Phenols.	
49	**Upendra Sharma**, Rajesh Kancherla Togati Naveen, Soumitra Agasti, Debabrata Maiti	Palladium-Catalyzed Annulation of Diarylamines with Olefins through C–H Activation: Direct Access to N-Arylindoles. *(Highlighted in Synfacts 2015, DOI: 10.1055/s-0034-1379706)*	*Angewandte Chemie International Edition,* 2014, 53, 11895. *Angewandte Chemie*, 2014, *126*, 12089.
48	**Upendra Sharma**, Yoonsu Park, Sukbok Chang	Rh(III)-Catalyzed Traceless Coupling of Quinoline *N*-Oxides with Internal Diarylalkynes.	*Journal of Organic Chemistry*, 2014, *79*, 9899-9906.
47	Mayanka Walia, **Upendra Sharma**, Vijai K. Agnihotri, Bikram Singh	Silica-Supported Boric Acid Assisted Conversion of Mono- and Poly-saccharides to 5-Hydroxymethylfurfural in Ionic Liquid.	*RSC Advance*, 2014, 4, 14414.
46	Soham Maiti, Togati Naveen, **Upendra Sharma**, Debabrata Maiti	Efficient and Stereoselective Nitration of Olefins with $AgNO_2$ and TEMPO. *(Invited Synpact article)*	*Synlett*, 2014, 25, 603.
45	Praveen K. Verma, Manju Bala, Kavita Thakur, **Upendra Sharma**, Neeraj Kumar and Bikram Singh	Iron and Palladium (II) Phthalocyanines as Recyclable Catalysts for Reduction of Nitroarenes.	*Catalysis Letter*, 2014, *144*, 1258.
44	Ashun Chaudhary, **Upendra Sharma**, Adrah. Pal Vig, Bikram Singh, Saroj Arora	Free radical scavenging, antiproliferative activities and profiling of variations in the level of phytochemicals in different parts of broccoli (*Brassica oleracea* italica).	*Food Chemistry*, 2014, *148*, 373.
43	Vishal Kumar, **Upendra Sharma**, Praveen Kumar, Neeraj Kumar, Bikram Singh	Silica-supported Boric Acid Catalyzed Synthesis of Dihydropyrimidin-2-ones, Bis(indolyl)methanes, Esters and Amides.	*Indian Journal of Chemistry Section – B,* 2014, *53B*, 83.
42	**Upendra Sharma**, Togati Naveen, Arun Maji, Srimanta Manna, Debabrata Maiti	Palladium Catalyzed Synthesis of Benzofurans and Coumarins from Phenols and Olefins. *(Most Accessed Paper in October, 2013)*	*Angewandte Chemie International Edition.* 2013, 52, 12669. *Angewandte Chemie* 2013, 125, 12901.
41	Soham Maiti, Togati Naveen, **Upendra Sharma**, Debabrata Maiti	Stereoselective Nitration of Olefins with tBuONO and TEMPO: Direct Access to Nitroolefins under Metal-	*Organic Letter*, 2013, 15, 3384.

		free Condition. *(Highlighted by Organic Chemistry Portal 2013 (http://www.organicchemistry.org/abstracts/lit4/087.shtm)*	
40	Togati Naveen, Soham Maiti, **Upendra Sharma**, Debabrata Maiti	A Predictably Selective Nitration of Olefin with $Fe(NO_3)_3$ and TEMPO. *(Highlighted in Organic Process Research & Development 2013, 17, 1076−1084; Organic Chemistry Portal 2013 (http://www.organic-chemistry.org/abstracts/lit4/062.shtm)*	*Journal of Organic Chemistry*, 2013, *78*, 5949.
39	Tuhin Patra, Arghau. Deb, Srimanta Manna, **Upendra Sharma**, Debabrata Maiti	Iron-Mediated Decarboxylative Trifluoromethylation of *α,β*-Unsaturated Carboxylic Acids with Trifluoromethanesulfinate. (*Highlighted in Organic Process Research & Development 2013, 17, 1369-1379)*	*European Journal of Organic Chemistry*, 2013, *24*, 5257.
38	Manju Bala, Praveen Kumar Verma, **Upendra Sharma**, Neeraj Kumar, Bikram Singh	Iron Phthalocyanine as an Efficient and Versatile Catalyst for N-alkylation of Heterocyclic Amines with Alcohols: One-pot Synthesis of 2-Substituted Benzimidazoles, Benzothiazoles and Benzoxazoles.	*Green Chemistry* 2013, *15*, 1687.
37	Shunmugam. Nagarajan, Syamantak. Majumder, **Upendra Sharma**, Saranya Rajendran, Neeraj Kumar, Suvro Chatterjee, Bikram Singh	Synthesis and anti-angiogenic activity of benzothiazole, benzimidazole containing phthalimide derivatives.	*Bioorganic Medicinal Chemistry Letters,* 2013*, 13*, 287.
36	Praveen K. Verma, **Upendra Sharma**, Manju Bala, Neeraj Kumar, Bikram Singh	Transition Metal-free 1,3-Dimethylimidazolium Hydrogen Carbonate Catalyzed Hydration of Organonitriles to Amides.	*RSC Advance*, 2013, *3*, 895.
35	Manoj Kumar, **Upendra Sharma**, Sushila Sharma, Vishal Kumar, Bikram Singh, Neeraj Kumar	Catalyst-Free Water Mediated Reduction of Nitroarenes Using Glucose as Hydrogen Source.	*RSC Advance*, 2013, *3*, 4894.
34	Manju Bala, Praveen Kumar Verma, Neeraj Kumar, **Upendra Sharma**, Bikram Singh.	Highly Efficient Iron Phthalocyanine Catalysed Oxidative Synthesis of Imines from Alcohols and Amines. *(Most downloaded articles of the from May to November, 2013)*	*Canadian Journal of Chemistry,* 2013, *91*, 732.
33	Praveen K. Verma, Neeraj Kumar, **Upendra Sharma**, Manju Bala, Vishal Kumar,	Transition Metal-Free Sodium Borohydride Promoted Controlled Hydration Of Nitriles To Amides.	*Synthetic Communication,* 2013, *43*, 2867.

	Bikram Singh		
32	**Upendra Sharma**, Neeraj Kumar, Bikram Singh, Renuka K. Munshi and Supriya. Bhalerao	Immunomodulatory Active Steroidal Saponins from *Asparagus racemosus*.	*Medicinal Chemistry Research,* 2013, *22*, 573.
31	Deepali Katoch, Dharmesh Kumar, **Upendra Sharma**, Neeraj Kumar, Yogendra S. Padwad, Brij Lal, Bikram Singh	Zephgrabetaine: A New Betaine-type Amaryllidaceae Alkaloid from *Zephyranthes grandiflora*.	*Natural Product Communications,* 2013, *8*, 161-164.
30	Manyaka Walia, **Upendra Sharma**, Sashi Bhushan, Neeraj Kumar, Bikram Singh	Arabinan-type Polysaccharides from Industrial Waste Apple Pomace.	*Chemistry of Natural compounds*, 2013, *49*, 794.
29	**Upendra Sharma**, Deepali. Katoch, Swati. Sood, Neeraj Kumar, Bikram Singh, Archana Thakur, Arvind Gulati	Synthesis, Antibacterial and Antifungal activity of 2-Amino-1,4-Naphthoquinones Using Silica-Supported Perchloric Acid ($HClO_4$-SiO_2) as a Mild, Recyclable and Highly Efficient Heterogeneous Catalyst.	*Indian Journal of Chemistry Section – B,* 2013, *52B*, 1431.
28	Chitra Singh, Vishal Kumar, **Upendra Sharma**, Neeraj Kumar, Bikram Singh	Recent Advances in the Synthesis of Amide.	*Current Organic Synthesis,* 2013, *10*, 241.
27	**Upendra Sharma**, Neeraj Kumar, Praveen K. Verma, Vishal Kumar, Bikram Singh	Zinc Phthalocyanine with PEG-400 as A Recyclable Catalytic System for Selective Reduction of Aromatic Nitro Compounds.	*Green Chemistry* 2012, *14*, 2289.
26	**Upendra Sharma**, Manju Bala, Neeraj Kumar, Bikram Singh, Renuka K. Munshi, Supriya Bhalerao	Immunomodulatory Active Compounds from *Tinospora cordifolia*.	*Journal of Ethnopharmacology,* 2012, *141*, 918.
25	**Upendra Sharma**, Manju Bala, Rikki Saini, Praveen K. Verma, Neeraj Kumar, Bikram Singh, Renuka K. Munshi, Supriya Bhalerao	Polysaccharide Enriched Immunomodulatory Fractions from *Tinospora cordifolia.*	*Indian Journal of Experimental Biology,* 2012, *50*, 612.
24	**Upendra Sharma**, Neeraj Kumar, Bikram Singh.	New Furostanol Saponin and Phenyl Propanoid from Roots of *Asparagus racemosus.*	*Natural Product Communications* 2012, *7*, 995-998.
23	Vishal Kumar, Sushila Sharma, **Upendra Sharma**, Bikram Singh, Neeraj Kumar	Synthesis of Substituted Amines and Isoindolinones: Catalytic Reductive Amination using Abundantly Available $AlCl_3$/PMHS.	*Green Chemistry* 2012, *14*, 3410.
22	Vishal Kumar, **Upendra Sharma**, Praveen K. Verma, Neeraj Kumar,	Cobalt(II) Phthalocyanine Catalyzed Highly Chemoselective Reductive Amination of Carbonyl Compounds	*Advanced Synthesis & Catalysis,* 2012, *354*, 870.

	Bikram Singh	in a Green Solvent.	
21	Ashun Chaudhary, Geetanjli Rampal, **Upendra Sharma**, Tarunpreet Singh Thind, Bikram Singh, A. P. Vig, Saroj Arora	Anticancer, antioxidant activities and GC-MS analysis of glucosinolates in two cultivars of broccoli.	*Medicinal Chemistry & Drug Discovery* 2012, *2*, 30.
20	Madhu Chandel, **Upendra Sharma**, Neeraj Kumar, Bikram Singh, Satwinderjeet Kaur	Antioxidant Activity and Identification of Bioactive Compounds from Leaves of *Anthocephalus cadamba* by Ultra-Performance Liquid Chromatography/Electrospray Ionization Quadrupole Time of Flight Mass Spectrometry.	*Asian Pacific Journal of Tropical Medicine,* 2012, 977.
19	Vishal Kumar, **Upendra Sharma**, Bikram Singh, Neeraj Kumar	Direct One-Pot Cobalt(II) Phthalocyanine Catalyzed Synthesis of *N*-Substituted Isoindolinones.	*Australian Journal of Chemistry*, 2012, *65*, 1594.
18	Praveen Kumar Verma, **Upendra Sharma**, Neeraj Kumar, Manju Bala, Vishal Kumar, Bikram Singh	Nickel Phthalocyanine Assisted Highly Efficient and Selective Carbonyl Reduction in Polyethylene Glycol-400.	*Catalysis Letter,* 2012, *142*, 907.
17	Neeraj Kumar, **Upendra Sharma**, Chitra Singh, Bikram Singh	Thalidomide: Chemistry, Therapeutic Potential and Oxidative Stress Induced Teratogenicity.	*Current Topics in Medicinal Chemistry,* 2012, *12*, 1436.
16	**Upendra Sharma**, Praveen Kumar Verma, Neeraj Kumar, Vishal Kumar, Manju Bala, Bikram Singh	Phosphane-Free Green Protocol for Selective Nitro Reduction with Iron Based Catalyst.	*Chemistry: A European Journal*, 2011, *17*, 5903.
15	Vishal Kumar**, Upendra Sharma**, Praveen Kumar, Neeraj Kumar, Bikram Singh	Silica-Supported Boric Acid with Ionic Liquid: A Recyclable and Green Catalytic System for One-Pot Three-Component Mannich Reaction.	*Chemical & Pharmaceutical Bulletin*, 2011, *59*, 639.
14	Rajbir Kaur, **Upendra Sharma**, Bikram Singh Saroj Arora	Antimutagenic and Antioxidant Characteristics of *Chukrasia tabularis* A. Juss. Extracts.	*International Journal of Toxicology*, 2011, *30*, 21.
13	Rajbir Kaur, **Upendra Sharma**, Bikram Singh Saroj Arora	Antimutagenic Potential of Chickrassy (*Chukrasia tabularis A. Juss*) bark.	*Journal of Medicinal Plants Research,* 2011, *5*, 5021.
12	**Upendra Sharma**, Praveen K.Verma, Neeraj Kumar, Vishal Kumar, Bikram Singh	Highly Chemo- and Regioselective Reduction of Aromatic Nitro Compounds Catalyzed by Recyclable Copper(II) as well as Cobalt(II) Phthalocyanine.	*Advanced Synthesis & Catalysis*, 2010, *352*, 1834.

