

Name of The Department : Chemistry Department
Subject : Chemistry (Inorganic)

Curriculum Vitae

Dr. Nandini Kumari (Ph.D)

1. Lecturer, Chemistry Dept., Patna Women's College (NAAC Re-accredited – A Grade, CPE Status accorded by UGC), Patna, Bihar, India.
2. Research Associate (CSIR), Indian Institute Of Technology, Kanpur, U.P. India.
3. Senior Research Fellow (CSIR), RRL, Jorhat (Assam) India.

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Date of Birth:- 01-01-1973

Educational Qualifications:

Ph.D.: Organometallic Chemistry, 2005

Dibrugarh University, Dibrugarh, Assam, India.

Thesis entitled "Synthesis and characterization of carbonyl complexes of rhodium and ruthenium containing different types of donor ligands and their reactivity."

M. Sc. : Inorganic Chemistry, 1998

Patna University, Patna.

Ist class, 66%

B. Sc. : Chemistry, 1995

Bihar University, Muzaffarpur.

Ist class, 62%

Technical Skills:

Instrumentation: IR, NMR (^1H , ^{13}C , ^{31}P), TGA, XRD, FESEM, single-X ray crystallography, UV-VIS, GC, Autoclave, Glove box, Eirich Mixer (RT05).

Computer: Apart from routine computational skills, familiar with ISIS Draw, Chem win

Research Experience:

- I have worked in the laboratory of Prof. P. K. Bharadwaj for a year on the synthesis of coordination polymers and their use as a heterogeneous catalyst.
- Five and half years research experience in the area of Organometallic chemistry with an aim to develop an efficient catalyst for carbonylation of alcohols to acids and to produce bio-chemically active molecules. Also have experience in development of an industrial process for making high strength proppants.

Teaching Experience:

- Working as a Lecturer in Patna Women's College, Patna, Bihar, India. (NAAC - 'A' grade) since 1st July 2010.

- Visited many times for the assessment & evaluation of science teacher at St. Michel's High School, Patna as an Science Expert.

Key Words:

Rhodium and Ruthenium Complexes; IR and NMR characterization, Single X-ray crystallography, monodentate, bidentate (Hemilabile) ligands; Homogeneous Catalysis; Carbonylation reaction.

Awards and Scholarship Won :

1. Project Assistant: For two years in a "Oil Industrial Development Board" sponsored project on "Scale up study for making high strength proppants" - from 2000 march to 2002 August.
2. CSIR Senior Research Fellowship (SRF) : From 2002 September to 2005 August.
3. CSIR Research Associate (RA): From 2006 July to 2007 August.
4. Patent appreciation : From RRL Jorhat

