Dr. Ajay Bhagwan Patil, Ph.D.

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HIGHLIGHTS

- Actively involved in project management, implementation of new technology and entrepreneurial activities at Paul Scherrer Institute, Switzerland.
- Ten years research experience in organic synthesis, analytical chemistry (including spectroscopy, chromatography and separations), energy and environment, and strategic metals chemistry.
- Presented and published research work in conferences and international science journals of repute (two best paper and presentation awards).
- Recipient of several awards and grants including two EU scholarships
- Entrepreneurial aptitude and training with soft skills relevant for project management, milestone planning and execution, negotiations, leadership, communications, financial planning and team working.
- German language proficiency level (A2) and Swiss Residence Permit (B).

PRESENT POSITION

- **Scientist (PSIFF): Paul Scherrer Institute, Switzerland.** 2018 November – till date
  Implementation of recycling technology for rare earth metals
  Scholarship: PSI Founder Fellowship sponsored by UBS

PREVIOUS POSITIONS

- Postdoctoral Researcher: Paul Scherrer Institute, Switzerland. 2015 May - October 2018
- Postdoctoral Researcher: University of Bologna, Italy. 2013 December - February 2015

ACADEMIC ACHIEVEMENTS / AWARDS

- Best presentation "audience award" at circular economy transition, Zurich (April 2019)
- Awarded **Founder Fellowship of PSI 2018** (CHF 150000) (**October 2018**)
- **Swiss Winner 2018 Award** (CHF 10000) from AIT-CH 18 at Zurich (**April 2018**)
- Stage 1 award from **EIT Climate KIC, Zurich** (€ 20000), Switzerland (**2018**)
- **Culmann-Fonds Award 2017** in Environmental Engineering of ETH Zurich, Switzerland awarded to the Master's thesis co-supervised by me (**November 2017**)
- Selected as **Team member** in **Academy Industry Training programme 2017-18, hosted by ZHAW, SERI, Venturelab and Swissnex Switzerland (2017-18)**.
- Selected as **Postdoctoral Research Scholar** to work in **General Energy Research Department of Paul Scherrer Research Institute, Switzerland (May 2015 – onwards).**
- Selected as **India4EuII Postdoctoral Research Scholar** to work in **University of Bologna, Italy (December 2013 – February 2015).**

- Selected for the **Postdoctoral fellowship EXPERTS III** to work at **KU Leuven University, Belgium** (Declined by me).
- **Best Paper Award** from **ASSET** at **MEMSEP 2013** held at Mumbai, M.S., India, in **September 2013.**
- **Best Paper and Oral Presentation Award** from **IANCAS** at **NUCAR 2011** held at Visakhapattanam, A.P., India, in **February 2011.**
- **Senior Research Fellowship** from DAE-Government of India, (**2010 – 2013**).
- **Junior Research Fellowship** from DAE-Government of India, (**2008-2010**).

EDUCATION

- **Doctor of Philosophy in Organic, Analytical and Radiochemistry**, October 2013
  University of Pune, India
  Thesis: Synthesis and evaluation of novel extractants for actinide partitioning URL
- **Master of Science in Analytical Chemistry,** July 2008
  University of Pune, Maharashtra, India Grade: First Class
- **Bachelor of Science in Chemistry with Physics and Life Science,** June 2006
  North Maharashtra University, India Grade: First Class with distinction

PUBLICATIONS INTERNATIONAL JOURNALS (Total: 15; citations: 245@scholar.google.)

1. Efficient solvent system containing malonamides in room temperature ionic liquids: Actinide extraction, fluorescence and radiolytic degradation studies
   Ajay B. Patil, P.N. Pathak, V. S. Shinde, S. V. Godbole, and P. K. Mohapatra;
   Dalton Trans., 2013, 42(5), 1519-1529. URL (ISSN:1477-9226) (Impact factor:4.177)

2. Evaluation of DMDOHEMA based supported liquid membrane system for high level waste remediation under simulated conditions
   Ajay B. Patil, P. Kandwal, V. S. Shinde, P. N. Pathak, and P. K. Mohapatra;
   J. Membra. Sci., 2013, 442, 48-56. URL (ISSN:0376-7388) (Impact factor:5.557)