11	**Upendra Sharma**, Praveen Kumar, Neeraj Kumar, Bikram Singh	Recent Developments in the Chemistry of Phthalimide Derivatives and Their Role as TNF-α Inhibitor.	*Mini Review in Medicinal Chemistry*, 2010, *10*, 678.
10	**Upendra Sharma**, Pamita Bhandari, Neeraj Kumar, Bikram Singh	Simultaneous Determination of Ten Sugars in *Tinospora cordifolia* by Ultrasonic Assisted Extraction and HPLC-ELSD Method.	*Chromatographia*, 2010, *71*, 633.
9	**Upendra Sharma**, Manju Bala, Praveen K Verma, Geetanjli. Rampal, Neeraj Kumar, Bikram Singh, Saroj Arora	Antimutagenic Extract from *Tinospora cordifolia* and its Chemical Composition.	*Journal of Medicinal Plants Research*, 2010, *4*, 2488.
8	**Upendra Sharma***	Silica Supported Perchloric Acid ($HClO_4$-SiO_2): A Versatile Reagent in Organic Synthesis.	*Synlett*, No. 2009, *19*, 3219.
7	**Upendra Sharma**, Rikki Saini, Bobita, Neeraj Kumar, Bikram Singh	Steroidal Saponins from *Asparagus racemosus.*	*Chemical & Pharmaceutical Bulletin,* 2009, *57*, 890.
6	Ritu Bala, Raj Pal Sharma, **Upendra Sharma**, Andrew D. Burrows, Kevin Cassar	Hexaamminecobalt(III) Complexes as Multiple Hydrogen Bond Donors: Synthesis, Characterization and X-ray Structural Study of Mixed Anion Complexes $[Co(NH_3)_6]Br_2(BF_4)$ and $[Co(NH_3)_6]Cl_2(HC_2O_4).H_2O$.	*Journal of Molecular Structure*, 2007, *832*, 156.
5	Ritu Bala, Raj Pal Sharma, **Upendra Sharma**, Veleria Ferretti	The First X-ray Structure of a Hexaamminecobalt(III) Salt with Two Different Complex Chlorocadmium Anions: Synthesis, Characterization and Crystal Structure of $[Co(NH_3)_6]_4[CdCl_6][CdCl_4(SCN)(H_2O)]_2Cl_2.2H_2O$.	*Acta crystallographica. Section C*, 2006, *62*, m 628.

BOOK CHAPTER

4. **U. Sharma**, A. Modak, S. Maity, A. Maji and D. Maiti. Direct Arylation *via* C-H activation. Thomas Colacot eds., *Introduction to New Trends in Cross-Coupling: Theory and Applications*. 2014.
3. M. Chandel, **U. Sharma**, N. Kumar, B. Singh and S. Kaur. In Vitro Studies on the Antioxidant/Antigenotoxic Potential of Aqueous Fraction from *Anthocephalus cadamba* Bark. P.R. Sudhakaran *et al.* (eds.), *Perspectives in Cancer Prevention-Translational Cancer Research*, 2013, DOI 10.1007/978-81-322-1533-25.

PATENT

2. B. Singh, S. Chattergi, N. Kumar and **U. Sharma**. Benzothiazole Substituted Phthalimide Analogues as Potential Angiogenesis Inhibitors. Ref. No. 0918 DEL 2011.
1. **U. Sharma**, N. Tagoti, and D. Maiti. Palladium-Catalyzed Synthesis of Benzofurans and Coumarins from Phenols and Olefins. Status: Provisional. IPA No: 2012/Mum/2013.

PAPER PRESENTED IN CONFERENCE

Oral Presentations

1. "**Phytochemical Investigation of *Tinospora cordifolia* and *Asparagus racemosus* for Potential Immunmodulatory Agents**" in Scientific Validation of Traditional knowledge, IIT Rorkee, Uttarakhand on March 12-13, 2016 Organized by: MHRD-IPR Chair IIT Roorkee, Uttarakhand

2. "**Efforts Towards Characterization of Bioactive Molecules from Medicinal Plants**" 4th International Congress of the Society for Ethnopharmacology, India Healthcare in 21st century: Perspectives of Ethnopharmacology & Medicinal Plant Research, UKA Tassadia University, Bardoli, Surat, Gujrat on February 23-25, 2017.
(Manjushree Pal Memorial Award for Best Presentation from Ethanopharmacology Society of India, Kolkata)

Poster Presentation

3. R. Sharma, I. Kumar and **U. Sharma**.* Rhodium-catalyzed remote C-H activation using traceless directing group. 21st International Conference on Organic Chemistry, IIT Bombay, Bombay, India on 11-16 December, 2016.

4. Onkar S Nayal, M S Thakur, N. Kumar, **U. Sharma*** and B. Singh.* Novel Approches for the Synthesis of Tertiary Amines via Carbocationic Pathway. ***VI National Symposium on Advances in Chemical Science at*** GNDU, Amritsar, Punjab, India on 5-6 March, 2017.
(Best Poster Award)

5. Rakesh Kumar, Ankit Kumar Dhiman and Upendra Sharma. Catalyst and Solvent Free Access to Bioactive Quinoline Derivatives. ***21st International Conference on Organic Chemistry***, IIT Bombay, Bombay, India on 11-16 December, 2016.

6. M. Kumar, N. Kumar, B. Singh and **U. Sharma**.* Harnessing bio-based reagents for C-N bond formation reactions. 21st International Conference on Organic Chemistry, IIT Bombay, Bombay, India on 11-16 December, 2016.

7. S. Sharma, N. Kumar, B. Singh and **U. Sharma**.* Bioactivity to organocatalysis: Introduction of vasicine for C-C bond formation and reduction reaction. 21st International Conference on Organic Chemistry, IIT Bombay, Bombay, India on 11-16 December, 2016.

8. A. Chaudhary, **U. Sharma**, A. P. Vig, V. Sharma, B. Singh and S. Arora. Biological and Chemical Investigation of Brassica oleracea L. Var. italica Plenck (Broccoli) at Different Developmental Stage. ICEMCH – 2016, International Conference on Environmental Mutagenesis, Carcinogenesis and Health and 40th Annual Meeting of Environmental Mutagen Society of India (EMSI), GNDU, Amritsar, India on 17-19 February, 2016.

9. M. Chandel, M. Kumar, **U. Sharma**, N. Kumar, B. Singh and S. Kaur. Isolation and Characterization of Phytoconstituents from Anthocephalus cadamba (Roxb.) Miq. Leaves with Potent Antioxidant, Antigenotoxic, Antiproliferative and COX-2 Inhibitory Activities. ICEMCH – 2016, International Conference on Environmental Mutagenesis, Carcinogenesis and Health and 40th Annual Meeting of Environmental Mutagen Society of India (EMSI), GNDU, Amritsar, India on 17-19 February, 2016.

10. **U. Sharma**, S. Agasti, T. Naveen and D. Maity. Palladium Catalyzed Selective Synthesis of Substituted Benzofurans from Phenols and Olefins: One-Step Triple C-H Activation. 16th CRSI National Symposium in Chemistry. Organised by Chemical Research Socity of India at Indian Institute of Technology Bombay, Powai, Mumbai. (**2014**)

11. V. Kumar, **U. Sharma**, P. K. Verma, B. Singh, N. Kumar. Metal Phthalocyanines: Biomimetic Catalysts for Selective and Sustainable Organic Synthesis. 6th International Conference on Green and Sustainable Chemistry (GSC-6) at The University of Nottingham, Nottingham, UK (**2013**).
12. **U. Sharma**, P. K. Verma, V. Kumar, N. Kumar and B. Singh. Highly Chemo- and Regioselective Metal Phthalocyanines Catalyzed Reductions. 12th Eurasia Conference on Chemical Sciences Organised by University of Ioannina at Chandris Hotel, Corfu, Greece. (**2012**)
13. **U. Sharma**, P. K. Verma, V. Kumar, N. Kumar and B. Singh. Metal Phthalocyanines as Efficient Catalysts for Highly Chemo- and Regioselective Organic Transformations. 3rd Asian Conference on Coordination Chemistry Organised by IIT, Kanpur and IIT Delhi at India Habitat Center, New Delhi, India (ACCC-3, **2011**).
14. **U. Sharma**, R. Saini, Bobita, N. Kumar and B. Singh. Diagnostic NMR Signals for Structure Elucidation of Steroidal Saponins from *Asparagus racemosus*. 17th Conference of National Magnetic Resonance Society at GNDU, Amritsar, India (NMRS, **2011**).
15. **U. Sharma**, R. Saini, P. Bhandari, N. Kumar and B. Singh Reversed-Phase HPLC-Evaporative Light Scattering Detection for Determination of Immunomodulatory Sugars in *Tinospora cordifolia*. 2nd National Symposium on Analytical Sciences on "Analytical Innovations for

Process and Technology Development**"** organized by Indian Society of Analytical Scientists and IHBT, at IHBT Palampur (**2008**).

16. V. Kumar, **U. Sharma**, P. K. Verma, C. Singh, N. Kumar, and B. Singh. Silica Supported Perchloric Acid (H_3BO_4-SiO_2): A Versatile Reagent for Fundamental Organic Transformations. International Symposium on "Recent Advances in Chromatography Science and Green Chemistry" organized by Indian Society of Analytical Scientists at Manav Rachna International University, Faridabad, India (**2012**).

17. V. Kumar, **U. Sharma**, N. Kumar and B. Singh. Structure Elucidation of Diastereomeric Furofuran Lignans of *Zanthoxylum armatum* by NMR Spectroscopy. 17th Conference of National Magnetic Resonance Society, GNDU, Amritsar, India (NMRS, **2011**).

AWARDS

Manjushree Pal Memorial Award for Best Oral Presentation from Ethanopharmacology Society of India, Kolkata (2017)
Thieme Chemistry Journal Award (2016)
D S Kothari Postdoc Fellowship (2012)
Fast Track Young Scientist project for three years (2012)
Postdoc Fellowship KAIST, South Korea (2014)
CSIR Senior Research Fellowship (2009)
CSIR Junior Research Fellowship (2007)
GATE (2007)
CSIR-NET (2006)

MEMBERS OF PROFESSIONAL SOCIETY

Life member of Analytical Society of Analytical Scientists since 2008 (LM No. 2008/38).

TRAINING

Attended one month "CSIR Technology Led Entrepreneurship Program" at IICT, Hyderabad in 2008.
Attended ten days "Scientist Induction Training Programme" at HRDC, Ghaziabad in 2016.

EDITORSHIP

1 Editorial Board member **Student Journal of chemistry** (Student's Publishing Services, Antalya, Turkey)

2 Editorial Board member **Pharmacolgia a Science Magzine** (pISSN: 2044-4648; eISSN: 2044-4656)

REVIEWER FOR JOURNALS

Organic Letters
The Journal of Organic Chemistry
Advance Synthesis & Catalysis
Biomedicine & Pharmacotherapy
Natural Product Communications
Separation Science and Technology
Toxicology and Environmental Health Sciences
International Journal of Environmental Analytical Chemistry

RESEARCH SUMMARY

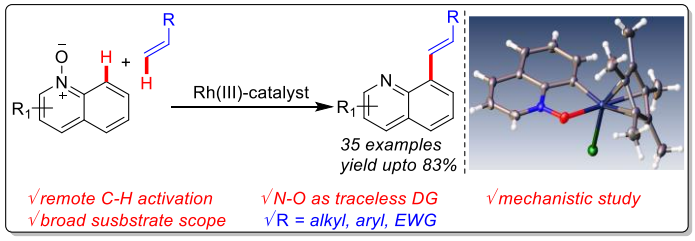
After Independent Lab (2014-Till date)

The research work driven by our group basically gives thrust to the basic science keeping close correlation with future applications. Natural product based novel and bioactive molecules will impute the therapeutic application in modern science. The scientific validation of Ayurveda plants provides scientific basis for their use leading towards high social impact. All our work will open new avenue for the chemical science development. Currently industries are trying to adopt green technologies and our work in the field of catalysis for C-H activation will have huge impact in this area.