Research Publications

1. Rhodium nitrene complexes: Efficient catalysts for carbonylation of methanol: Pankaj Das, Monalisha Borauh, Nandini Kumari, Manab Sharma, Dilip Konwar and Dipak Kumar Dutta, J. Mol. Catal. A: Chemical 178, 283-287, 2002.
2. Synthesis and characterization of ruthenium(II) complexes of different types of potential unsymmetrical hemilabile P-O and P-S donors ligands: Pankaj Das, Manab Sharma, Nandini Kumari, Dilip Konwar and Dipak Kumar Dutta, Ind. J. Chem. Sec A: 41A, 560-562, 2002.
3. Carbonylrhodium complexes of pyridine ligands and their catalytic activity towards carbonylation of methanol: Nandini Kumari, Manab Sharma, Pankaj Das and Dipak Kumar Dutta, Appl. Organomet. Chem. 16, 258 -264, 2002.
4. Rhodium(I) carbonyl complexes of ether-phosphine ligands and their reactivity : Pankaj Das, Dilip Konwar, Manab Sharma, Nandini Kumari and Dipak Kumar Dutta, Appl. Organomet. Chem. 16, 302-306, 2002.
5. Catalytic activity of dicarbonylrhodium complexes of amino benzoic acid ligands on carbonylation of alcohol: Manab Sharma, Nandini Kumari, Pankaj Das, Pratap Chutia and Dipak Kumar Dutta, J. Mol. Catal. A: Chemical 188, 25-35, 2002.
6. Carbonyl complexes of ruthenium(II) with unsymmetrical phosphine-phosphinesulfide ligands of the type $\text{Ph}_2\text{P}(\text{CH}_2)_n\text{P}(\text{S})\text{Ph}_2$, $n = 1 - 4$: Pratap Chutia, Manab Sharma, Pankaj Das, Nandini Kumari, John Derek Woollins, Alexandra M Z Slawin and Dipak Kumar Dutta, Polyhedron 22, (19), 2725-2730, 2003.
7. Ruthenium(II) carbonyl complexes containing tertiaryphosphinechalcogenides ligands of the types Ph_3PX ; X=O, S, Se: Pratap Chutia, Nandini Kumari, Manab Sharma, J Derek Woollins, Alexandra M Z Slawin and Dipak Kumar Dutta, Polyhedron 23, 1657-1661, 2004.
8. Oxidative addition reaction of rhodium(I) carbonyl complexes of the pyridine-aldehyde ligands and their catalytic activity in carbonylation reaction: Nandini Kumari, Manab Sharma, Pratap Chuti and Dipak Kumar Dutta, J. Mol. Catal. A: Chemical 222,53-58,2004.

9. Dicarboxylrhodium(I) complexes of functionalized pyridine ligands and their catalytic activities: Nandini Kumari, Bhaskar Joyti Sarmah and Dipak Kumar Dutta, J. Mol. Catal. A: Chem. 266, 260-266, 2006.

Patents (Indian) : Filed / communicated :

1. A process for the preparation of novel rhodium metal complexes. (NF 105/2001); Dipak Kumar Dutta, Nandini Kumari, Pankaj Das, Manab Sharma, Dilip Konwar, Madan Gopal Pathak.
2. An improved process for carbonylation of methanol for producing acetate ester or a mixture of carboxylic acid and ester (NF 216/2001); Dipak Kumar Dutta, Pankaj Das, Nandini Kumari, Manab Sharma, Dilip Konwar, Madan Gopal Pathak.
3. A process for the preparation of novel rhodium carbonyl complexes containing pyridine and nitrene as ligands (0475 Del/2002); Dipak Kumar Dutta, Manab Sharma, Pankaj Das, Monalisha Boruah, Nandini Kumari, Dilip Konwar.
4. An improved Process for carbonylation of methanol by using novel rhodium metal complexes as catalyst (0474Del /2002); Dipak Kumar Dutta, Manab Sharma, Pankaj Das, Monalisha Boruah, Nandini Kumari, Dilip Konwar.
5. A process for the preparation of novel rhodium carbonyl complexes of nitrogen donor ligands suitable as catalysts for carbonylation of methanol (NF0348/2004); Dipak Kumar Dutta, Manab Sharma, Pratap Chutia, Nandini Kumari, Madan Gopal Pathak.
6. A process for the preparation of novel rhodium carbonyl complexes containing nitrogen-oxygen donors based ligands (NF 013/2005); Dipak Kumar Dutta, Pratap Chutia, Nandini Kumari, Manab Sharma.
7. A process for the carbonylation of ethanol to produce propanoic acid and ester using rhodium carbonyl complexes of Nitrogen and oxygen donor ligands as catalysts (Applied): Dipak Kumar Dutta, Manab Sharma, Nandini Kumari, Pratap Chutia, Pradeep Khound, Madan Gopal Pathak.
8. Preparation of novel rhodium carbonyl complexes of nitrogen-oxygen donors based ligands useful as carbonylation catalyst (NF308/2005). Dipak Kumar Dutta, Manab Sharma, Pratap Chutia, Nandini Kumari.