3. Modified Synthesis Scheme for *N*,*N*′-dimethyl-*N*,*N*′-dioctyl-2,(2′-hexyloxyethyl) malonamide (DMDOHEMA) and its Comparison with Proposed Solvents for Actinide Partitioning
   Ajay B. Patil, V. S. Shinde, P. N. Pathak, P. K. Mohapatra, and V. K. Manchanda;
   Radiochim. Acta, 2013, 101, 93-100. URL (ISSN: 2193-3405) (Impact factor:1.1)

4. Phytochemical Analysis and Free Radical Scavenging Activity of Medicinal Plants *Gnidia glauca* and *Dioscorea bulbifera*

S. Ghosh, A. Derle, M. Ahire, P. More, S. Jagtap, S. D. Phadatare, A. B. Patil, A. M. Jabgunde, G. K. Sharma, V. S. Shinde, K. Pardesi, D. D. Dhavale, and B. A. Chopade;

Plos One, 2013, 8(12), e82529. URL (ISSN: 1932-6203) (Impact factor: 3.057)

5. A novel dipicolinamide-dicarbollide synergistic solvent system for actinide extraction

Ajay B. Patil, P. N. Pathak, V. S. Shinde, V. A. Babain, and P. K. Mohapatra;

Radiochim. Acta, 2014, 102 (6), 481-487. URL (ISSN: 2193-3405) (Impact factor:1.1)

6. Synthesis and evaluation of *N,N′*-dimethyl-*N,N′*-dicyclohexyl-malonamide (DMDCMA) as an extractant for actinides

Ajay B. Patil, P. N. Pathak, V. S. Shinde, P. K. Mohapatra;

Sep. Sci. Technol., 2014, 49(18), 2927-2932. URL (ISSN:0149-6395) (Impact factor:1.083)

7. Studies on the radiolytic stability of newly developed solvent systems containing four calix-crown-6 ligands for radio-cesium recovery

P. Jagasia, P. K. Mohapatra, P. S. Dhami, A. B. Patil, V. C. Adya, A. Sengupta, P. M. Gandhi, P. K. Wattal;

J. Radioanal. Nucl. Chem., 2014, 302(3), 1087-1093. URL (ISSN:0236-5731) (Impact factor: 0.983)

8. Diosgenin from Dioscorea bulbifera: Novel Hit for Treatment of Type II Diabetes Mellitus with Inhibitory Activity against a-Amylase and a-Glucosidase

S. Ghosh, P. More, A. Derle, A. B. Patil, P. Markad, A. Asok, N. Kumbhar, M. L. Shaikh, B. Ramanamurthy, V. S. Shinde, D. D. Dhavale, and B. A. Chopade;

Plos One, 2014, 9(9), e106039. URL (ISSN: 1932-6203) (Impact factor: 3.057)

9. Evaluation of malonic acid diamide analogues as radical scavenging agents;

Ajay B. Patil, Saugata Ghosh, S. D. Phadatare, G. K. Sharma, B. A. Chopade, P. N. Pathak, V. S. Shinde;

New J. Chem., 2015, 39, 1267-1273. URL (ISSN: 1144-0546) (Impact factor: 3.277)

10. Effect of irradiation on some actinide and fission product ions' extraction using several tetraalkyl diglycolamides;
R. B. Gujar, G. B. Dhekane, Ajay B. Patil, P. K. Mohapatra;
Radiochim. Acta, 2015, 103(5), 335-344. URL (ISSN: 2193-3405) (Impact factor:1.1)

11. DMDCDDEMA as the new malonamide analogue for actinide partitioning: Synthesis, Extraction and Membrane Transport studies;
Ajay B. Patil, P. N. Pathak, V. S. Shinde, P. K. Mohapatra;
Sep. Purif. Technol., 2015, 145, 83-91. URL (ISSN:1383-5866) (Impact factor:3.299)

12. Novel Dipicolinamide-ionic liquid based solvent system for actinide extraction;
Ajay B. Patil, P. N. Pathak, Vaishali S. Shinde, V. A. Babain, P. K. Mohapatra;
J. Radioanal. Nucl. Chem., 2015, 305, 521-528. URL (ISSN:0236-5731) (Impact factor: 0.983)