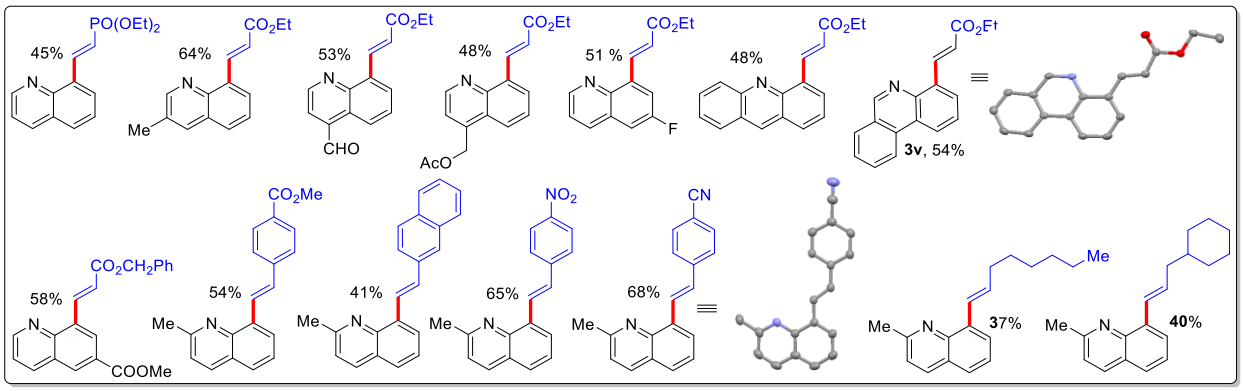
Our group is working towards the synthesis of new quinoline based molecules C-H activation/functionalization.

Rh(III)-Catalyzed Dehydrogenative Coupling of Quinoline *N*-Oxides with Alkenes: *N*-Oxide as Traceless Directing Group for Remote C-H Activation (*Eur. J. Org. Chem.* **2015**, 7519.)

A Rh(III)-catalyzed oxidative dehydrogenative coupling of quinoline N-oxides with alkenes to provide 8-alkenylated quinoline derivatives through remote C-H activation is reported. Main features of the current catalytic method include N-oxide as traceless directing group, high selectivity for C-8 position and broad substrate scope. Mechanistic studies such as isolation and characterization of key five-membered rhodacycle intermediate has also been performed. We have synthesized thirty five new quinoline derivatives via distant C-H activation most of which are new entities.

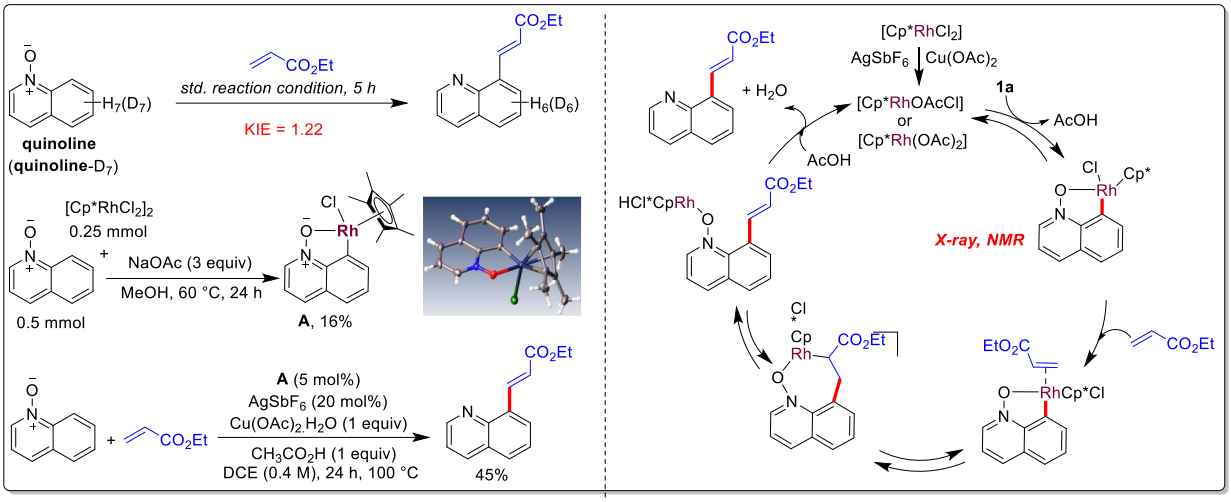


Selected examples of first time synthasized molecules



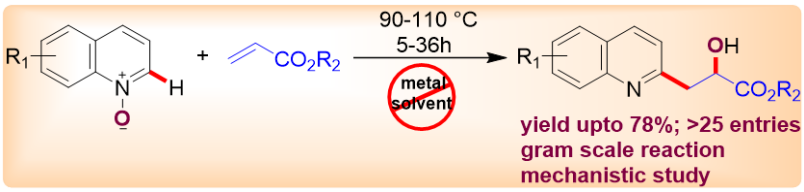
Number of experiments were carried out to understand the pathway of remote C-H activation. Rhodacycle with quinoline *N*-oxide was synthesized for the first time and it is not

only helpful in establishing the mechanistic pathway of current reaction but will also be helpful for developing related new transformations.

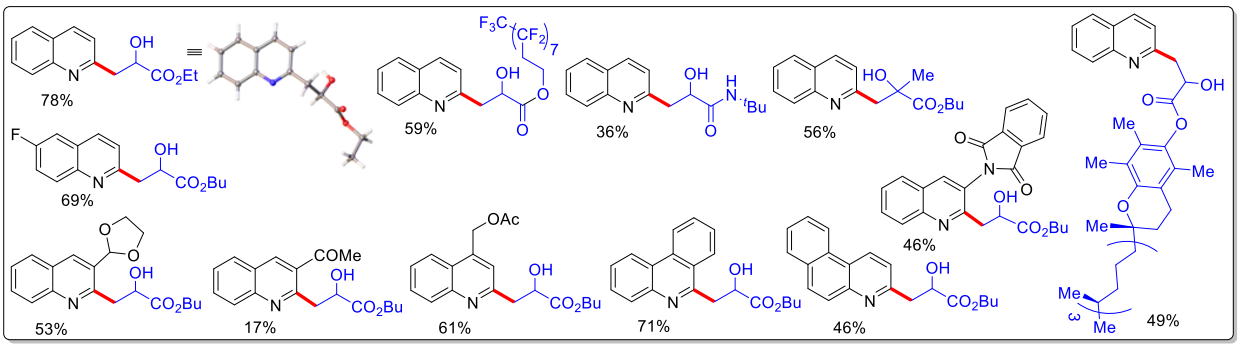


Catalyst and Solvent-Free alkylation of Quinoline N-oxides with Olefins: Direct Access to Quinoline Substituted α–Hydroxy Carboxylic Derivatives *(Org. Bio. Chem.* **2016**, *14,* 2613.*)*

A catalyst/solvent-free, one-pot and operationally simple method for the synthesis of quinoline substituted *α*-hydroxy carboxylic derivatives by hydroxyheteroarylation of olefins with quinoline *N*-oxides is reported. The reaction features high atom-economy, mild and reagent/solvent-free conditions, broad substrate scope and good selectivity with high yields. Preliminary mechanistic study to shed light into the reaction pathway was also carried out.

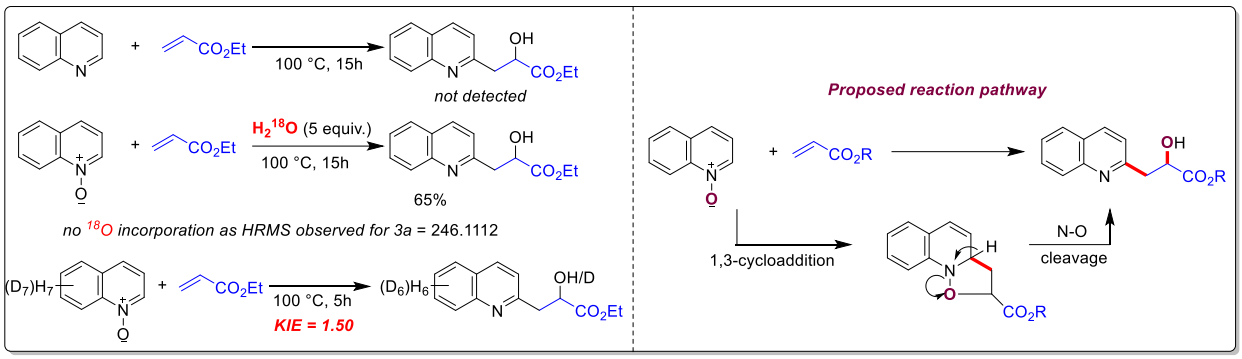


Selected examples of synthasized molecules

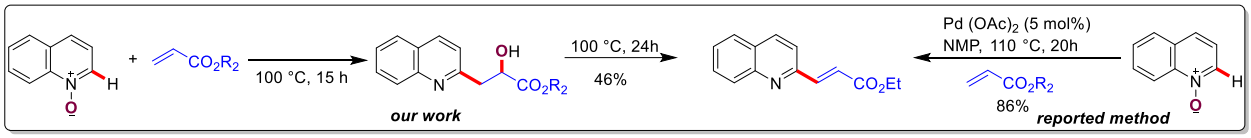


For preliminary understanding of the reaction pathway, few experiments were carried out. Use of quinoline instead of quinoline *N*-oxide failed to provide any product confirming the requirement of later. To probe the O-atom transfer course, standard reaction was carried out in the presence of 99% $H_2{}^{18}O$. HRMS and GC-MS analysis of the isolated product revealed no ^{18}O incorporation, thus suggesting that O-atom transfer is probably intramolecular. Competition experiment between quinoline and the deuterated analogue ***d7-*** quinoline

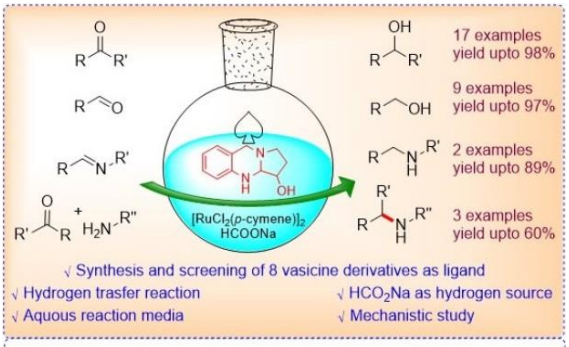
revealed a kinetic isotope effect of $k_H/k_D \approx 1.50$, indicating that the cleavage of C-H bond of quinoline *N*-oxide may or may not be involved in the rate-limiting step. On the basis of these preliminary mechanistic experiments and literature, a probable mechanistic pathway is depicted. Reaction might involve 1,3-dipolar cycloaddition followed by cleavage of N-O bond to provide the final product.



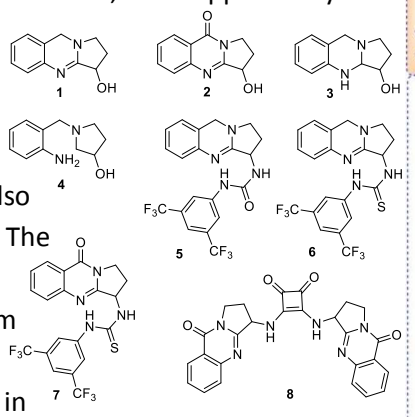
Quinoline substituted *α*–hydroxy carboxylic acid derivatives (**3a)** can be converted into corresponding C-2 olefinated quinoline by simply heating at 100 ^{0}C for 24h without using any additive or solvent albeit in low yield.



Designing of Vasicine Derived Ligands and Their Application for Ruthenium Catalyzed Transfer Hydrogenation Reactions in Water: Synthesis of Amines and Alcohols (*Asian Journal of Organic Chemistry,* **2016**, *accepted)*



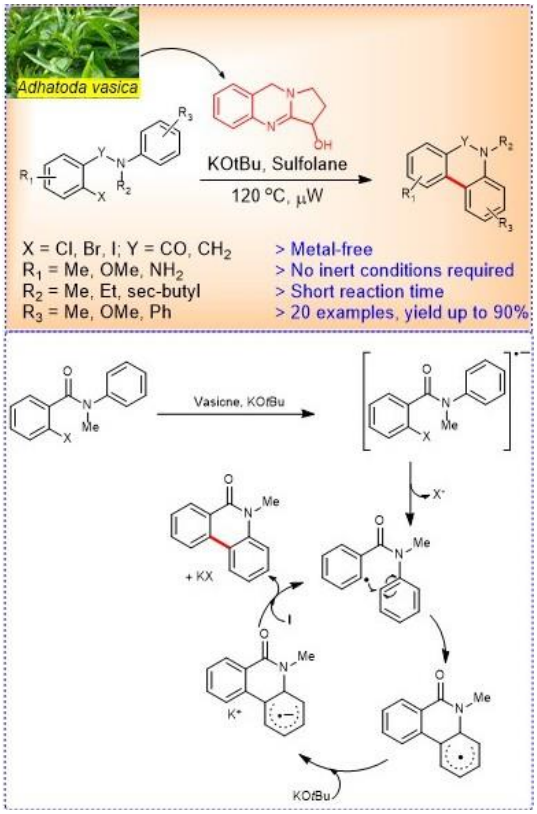
Quinazoline ligands (3-8) have been synthesized starting from vasicine (1) and vasicinone (2) and their potential as ligand were evaluated for ruthenium catalyzed transfer hydrogenation of aldehydes, ketones and imines to corresponding alcohols and amines, respectively. Further, the applicability of catalytic system for direct reductive amination of carbonyls with anilines was also investigated. The 3/[$RuCl_2$(*p*-cymene)]$_2$ catalytic system exhibited good to excellent activity in water with sodium formate as hydrogen source. Current study revealed that among all the synthesized ligands, ligands with secondary amine



groups with a rigid backbone were more active for transfer hydrogenation of unsaturated compounds.