Papers presented in National Seminars:

1. Synthesis and Characterization of ruthenium(II) complexes of different types of hemilabile P-O and P-S donors ligands: Pankaj Das, Manab Sharma, Nandini Kumari, Dilip Konwar and Dipak Kumar Dutta; Proceedings, 38th Convention of Chemist Seminar, Jai Narain Vyas University, Jodhpur, India, ING (OP) - : 06, 2001.
2. Rhodium(I) complexes of pyridine base ligands and their catalytic activity on carbonylation of methanol: Nandini Kumari, Manab Sharma, Pratap Chutia, Pankaj Das and Dipak Kumar Dutta; Proceedings of Modern Trends in Chemistry Indian Association for the cultivation of science, Kolkata, India, Abs. No. P-18, 2001.
3. Efficient carbonylation of methanol using rhodium complexes of different types of donors ligands as catalyst precursors: Dipak Kumar Dutta, Pankaj Das, Pratap Chutia, Manab Sharma, Nandini Kumari, Madan Gopal Pathak, Pradip Khound, Om Prakash Sahu and Dilip Konwar; Proceedings, National Workshop on catalysis CATWORK, Gauhati University, Abs. No. P-21, 2002.

4. Reactivity of carbonylrhodium complexes of aminobenzoic acid ligands and their catalytic activity on carbonylation of methanol: Manab Sharma, Nandini Kumari, Pankaj Das and Dipak Kumar Dutta; Proceedings of Indian Science Congress Association (ISCA) Seminar 2002, Lucknow University, India.
5. Oxidative addition and carbonylation reaction of rhodium(I) complexes containing pyridine based ligands: Nandini Kumari, Manab Sharma, Pankaj Das and Dipak Kumar Dutta; Proceedings of Indian Science Congress Association (ISCA) Seminar 2002, Lucknow University, India.
6. Ruthenium(II) carbonyl complexes of mixed phosphino-phosphine sulphide ligands: Pratap Chutia, Manab Sharma, Nandini Kumari, Pankaj Das, Dilip Konwar and Dipak Kumar Dutta; Proceedings of Nat. Sem. Adv. Mat., Gorakhpur University, March (17-19), Abs. No. C-41, 2002.
7. Carbonyl complexes of ruthenium(II) with unsymmetrical phosphine-phosphinesulfide ligands of the type $\text{Ph}_2\text{P}(\text{CH}_2)_n\text{P}(\text{S})\text{Ph}_2$, $n=1-4$: Pratap Chutia, Nandini Kumari and Dipak Kumar Dutta; Proceedings of the 39 th Annual Convention of Chemists, Nagarjuna University, Nagarjunanagar (A.P), Abs. No. ING(OP)-34, 2002.
8. Synthesis and spectroscopic characterization of rhodium(I) complexes of methyl and ethyl nicotinate ligands and their reactivity: Nandini Kumari, Manab Sharma, Pankaj Das, and Dipak Kumar Dutta; Proceedings of Indian Science Congress Association (ISCA) Seminar, Jana Bharati University, Bangalore, India, Abs. No. LI-03, 2003.
9. Rhodium catalyzed carbonylation of benzyl alcohol for preparation of phenylacetic acid : Manab Sharma, Pankaj Das, Nandini Kumari and Dipak Kumar Dutta; Proceedings of Indian Science Congress Association, Seminar held at Jana Bharati University, Bangalore, India, 2003.
10. Rhodium(I) carbonyl complexes of pyridine-aldehyde ligands: efficient methanol carbonylation catalyst : Dipak Kumar Dutta, Nandini Kumari, Pankaj Das, Manab Sharma and Pratap Chutia; "16th National Symposium and 1st Indo-German Conference on catalysis to be held at IICT" Hyderabad February, 6-8, 2003, Abs No P-5, P-122.
11. Rhodium(I) carbonyl complexes with unsymmetrical phosphine-phosphineselenide ligands of the type $\text{Ph}_2\text{P}(\text{CH}_2)_n\text{P}(\text{Se})\text{Ph}_2$, $n = 1-4$: Pratap Chutia, Manab Sharma, Nandini Kumari and Dipak Kumar Dutta; Proceedings of 40 th Annual Convention of Chemists, December (23-27), Bundelkhand University, Jhansi (UP), Abs. No. ING (OP)- 40, 2003.
12. Ruthenium(II) carbonyl complexes containing triphenylphosphinechalcogenide ligands of the type Ph_3PX ; $\text{X} = \text{O}, \text{S}, \text{Se}$: Nandini Kumari, Pratap Chutia, Manab Sharma and Dipak Kumar Dutta; Proceedings of 40 th Annual Convention of Chemists, December (23-27), Bundelkhand University, Jhansi (UP), Abs. No. ING (AP)-11, 2003.
13. Rhodium carbonyl complexes of unsymmetrical Phosphine-phosphinesulfide ligands of the type $\text{Ph}_2\text{P}(\text{CH}_2)_n\text{P}(\text{S})\text{Ph}_2$, $n = 1-4$: Manab Sharma, Nandini Kumari and Dipak Kumar Dutta; Proceedings of Indian Science Congress Association, Seminar held at Punjab University, Chandigarh, India, 2004.
14. Rhodium(I) carbonyl complexes: efficient catalyst for carbonylation of methanol : Manab Sharma, Nandini Kumari, Pratap Chutia and Dipak Kumar Dutta; Proceedings of National symposium on Current Trends in Chemical Research, February (27-28), Gauhati University, Guwahati, Abs. No. P-4, 2004.
15. Carbonyl complexes of ruthenium(II) with triphenylphosphinechalcogenide ligands of the type Ph_3PX ; $\text{X} = \text{O}, \text{S}, \text{Se}$: Pratap Chutia, Nandini Kumari, Manab Sharma and Dipak Kumar Dutta; Proceedings of National symposium on current trends in chemical research, February (27-28), Gauhati University, Guwahati, Abs. No. P-5, 2004.