13. Thermoresponsive copolymers with pendant D-galactosyl 1,2,3-triazole groups: synthesis, characterization and thermal behavior;
A. B. Dhumure, Ajay B. Patil, A. S. Kulkarni, I. Voevodina, M. Scandola, V. S. Shinde;
New J. Chem., 2015, 39, 8179-8187. URL (ISSN: 1144-0546) (Impact factor: 3.277)

14. Radiation stability of diglycolamide functionalized calix[4]arenes in ionic liquid: Solvent extraction, EPR and GC-MS studies;
A. Sengupta, P.K. Mohapatra, A. B. Patil, R.M. Kadam, W. Verboom;
Sep. Purif. Technol., 2016, 162, 77-83. URL (ISSN:1383-5866) (Impact factor:3.299)

15. Gnidia glauca Leaf and Stem Extract Mediated Synthesis of Gold Nanocatalysts with Free Radical Scavenging Potential;
Ghosh S., Patil S., Chopade NB., Luikham S., Kitture R., Gurav D., Patil AB., Phadatare SD., Sontakke V., Kale S., Shinde V., Bellare J., Chopade BA.,
J. Nanomed. Nanotechnol., 2016, 7, 358. URL (ISSN: 2157-7439) (Impact factor: 3.573)

PATENT: (total: 1)

Rare Earth Recycling from Fluorescent Powder e-wastes
(Europian patent (filed in April 2018): 2018P04277EP)

BOOK CHAPTER: (total: 1)

1. Rare earth metals recycling from e-wastes: strategy and perspective
   Ajay B. Patil and co-workers; Progress towards the resource revolution; edited by Prof. Chr. Ludwig and Sonia Valdivia; ISBN 978-3-9521409-8-7, 2019, sub chapter 23, 162-164.

SEMINARS /TALKS / INTERNATIONAL CONFERENCES: (total presentations 13)

1. Efficient synthesis of *N,N'*-dimethyl-*N,N'*-dioctyl-2,(2'-hexyloxyethyl) malonamide (DMDOHEMA) as actinide partitioning agent;

Ajay B. Patil, Vaishali S. Shinde, P.N. Pathak, P.K. Mohapatra, V.K. Manchanda

DAE BRNS symposium on Emerging Trends in *Separation Science and Technology (SESTEC-2010)*, held at IGCAR, Kalpakkam, Tamilnadu, during February 2010; POSTER presentation

2.New synthesis route for *N,N'*-dimethyl-*N,N'*-dioctyl-2,(2'-hexyloxyethyl) malonamide (DMDOHEMA) and its evaluation under simulated high-level waste conditions

Ajay B. Patil, Vaishali S. Shinde, P.N. Pathak, P.K. Mohapatra, V.K. Manchanda

Nuclear and Radiochemistry Symposium (NUCAR-2011), held at GITAM University, Visakhapattanam, A. P. during February 22nd to 26th, 2011; ORAL presentation

(**Best paper and Oral presentation award** to this paper by IANCAS)

3.Am(III) Permeation Studies across Supported Liquid Membrane impregnated with DMDOHEMA/*n*-dodecane;

Ajay B. Patil, V.S. Shinde, P.N. Pathak, P.K. Mohapatra;

DAE BRNS symposium on Emerging Trends in *Separation Science and Technology (SESTEC-2012)*, held at Mithibai College, Vile Parle, Mumbai, during February 27th to March 1st, 2012; ORAL presentation

4. Am(III) extraction studies employing diamide extractants from different acid media

Ajay B. Patil, V.S. Shinde, P.N. Pathak, P.K. Mohapatra

DAE BRNS symposium on Emerging Trends in *Separation Science and Technology (SESTEC-2012)*, held at Mithibai College, Vile Parle, Mumbai, during February 27th to March 1st, 2012; POSTER Presentation

5. Extraction Studies of Am(III) using Malonamides Dissolved in Ionic Liquids

P.N. Pathak, **Ajay B. Patil**, V.S. Shinde, P.K. Mohapatra

International conference, *Plutonium Futures 2012*, held at Cambridge University, London, UK during July, 15th to 20th, 2012; ORAL presentation