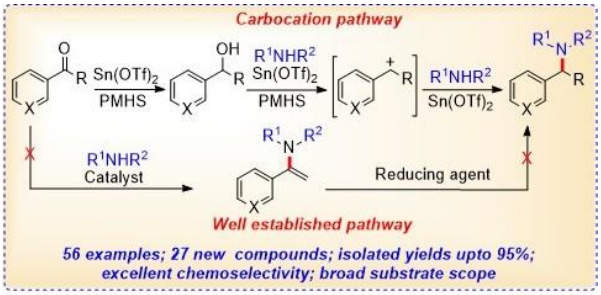
Microwave Assisted Synthesis of Phenanthridinones and Dihydrophenanthridines by Vasicine/KO*t*Bu Promoted Intramolecular C-H Arylation (*Organic & Biomolecular Chemistry***, 2016**, *14*, 8536**)**

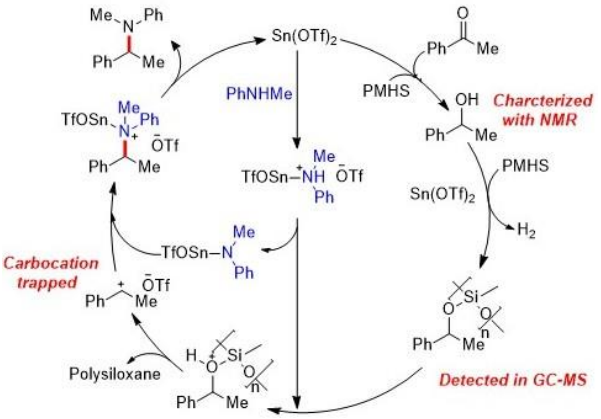
A simple, efficient, rapid and transition metal-free methodology has been developed by utilizing vasicine (a natural product), as catalyst for the synthesis of phenanthridinones and dihydrophenanthridines. The reaction proceeds through intramolecular C-H arylation with aryl halides in the presence of KO*t*Bu as base under microwave irradiation in sulfolane as solvent. The reaction proceeds well with various aryl iodides, bromides and more remarkably with less reactive aryl chlorides within 15 minutes providing corresponding products in 45-90% yields.



Synthesis of tertiary arylamines: Lewis acid-catalyzed direct reductive *N*-alkylation of secondary amines with ketones through an alternative pathway (*Chemical Communications***, 2016**, *52*, 9648**)**

A highly efficient tin(II)/PMHS catalyzed method has been developed for reductive *N*-alkylation of arylamines with ketones for the synthesis of various tertiary arylamines. Very wide substrate scope was observed for current catalytic method as all six permutations of ketones/aldehydes/heterocyclic carbonyls and primary/ secondary/ heterocyclic amines were well tolerated, enabling access to secondary, tertiary and heterocyclic amines. The method is also convenient for the synthesis of *N*-substituted isoindolinones and phthalazinones via tandem amination–amidation sequence. Mechanistic investigations revealed



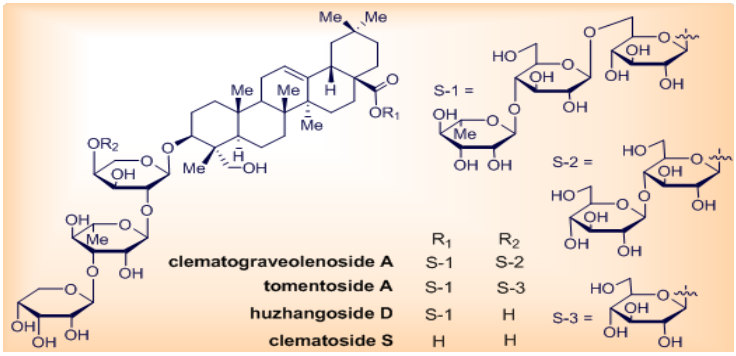


carbocationic pathway instead of ordinary direct reductive amination pathway.

Natural Product Chemistry

Phytochemical Investigation of Clematis graveolens *(Nat. Prod. Commun.* **2015***, 10(9),* 1525.*)*

A new hederagenin based triterpenoid saponin, clematograveolenoside A (**1**), along with three known saponins, tomentoside A (**2**), huzhangoside D (**3**) and clematoside S (**4**), were isolated from the roots of *Clematis graveolens*. The structure of new compound was elucidated as *3-O-β-D-ribopyranosyl-(1→3)-α-L-rhamnopyranosyl-(1→2)-[β-D-glucopyranosyl-(1→4)-β-D-glucopyranosyl-(1→4)]-α-L-arabino pyranosyl hederagenin 28-O-α-L-rhamnopyranosyl-(1→4)-β-D-glucopyranosyl-(1→6)-β-D-glucopyranoside* (**1**), on the basis of detailed analysis of chemical and spectroscopic data including 1D- and 2D NMR. This is the first report for the isolation of tomentoside A (**2**) from this genus and huzhangoside D (**3**) and clematoside S (**4**) from this species. Compound **2** was found more effective against aphid, *Aphis craccivora* with an LC_{50} of 1.21 and 0.46 mg/L at 72 and 96 h after treatment respectively and was followed by compound **4** (LC_{50} = 2.33 and 1.88 mg/L) and **1** (LC_{50} = 3.17 and 2.60 mg/L). In case of termite (*Coptotermis homii*), compound **1** was found more toxic with an LC_{50} of 0.12 mg/L after 24 h of treatment followed by compound **2, 3** and **4** (LC_{50} = 0.13, 0.15 and 0.19 mg/L respectively).



Before Independent Lab (2007-2014)

Palladium Catalyzed Synthesis of Indoles through multiple C-H functionalization:

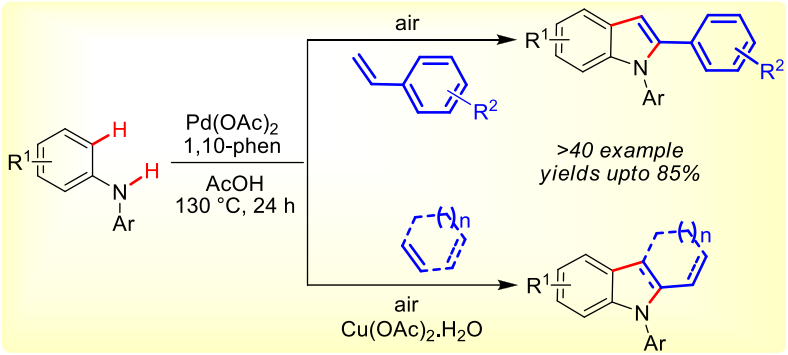
A palladium-catalyzed dehydrogenative coupling between diarylamines and olefins has been discovered for the synthesis of substituted indoles. This intermolecular annulation approach incorporates readily available olefin for the first time and obviates the need of any additional directing group. An *ortho*-palladation, olefin coordination and *β*-migratory insertion sequence has been proposed for the generation of olefinated intermediate, which is found to produce expected indole moiety.

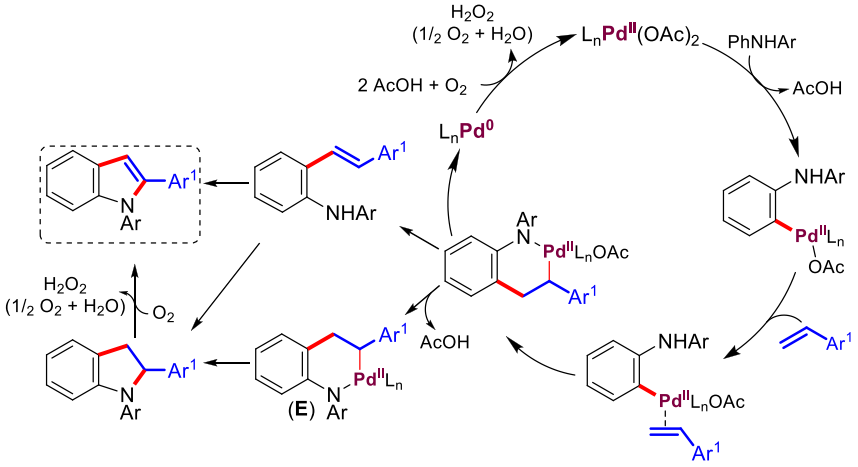
A Journal of the Gesellschaft Deutscher Chemiker
Angewandte
International Edition
Chemie
www.angewandte.org
2014–53/4

Indole Synthesis

*Upendra Sharma, Rajesh Kancherla, Togati Naveen, Soumitra Agasti and Debabrata Maiti**

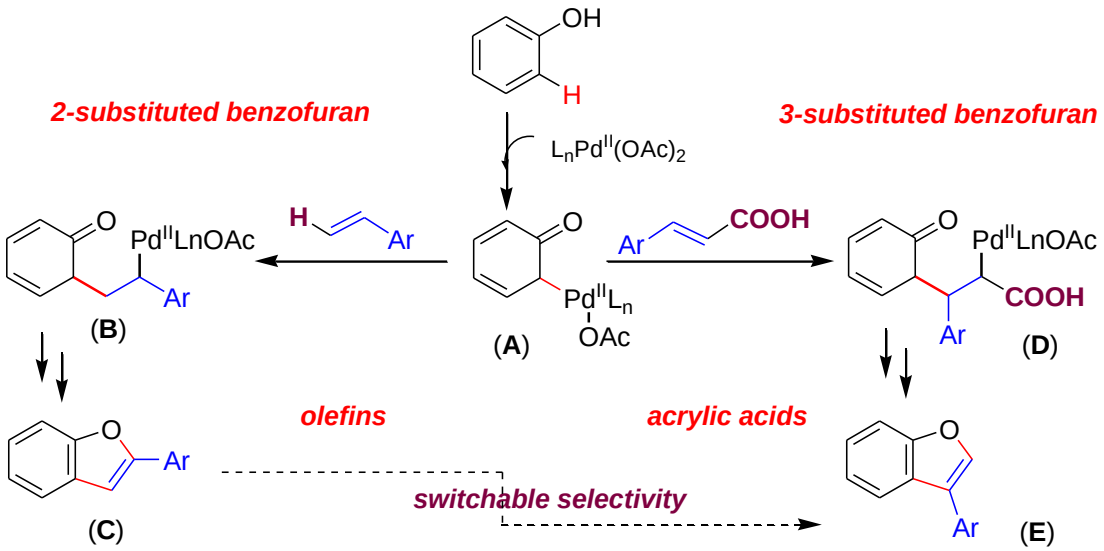
Palladium Catalyzed Annulation of Diarylamines with Olefins through C–H Activation: Direct Access to *N*-Arylindoles





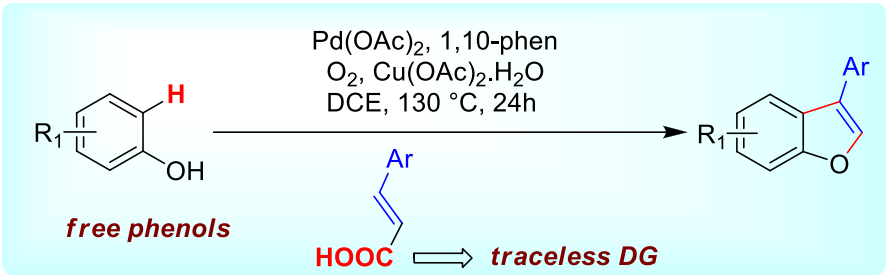
Palladium Catalyzed Synthesis of Benzofurans and Coumarins from Phenols and Olefins:

Idea for Pd Catalyzed inducing switchable selectivity and reactivity



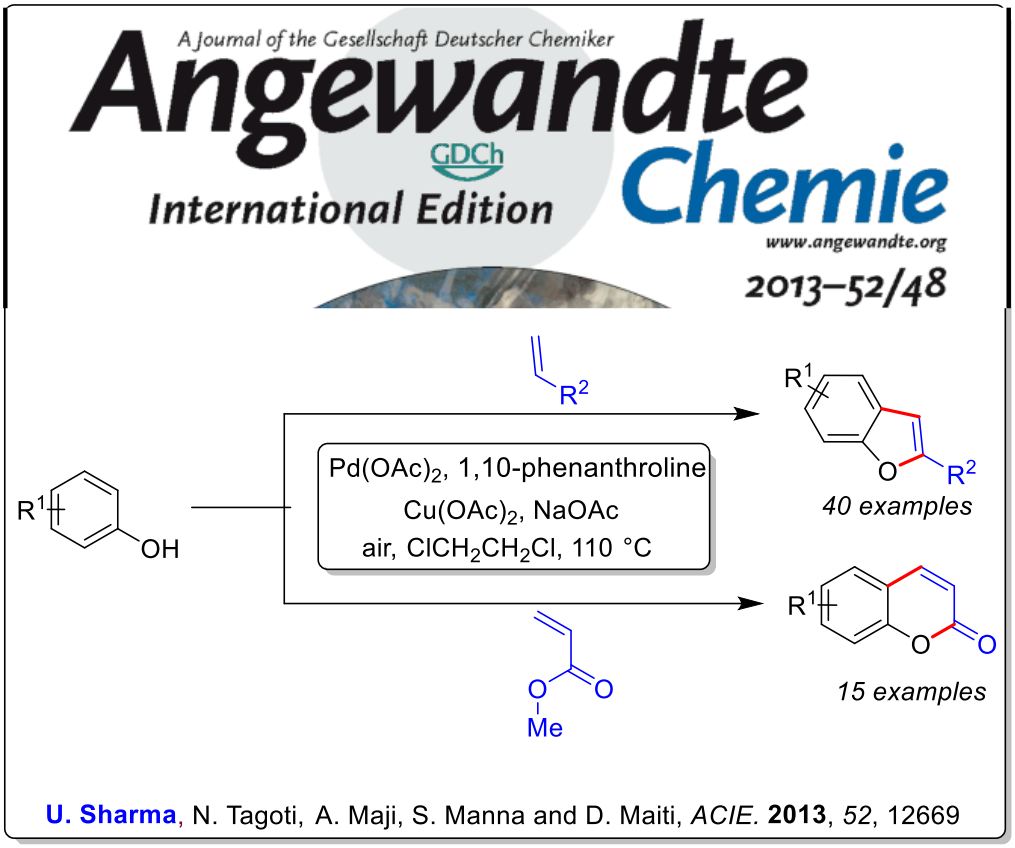
Synthesis of 3-substituted benzofurans through multiple C-H functionalization
(Chem. Commun. **2015**, *51*, 5375)

A palladium catalyzed intermolecular annulation of cinnamic acids and phenols has been achieved for the selective synthesis of 3-substituted benzofurans. Isotope labeling, competition experiments, kinetic studies, and intermediate trapping have supported a sequence of C–C bond formation and decarboxylation followed by the C–O cyclization pathway.

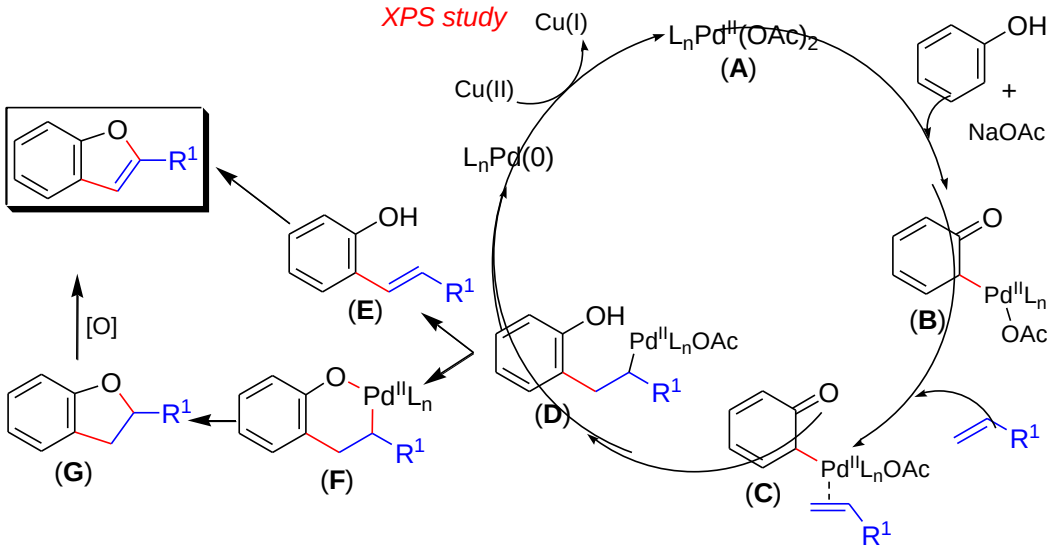


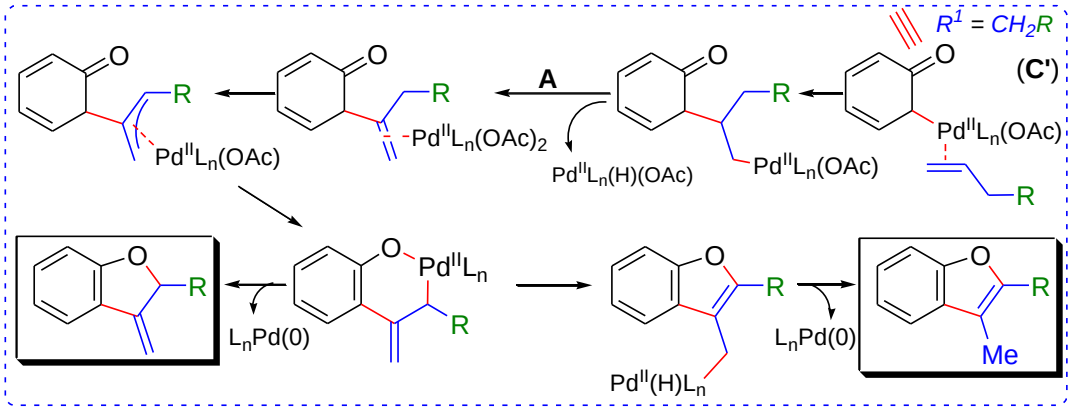
Synthesis of 2-substituted benzofurans through multiple C-H functionalization

Palladium-catalyzed synthesis of benzofurans and coumarins by reacting phenols and unactivated olefins is described. The reaction comprises sequential C-H functionalization and shows diverse functional group compatibility. Preliminary mechanistic studies have been reported to shed light into the possible mechanisms.



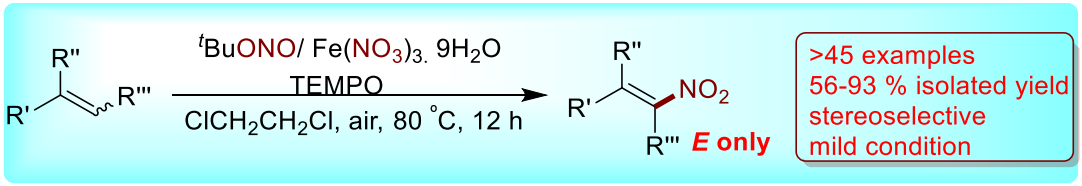
Plausible Reaction Pathway





Stereo Selective Nitration of Olefin: (*J. Org. Chem.* **2013**, *78*, 5949; *Org. Lett.* **2013**, *15*, 3384; *Synlett*, **2014**, *25*, 603.)

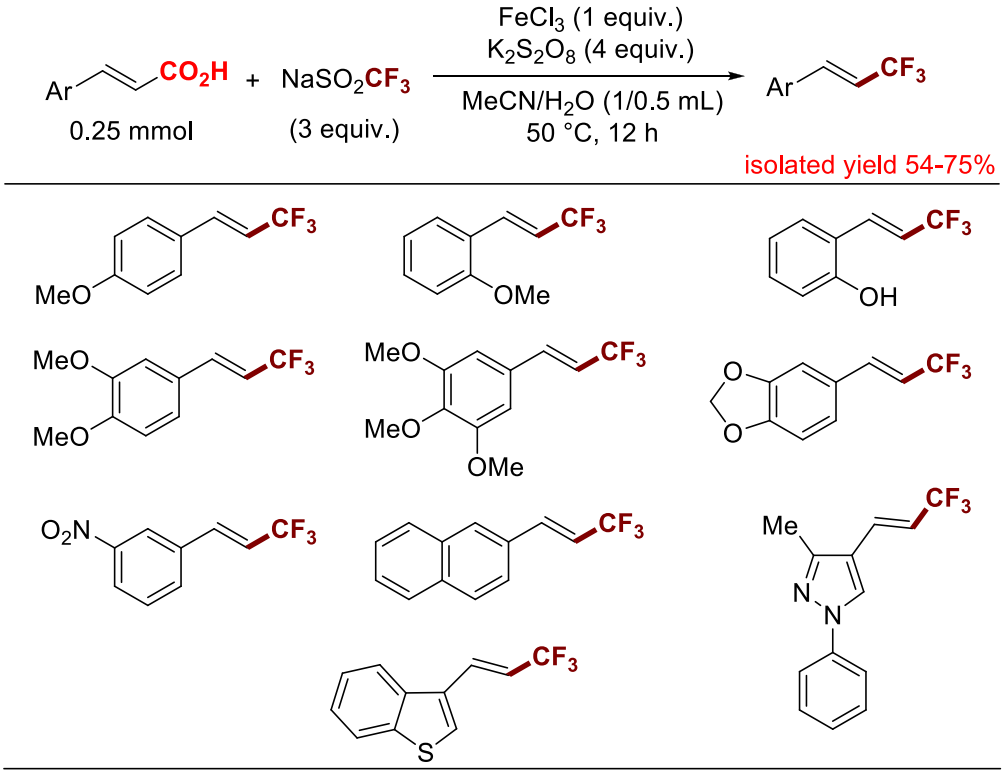
Nitro group is very important in organic synthesis due to number of reasons including high reactivity, easily convertible to important functional groups, strong directing nature and most importantly easy to remove. Obeying to its immense importance number of methods have been developed for the direct nitration of aromatic and vinaylic C-H bond by employing various nitrating reagents. But, most of the methods developed for nitration of vinylic C-H bond which leads to important conjugated nitrooflefins suffer from number of limitations such as harsh reaction conditions, multiple step and limited substrate scope. Lack of sereoselectivity further limit their scope. We have developed highly efficient and selective method for nitration of olefins using $Fe(NO_3)_3$/ *t*BuONO as nitration source and TEMPO as promoter.



Decarboxylative Trifluoromethylation of α,β-Unsaturated Carboxylic Acids: *(Eur. J. Org. Chem.* **2013**, *24*, 5257.)

The introduction of fluoroalkyl groups and particularly the trifluoromethyl (CF_3) group in pharmaceuticals and drug candidates can improve their physical, chemical and biological properties because of the electronic property, special size, lipophilicity, and metabolic stability of trifluoromethyl group. Although, a variety of processes for construction of $C_{sp}3$-CF_3 bonds have been developed in last few years, fewer reports are there for construction of $C_{sp}2$-CF_3 bonds. In this respect, we have developed a sustainable $FeCl_3$ mediated method for decarboxylative trifluoromethylation of *α,β*-unsaturated carboxylic acids with $NaSO_2CF_3$ as economic and stable CF_3 source. This reaction proceeds under mild condition and tolerates

various functional groups. Advantageously, this method does not require inert atmosphere and proceeds well under air at ambient temperature.



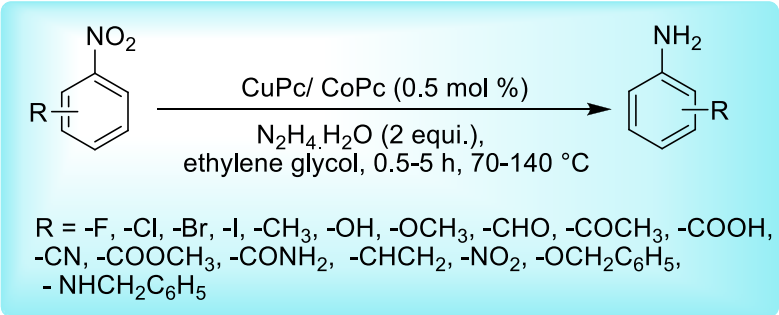
Catalytic Applications of Metal Phthalocyanines

Metal phthalocyanines (MPcs) are stable metal organic complexes that have been extensively employed as catalyst for oxidation and reduction methods. The catalytic potential of MPc is due to their unique property to participate in electron transfer reactions. Their structural similarity with porphyrins like chlorophyll and haemoglobin make them attractive candidates in catalyzing enzyme analogs redox transformations in selective manner. The present work deals with the development of highly selective metal phthalocyanine catalyzed industrially important organic transformations such as nitro reduction to amine, carbonyl reduction to alcohols and reductive amination of carbonyl compounds to corresponding secondary amines. Role of MPc in all these reaction has also been studied.