16. Rhodium(I) Carbonyl complexes of pyridine -carboxylic acid ligands: Pratap Chutia, Manab Sharma Nandini Kumari, and Dipak Kumar Dutta; Proceedings of 41 st Annual Convention of Chemists, December (23-27), Delhi University, Delhi,, Abs. No. ING (PP)-70, 2004.
17. Iodo-carbonyl ruthenium(II) complexes of unsymmetrical phosphine -phosphine sulfide ligands of the type $\text{Ph}_2\text{P}(\text{CH}_2)_n\text{P}(\text{S})\text{Ph}_2, n=1-4$: Dipak Kumar Dutta, Pratap Chutia, Manab Sharma and Nandini Kumari; Proceedings of Indian Science Congress Association, Seminar held at Ahmedabad, India, 2005.
18. Catalytic carbonylation of methanol by rhodium carbonyl complexes of N-O donor ligands: Manab Sharma, Pratap Chutia, Nandini Kumari and Dipak Kumar Dutta; Proceedings of Indian Science Congress Association, Seminar held at Ahmedabad, India, 2005.
19. X-ray crystallography: A diagnostic tool for revealing novel characteristics of metal complexes: Dipak Kumar Dutta, Dilip Konwar, Pratap Chutia, Manab Sharma, Nandini Kumari, D. Woolings and A. M. Z. Slawin, Proceeding of the 34th National Seminar on Crystallography, January (10-12), 2005, Gauhati University, Guwahati, Abs. No. OP-17
20. Rhodium carbonyl complexes of pyridine ligands functionalized with hard donors: Nandini Kumari, Manab Sharma, Bhaskar Jyoti Sarmah and Pratap Chutia, Proceedings of Modern Trends in Chemistry Indian institute of technology, Delhi, Hauz khas, New Delhi, December (8-10), 2005, Abs. No. P-15, 2005

Referee name:

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Annexure I

Research experience of Dr. (Mrs) Nandini Kumari

Details of Experience: I have more than five years working experience as a Research fellow (Project Assistant and Senior Research Fellow) in the material Science Division, Regional Research Laboratory (CSIR), Jorhat, Assam.