6. Novel dipicolinamide-dicarbollide synergistic solvent system for actinide extraction

Ajay B. Patil, V.S. Shinde, P.N. Pathak, V. A. Babain, P.K. Mohapatra

Nuclear and Radiochemistry Symposium (NUCAR-2013), held at Govt. Model Science College, Jabalpur, India February 19th to 23th, 2013; POSTER presentation

7. Pulse Radiolysis study of Malonic acid diamide analogues for their evaluation as radical scavenging agents

Ajay B. Patil, Sougata Ghosh, P.N. Pathak, B. A. Chopade, V.S. Shinde

National Symposium on Radiation and Photochemistry (NSRP 2013) held at North Eastern Hill University, Shillong (Meghalaya) during March 20th -22rd, 2013; POSTER presentation

8. Synthesis, extraction and liquid membrane transport behaviour of *N,N′*-dimethyl-*N,N′*-dicyclohexyl-2,(2′-dodecyloxyethyl) malonamide towards Am(III) recovery from acidic feeds;

Ajay B. Patil, V.S. Shinde, P.N. Pathak, P.K. Mohapatra; *(MEMSEP 2013)* held at BARC, Mumbai (Maharashtra) during September 16th -18th, 2013.

(Best Paper and Oral Presentation Award to this paper by ASSET**)**

9. Novel Dipicolinamide-ionic liquid based solvent system for actinide extraction;

Ajay B. Patil, V.S. Shinde, P.N. Pathak, V. A. Babain, P.K. Mohapatra;

DAE BRNS symposium on Emerging Trends in *Separation Science and Technology (SESTEC2014)*, held at Mumbai, during February 25th – 28th, 2014; POSTER Presentation

10. *Ischia Advanced School of Organic Chemistry* held at Ischia, Naples, Italy, September 2014.

11. *Design thinking workshop*, organized by Xavier University USA and ParkInnovAare, Switzerland, September 2017.

12. New Technology to Recover Clean Rare Earth Metals from e-Wastes,

Ajay B. Patil; at World Recycling Forum held at Macau, China. November 14-17, 2017. **Invited Talk**

13. Rare earth metals recycling from e-wastes: strategy and perspective**;**
Ajay B. Patil, Rudolf P.W.J. Struis, Albert J. Schuler, Mohamed Tarik, Andreas Krebs, Werner Larsen and Christian Ludwig; World Resource Forum held at Geneva, Switzerland. October 24-25, 2017. Oral and Poster Presentation

14. Economic process hydrometallurgy for rare earth metals recycling from e-waste;
Ajay B. Patil, Rudolf PWJ Struis, Albert J. Schuler, Mohamed Tarik, Christian Ludwig;
10th International Conference on f-Elements (ICFE-10) held in Lausanne, Switzerland. September 3-6, 2018.
Invited Talk (IL-10-6)

RESEARCH EXPERIENCE

Synthesis of selectively complexing ligands and development of the separation and Analytical methods the for strategic and expensive metals

- The work during my second post-doctoral tenure at Paul Scherrer Institute Switzerland and during my doctoral tenure at Department of Chemistry, University of Pune and Bhabha Atomic Research Centre, Mumbai, India; I was dealing with the synthesis of multivalent organic ligand molecules like different malonamides and their derivatives which are having ability of binding and complexing with actinides/ lanthanide metal ions.
- The work also involved the designing of the new ionic liquid ligands and diluent moieties to get the selectivity in actinides metal ions and their applications in coordination and separation chemistry of f-block elements.
- Supported liquid membrane system using synthesized ligands have been developed for the separation of actinides.
- During this work the basic actinide complexation studies have been carried out using the different spectroscopic techniques such as UV, ICP-OES, TRLFS, GCMS, IR, NMR, GPC, HPLC, LC-MS and gamma ray spectroscopy. The work has resulted in most of my major publications.