Chemo- and Regioselective Reduction of Aromatic Nitro Compounds Catalyzed by Recyclable Copper(II) as well as Cobalt(II) Phthalocyanine

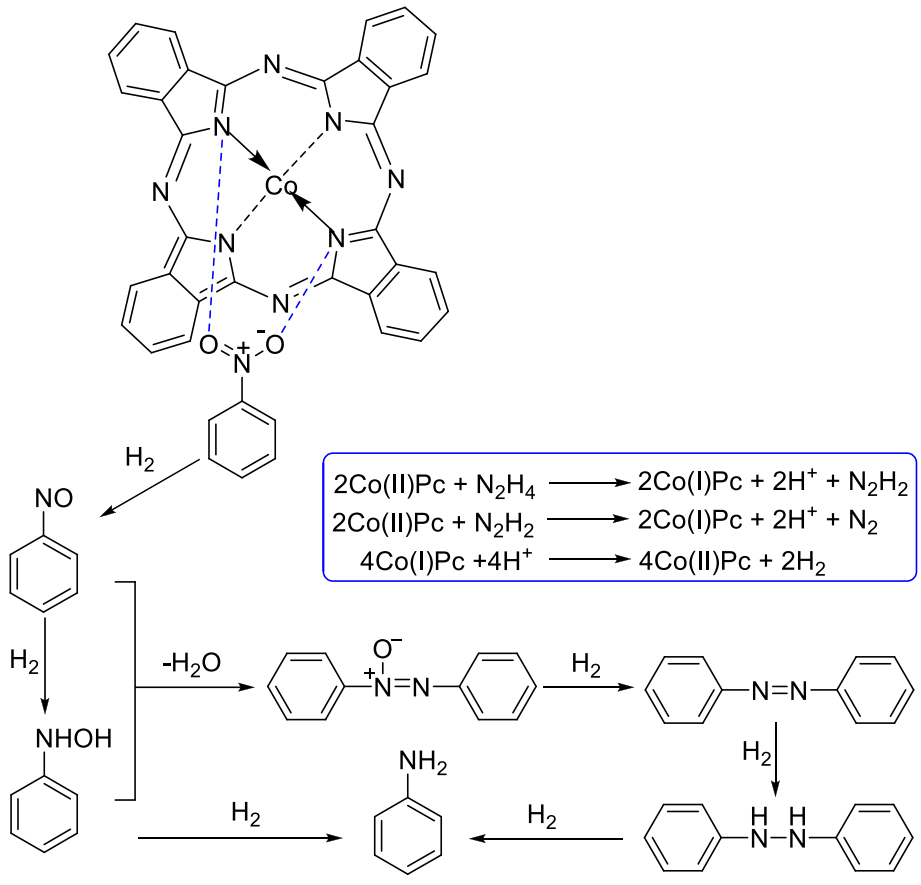
Copper/cobalt phthalocyanines were first time established as catalyst for very efficient chemo- and regio -selective reduction of aromatic nitro compounds to generate corresponding amines. The selective reduction of nitro compounds were observed in

presence of large range of functional groups such as aldehyde, keto, acid, amide, ester, halogen, lactone, nitrile and heterocyclic functional groups.

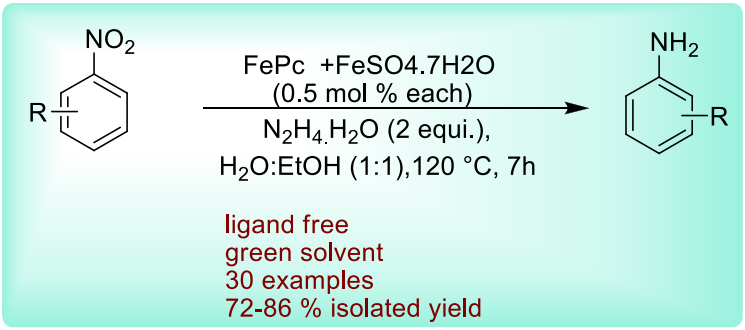


Plausible Mechanism

The reduction mechanism was elucidated by UV-vis and electrospray ionization quadrupole time-of-flight tandem mass spectrometry.

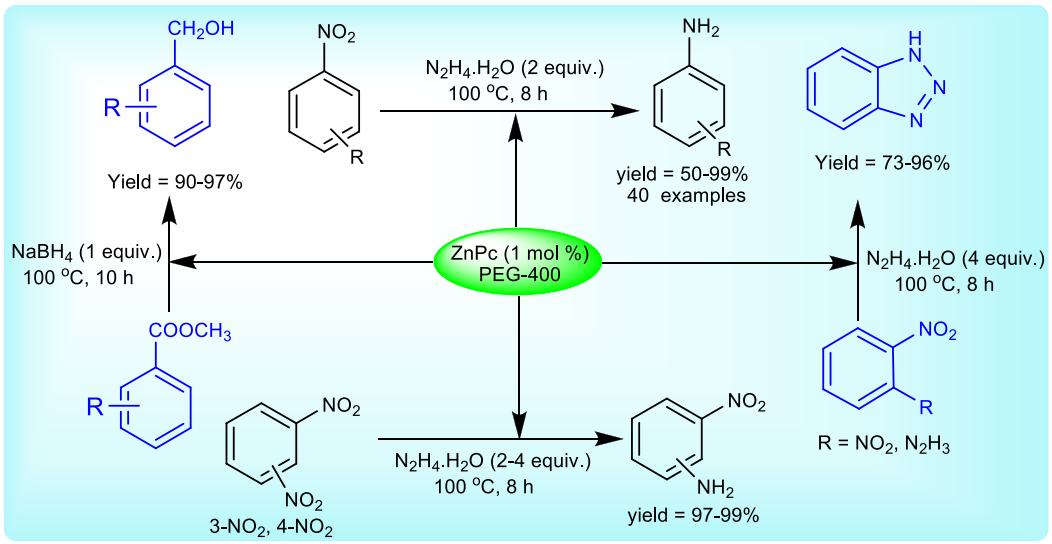


Phosphane-Free Green Protocol for Selective Nitro Reduction with Iron Based Catalyst



Iron phthalocyanine with iron sulphate has been successfully applied for high chemo- and regio -selective reduction of aromatic nitro compounds to corresponding amines in a green solvent system without using any toxic ligand. Present catalytic systems were compatible with other large range of reducible functional groups such as keto, acid, amide, ester, halogen, lactone, nitrile, *N*-benzyl, *O*-benzyl, hydroxy and heterocycles. In the present study dinitro compounds have been regioselectively reduced to corresponding amine with high yield. In most of the cases the conversion and selectivity was > 99% as monitored by GC-MS.

Zinc(II) Phthalocyanine with PEG-400 as a Recyclable Catalytic System for Selective Reduction of Aromatic Nitro and Carbonyl Compounds

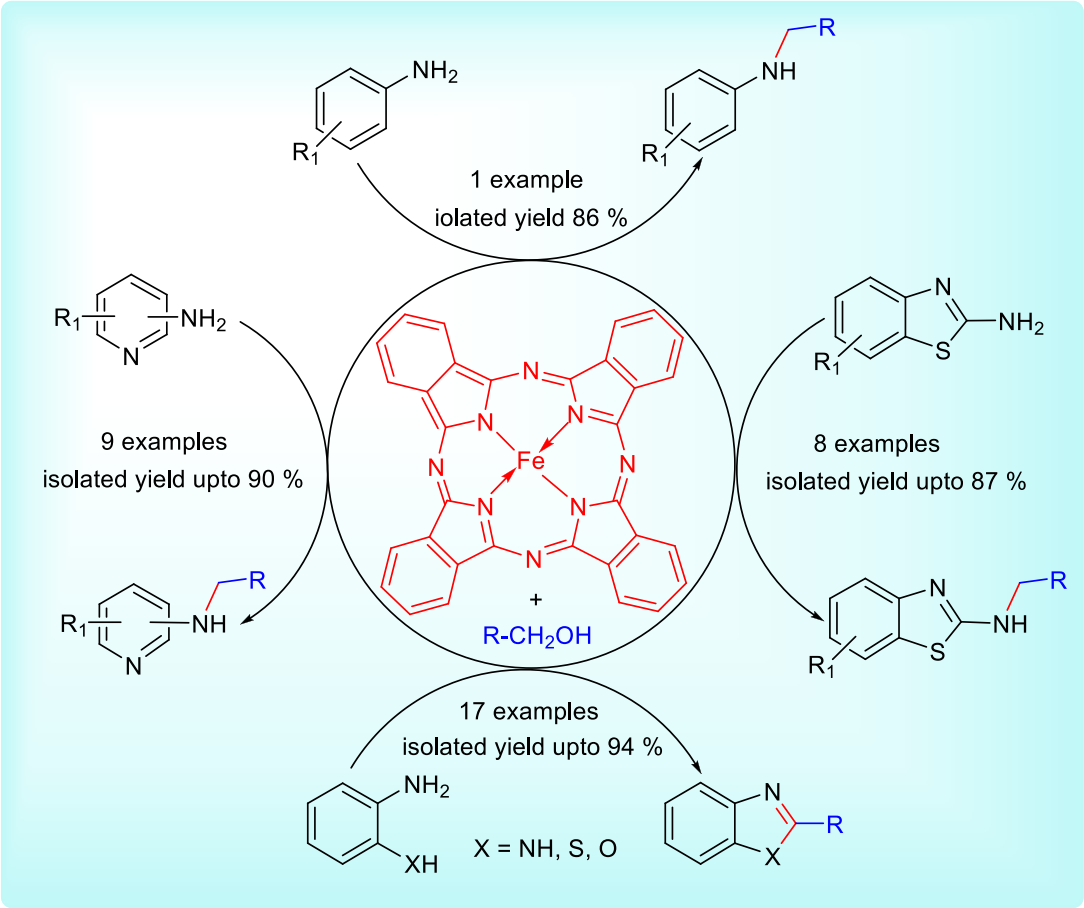


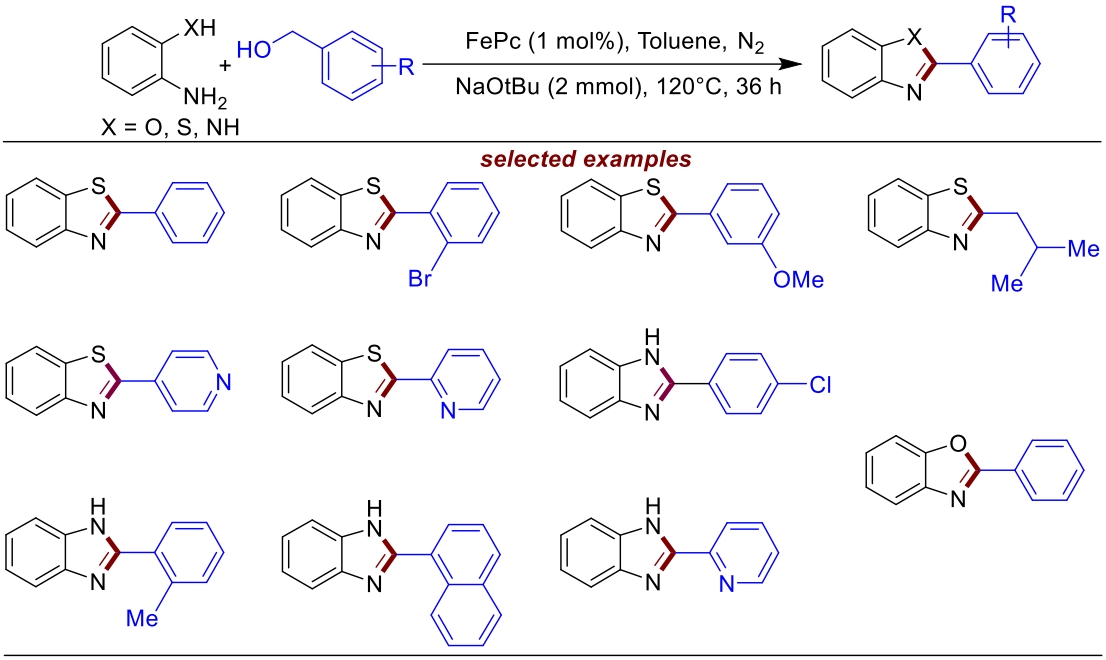
Direct synthesis of benzotriazole form *o*-dinitrobenzene was achieved for the first time. The present catalytic system was successfully employed for reduction of carbonyl and ester compounds to corresponding alcohols and reductive amination of benzaldehydes with primary amines to form corresponding secondary amines. Remarkable advantages of present

catalytic method include low loading of metal, avoidance of toxic ligand and high isolated yields. Catalyst was recyclable up to four times without any loss of selectivity and activity.