I have working experience in the following areas:

- **High temperature materials** : Preparation and characterization of High and Medium Strength Proppants to be used in oil field exploration for enhancement of crude oil production.
- **Metal complexes** : Synthesis and characterization of metal complexes
- **Homogeneous catalysis** : Evaluation of catalytic activity metal complexes towards carbonylation reactions in homogeneous catalytic system.

Brief descriptions of nature of research works are given:

Experience of utilization of modern instrumentation technique:

I have the experience of utilization of the following equipments :

- (i) Eirich Mixer for preparation of proppants (green pellets),
- (ii) High Temperature (1600⁰C) Semi industrial Chamber Furnace,
- (iii) Hydraulic Pressure Equipments,
- (iv) FT-IR spectrophotometer,
- (v) FT-NMR spectrophotometer,
- (vi) UV-VIS spectrophotometer,
- (vii) GC,
- (viii) High Pressure Catalytic Reactor, etc.

I have been awarded Ph. D. degree in Chemistry under Dibrugarh University, Dibrugarh, Assam (Work was carried out in the material Science Division, RRL, Jorhat).

Brief description of Research work:

Project work:

The project was related with **high temperature materials**, viz., Proppants.

Title of the Project: "Scale-up study for making High Strength Proppants"

As a Project Assistant, in association with other members, I was assigned several tasks (shown below) which were accomplished :

- Optimization of Raw material (Bauxite from different ores) processing involving grinding (Ball Mill capacity 100 kg charged), particle size determination (CILAS 1180, laser diffraction) etc.
- Optimization of parameters for making green pellets using an imported equipment (50kg / batch)
- Optimization of sintering temperature in a Pilot Scale Chamber furnace and Laboratory Furnace.

- Evaluation of sintered pellets as per the recommendations of American Petroleum Institute 60 [RP 60] First Edition, February 1, 1989, for High Strength Proppants.

Achievements: A process has been optimized for making High Strength Proppants from different indigenous ore Bauxites at a scale of 50 kg / batch and characteristics of the prepared proppants conform the API specification for High Strength Proppants.

Equipment used during the work: Eirich Mixer R05T (M/s Maschinenfabrik Gaustav Eirich, Germany), High Temperature (1600⁰C) Chamber Furnace, Hydraulic Pressure Equipment etc.

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Annexure II

Basic / Ph. D work :

The basic works leading to Ph. D are mainly concentrated in the field of Organometallic chemistry and Homogeneous Catalysis. The work involves synthesis and characterization of Rh(I) and Ru(II) carbonyl complexes and evaluation of their catalytic activity. Rh(I) and Ru(II) carbonyl complexes were prepared with different types of N, P and chalcogen (O, S, Se) donor ligands and characterized by spectroscopic and some of them by single crystal X-ray crystallography technique. The Rh(I) complexes were evaluated for their catalytic activity for carbonylation of alcohols, like methanol, ethanol, benzyl alcohols, to produce corresponding higher acids and their esters. Most of the complexes were found to show higher catalytic activity as compared to the well known Monsanto's catalytic species, $[\text{Rh}(\text{CO})_2\text{I}_2]^{2-}$ under the reaction condition of 6 - 20 bar CO pressure, 125 - 150⁰C temperature and in the time period of 0.5 to 1.5 hours.

Equipment/apparatus utilized during the work: Different equipments / apparatus utilized during the characterization and evaluation of the synthesized products are -

- (i) FT-IR spectrophotometer,
- (ii) FT-NMR spectrophotometer,
- (iii) UV-Vis spectrophotometer,
- (iv) GC,
- (v) Single crystal X-ray spectrophotometer,
- (vi) High Pressure Catalytic Reactor, etc

Computer Knowledge: Working experience of Microsoft Environment, Internet Explorer, ISIS Draw etc.

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