Iron Phthalocyanine as an Efficient and Versatile Catalyst for N-alkylation of Heterocyclic Amines with Alcohols: One-pot Synthesis of 2-Substituted Benzimidazoles, Benzothiazoles and Benzoxazoles

An efficient and versatile iron phthalocyanine catalyzed method has been developed for *N*-alkylation of various amines with alcohols. Readily available alcohols were used as the alkylating agents for direct *N*-alkylation of aminobenzothiazoles, aminopyridines and aminopyrimidines. *N*-alkylation of *ortho*-substituted anilines (-NH_2, -SH and –OH) led to the synthesis of 2-substituted benzimidazoles, benzothiazoles and benzoxazoles in one-pot.



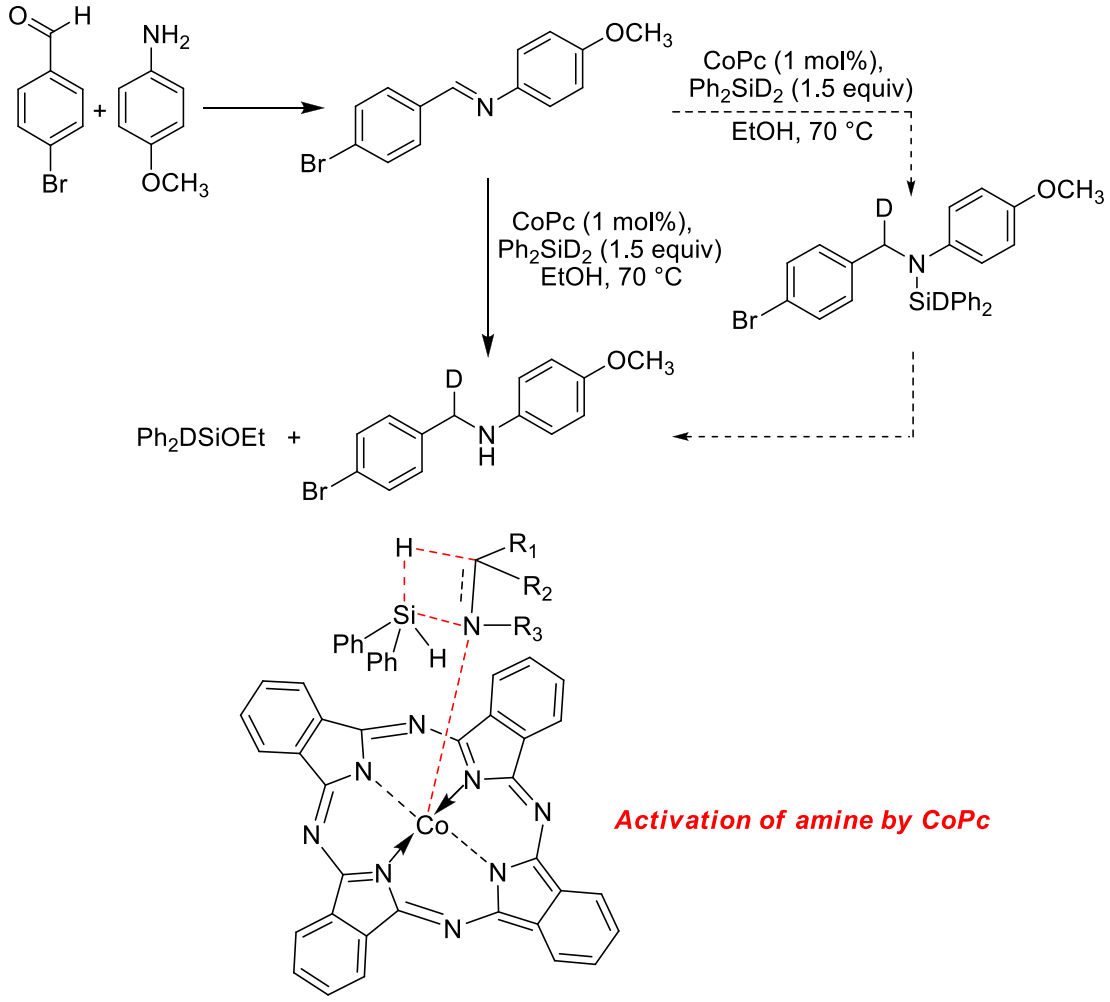


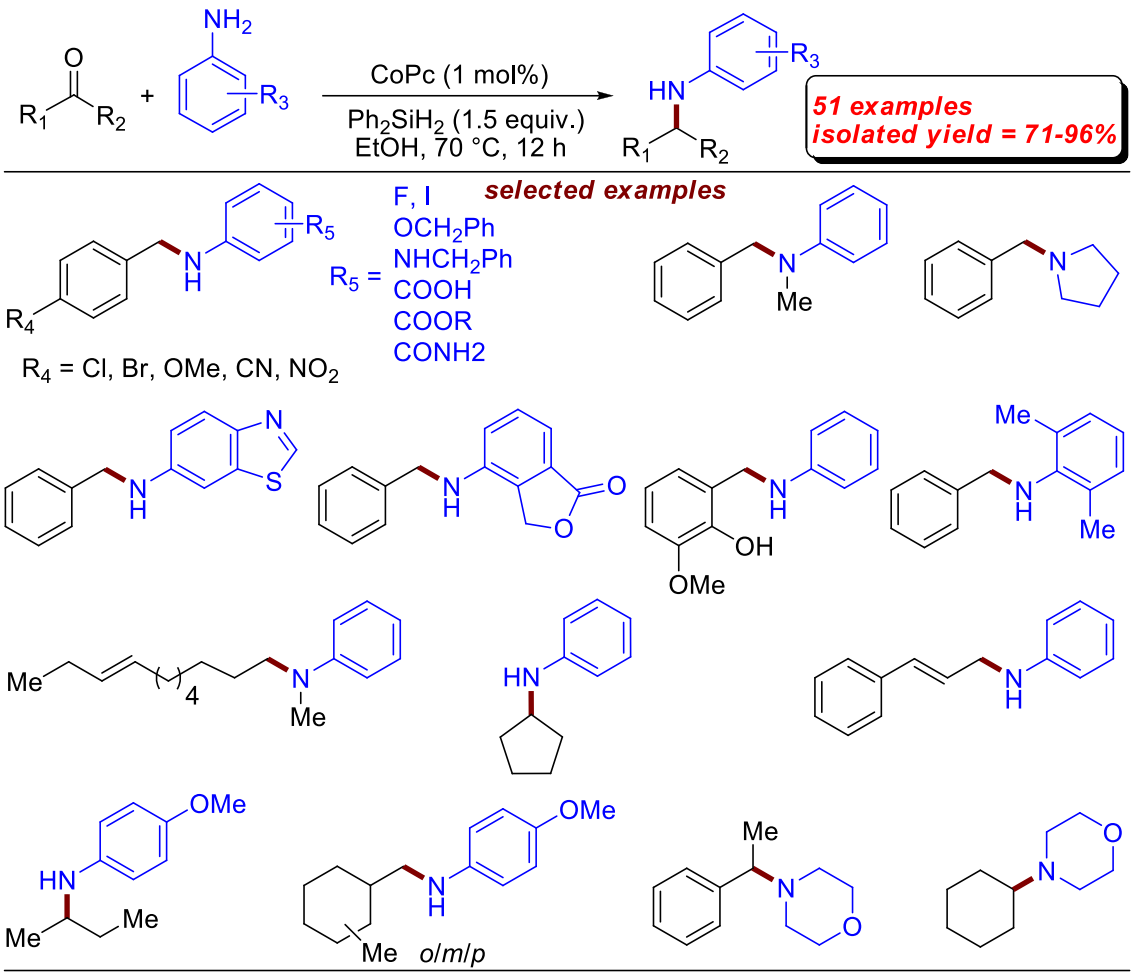
Cobalt(II) Phthalocyanine Catalyzed Highly Chemoselective Reductive Amination of Carbonyl Compounds in ethanol

Cobalt phthalocyanine has been employed for highly chemoselective reductive amination of aldehydes and ketones in a green solvent. A large range of functional groups such as nitro, acid, amide, ester, nitrile, halogen, lactone, methoxy, hydroxy, alkene, *N*-benzyl, *O*-benzyl and heterocyclic functional groups were well tolerated under present reaction conditions. The clear insertion of deuterium on the carbon of the double bond indicated the hydrosilylation of imine to give an intermediate N-silylamine, followed by solvolysis with ethanol or trace amount of water. The formation of diethoxydiphenylsilane as a byproduct confirmed the solvolysis of N-silylamine with ethanol. No change in oxidation state (as monitored by UV-VIS spectrophotometry) and color of CoPc was observed during the reaction that ruled out the involvement of any hydridocobalt species as previously reported. However, the exact role of CoPc is not clear, Lewis acidic character of CoPc might be responsible for imine activation via Lewis acid-base interaction. In order to verify this, a competitive reaction of two imines

having different electronic characters was carried out using standard reaction condition. The higher yield of product was observed from more electron rich imine due to its greater Lewis basic character. This indicated the possible role of Lewis acid-base type interaction in catalyzing the reaction.

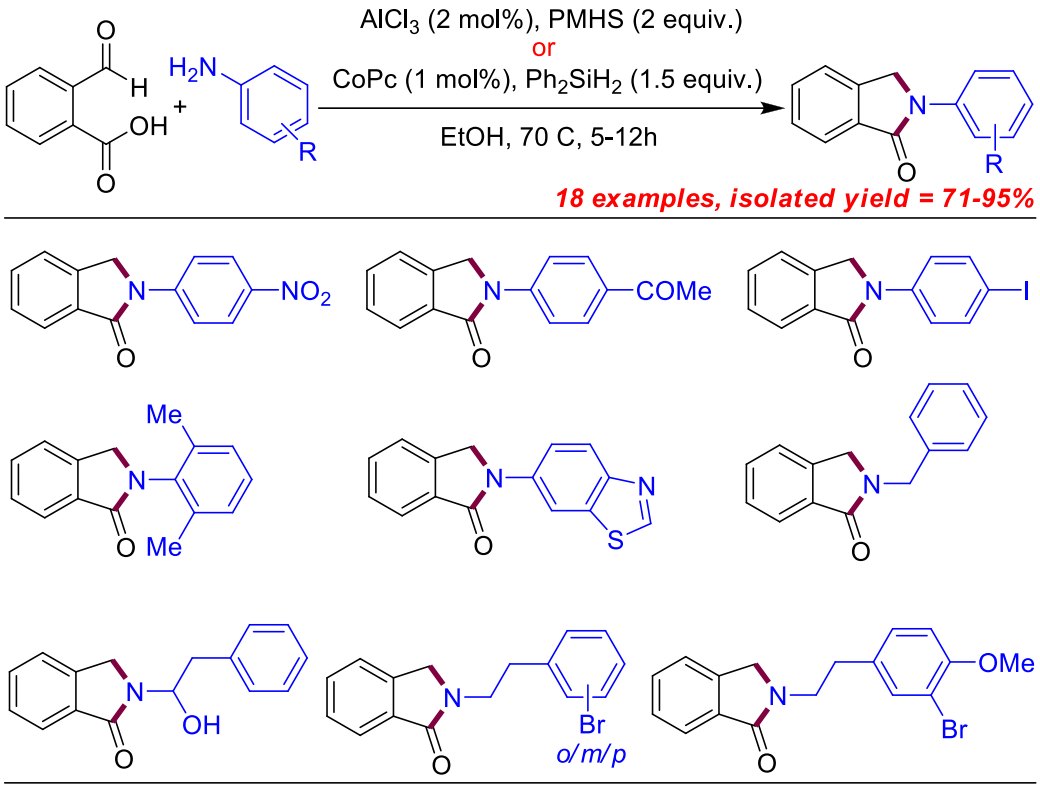
Proposed pathway





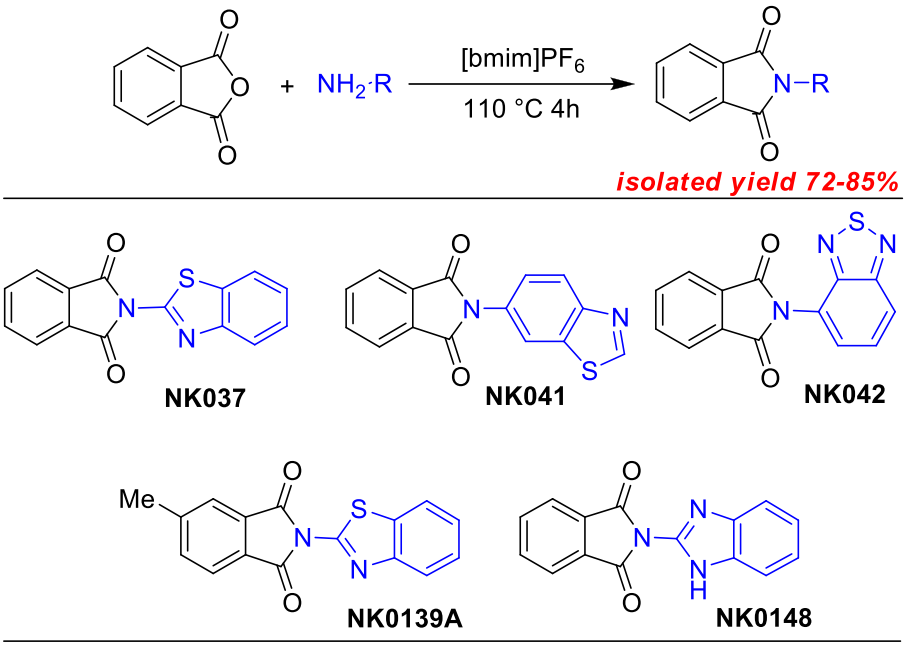
Synthesis of isoindolinones

A direct one-pot synthetic approach is described wherein cobalt(II) phthalocyanine (CoPc) catalyzed reductive amination of 2-carboxybenzaldehyde, followed by intramolecular amidation afforded *N*-substituted isoindolinones. The method used diphenylsilane as reducing agent in ethanol. High chemoselectivity with excellent yield was obtained in most of the studied substrates.

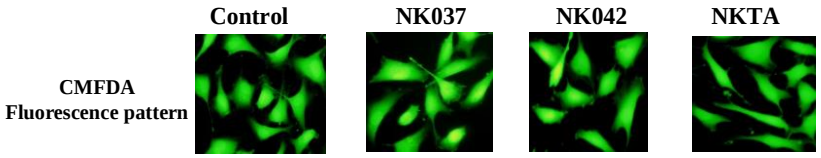


N-Substituted Phthalimide Derivatives as Angiogenesis Inhibitors

Angiogenesis is an important natural process occurring in the body, both in health and disease. The growth and maintenance of solid tumors is highly dependent on neovascularization and can be regulated by compounds that interfere with either the stimulation or proliferation of endothelial cells. As a result, the control of angiogenesis continues to be an attractive area for novel therapeutic agent development. One such agent is thalidomide. Aside from this serious teratogenic effect on the fetus, the drug does have therapeutic value. In addition, thalidomide has significant anti-angiogenic activity. We have synthesized number of phthalimide derivative and evaluated their antiangiogenic activity. During this effort we found two new derivatives which are more active then thalidomide.

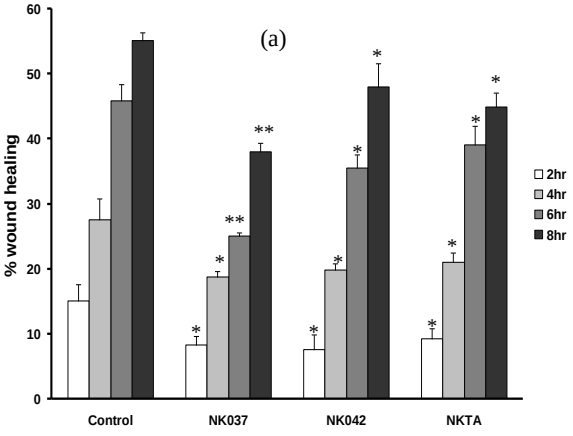


Cell viability



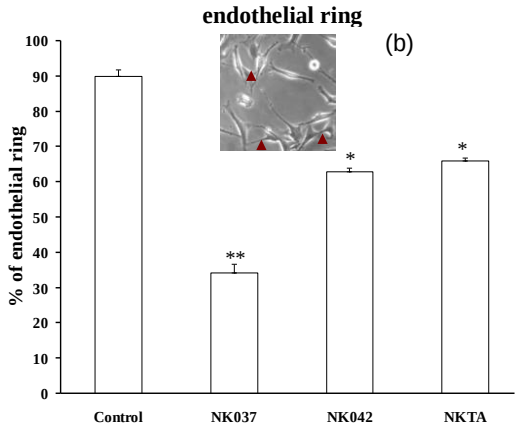
Analogs did not compromisec cellular viability

Comparative study of the analogs using endothelial wound healing model



*P<0.05, **P<0.001 as compare to controll

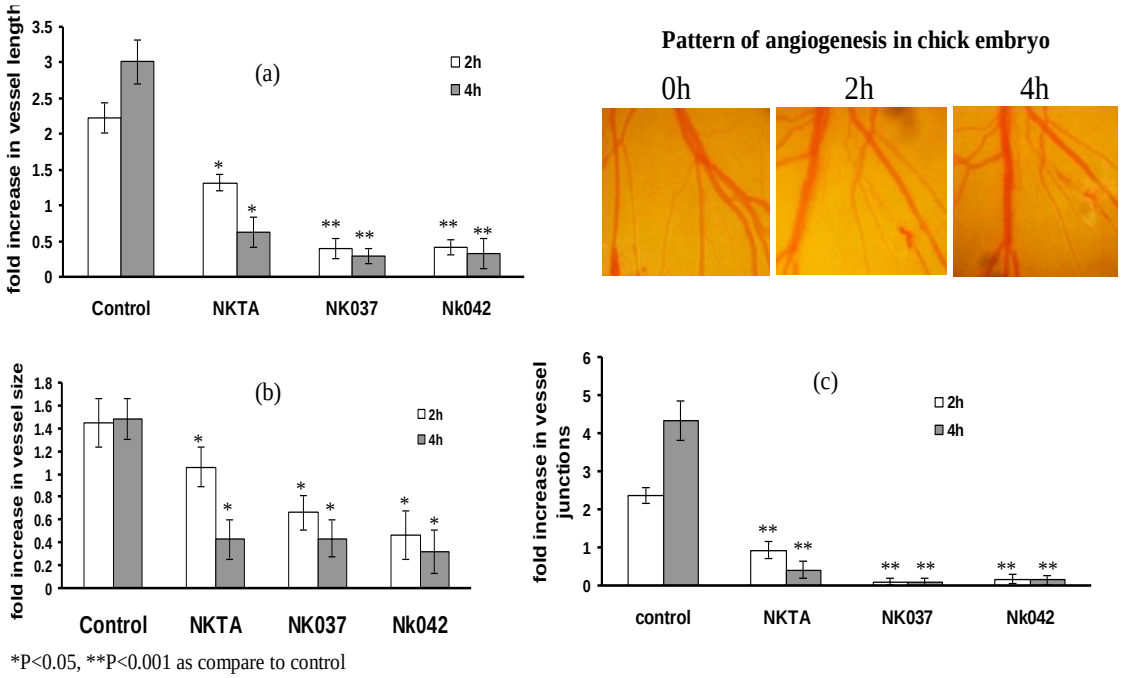
Comparative study of the analogs using endothelial ring formation model



*P<0.05, **P<0.001 as compare to controll

NK037 showed maximum effect on endothelial wound healing and ring formation

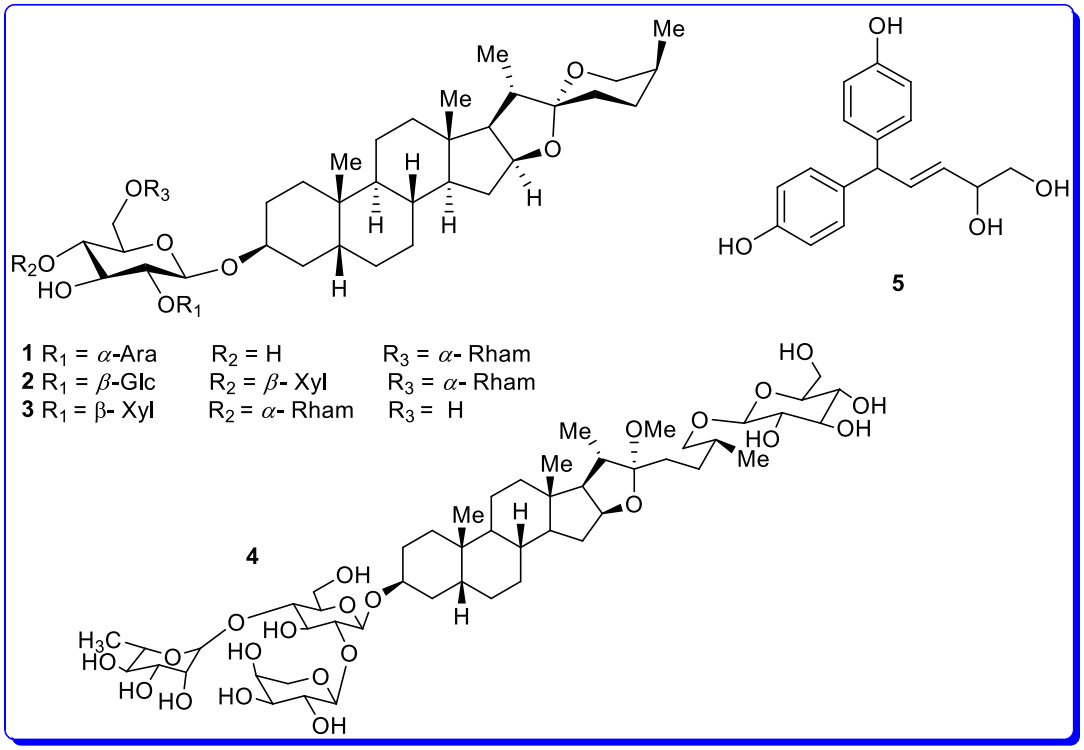
Angiogenesis under the analogs treatment was studied using ex vivo CAM model



*P<0.05, **P<0.001 as compare to control

Characterization of Immunomodulatory Active Secondary Metabolites

Asparagus racemosus

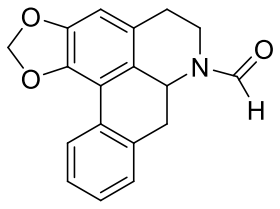


Three novel steroidal saponins, shatavaroside A (**1**), shatavaroside B (**2**) and shatavaroside C (**4**) together with a new diphenylpentendiol, shatavarol (**5**) were isolated from the roots of *A. racemosus*. A known saponin, filiasparoside C(**3**), was first time isolated from this plant. Their

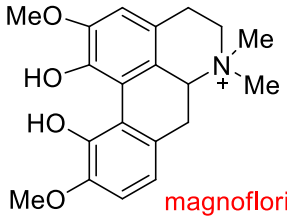
structures were elucidated by 1D and 2D NMR experiments including COSY DEPT, HMQC and HMBC spectroscopy as well as ESI-QTOF-MS/MS analysis. Novel compounds **1** and **2** were found immunostimulator at nano concentration. In addition, five known compounds have also been isolated from the roots of *A. racemosus*.

Tinospora cordifolia

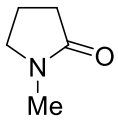
The immunomodulatory activity of different extracts, fractions and isolated compounds in relation to phagocytosis and reactive oxygen species production in human neutrophil cells have been investigated using the PMN phagocytic function studies, NBT, NO and chemiluminescence assay. The results obtained indicate that ethyl acetate, water fractions and hot water extract exhibited significant immunomodulatory activity with an increase in percentage phagocyctosis. Chromatographic purification of these active fractions led to the isolation of a mixture of following compound most of which were found immunomodulatory active



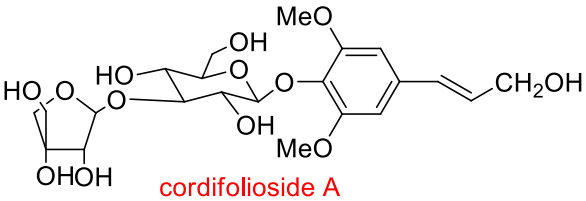
N-formylannonain



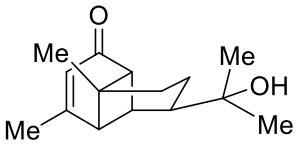
magnoflorine



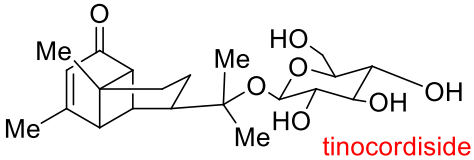
N-methyl-2-pyrolidone



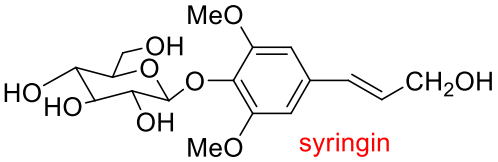
cordifolioside A



11-hydroxy-mustakone



tinocordiside



syringin

(Dr. U. Sharma)