Synthesis of Imidazolidinone hybrid organocatalyst, and gold/thiourea catalysis on nitro alkyne and allene isatin analogues

- The research work carried out during my first postdoctoral tenure at the Department of Chemistry 'Ciamician', University of Bologna, Italy is dealing with the organocatalysis research area. We have emphasized our efforts on the synthesis of new Imidazolidinone hybrid catalyst, and study of the thiourea and gold catalyst strategies on newly designed structural entities belonging to the isatin alkyne or allenes.
- We have developed the cyclic amino acid amine type of Imidazolidinone organocatalyst ligands from the amino acid precursors. Attempts were carried out starting from the *L*-Serine or ethyl bromo acetate to achieve the cyclic Imidazolidinone moiety by using acetonide or formyl cyclization of amino acid amidic and amine nitrogen atoms. Further installation of the diphenyl alcohol group using the methylation reaction using strong base and silyalation afforded the desired hybrid class of imidazolidininone catalyst in good stereochemical control. The organocatalysis studies were carried out on the reactions such as alkylation, cyclopropanation, and Michael addition. Present work is in process of manuscript preparation.
- The allene and nitroalkyne adduct of the isatin has been constructed successfully. The simple protocol for the allene synthesis has been developed using the formyl homologation reaction on the propargyl protected Isatin. Further efforts towards the cyclization of such nitro unsaturated isatin systems can give rise the fascinating cyclised products and could be studied for the cascade type of reactions. Present work is in advanced stage of cyclization of the nitro alkynes with functionalized isatin using Au catalyst.

Work done at University of Bologna, Italy, under communication for publication

Carbohydrates modification using click chemistry and carbohydrate smart polymers

- Along with my PhD work, at dept. of chemistry, University of Pune; I was also involved in the synthetic organic chemistry projects for the carbohydrate modifications using simpler strategies. It involves the conversion of D-glucose into the five membered ring furanose form using the acetonide protection.

- C-5 position of this moiety undergoes selective deprotection and $NaIO_4$ diol cleavage to get aldehyde and then the subsequent alkyne construction using Bestmann conditions. In another sequence, the C-3 alcohol was converted to corresponding azide or alkyne using NaN_3 or propargyl bromide. These scaffolds then exposed to click reactions in mild conditions.
- The free OH in the sugar moieties can be acrylated and polymerized under radical conditions; or copolymerized with acrylic acid or *N*-isopropyl acrylamide to give pH or thermosensitive smart polymers. The synthesized polymer molecules showed good haemeagglutination and viral recognition activity.

Work done at University of Pune, India, New J. Chem. 2015

THE MAIN AREA OF THIRST WERE

- The designing and synthesis of new multivalent ligands derivatives and ionic liquids ligands.
- Separation of f blocks metals by complexation, membranes, and utilization of spectroscopic and chromatographic techniques and Radiochemistry.
- Rare earth metal separations using improved strategies.
- Rigorous analytical (separation and spectroscopy) and synthetic organic chemistry expertise

EXPERIMENTAL SKILLS:

- Experienced in handling organic reactions like amide coupling, Imine coupling, Huisgens Cycloaddition, C- Coupling using organolithium reagents.
- Pd, Fe, Zn, Cu mediated hydrogenation/reduction reactions.
- Handling moisture sensitive reactions. Capable of handling radioactivity and radiation detectors. Well versed with the solution and redox chemistry of actinides.
- Purification of organic compounds by distillation, vacuum distillation, crystallization and chromatographic techniques.

RELEVANT SCIENTIFIC / SOFTWARE SKILLS LEARNT:

- Operation of instruments and Interpretation of spectral data from UV, ICP-OES, ICP-MS, TRLFS, IR, NMR, LC-MS, CHNS etc.
- Well versed with HPTLC, Prep HPLC technique, Gel Permeation Chromatography, Combiflash, chiral chromatography.Knowledge software's such as ISIS Draw, ChemDraw, and other computer knowledge.
- Literature search by using Spresi-web, Sci-Finder, Scopus, reaxys, etc.

- Well acquainted with the chemistry of f block elements and their spectroscopic properties like Time Resolved Laser Fluorescence Spectroscopy.
- Capable of handling radiotracers and radiation detectors including Gamma ray spectroscopy and alpha scintillation counting techniques

MEMBERSHIP OF ACADEMIC BODIES

- Life membership of "Association of Separation Scientists and Technologists" (ASSET), Mumbai, India since Feb 2010.
- Life membership of "Indian Association of Nuclear Chemists and Allied Scientists (IANCAS), since November 2013.

INVOLVEMENT AND RESPONSIBILITIES

- Co-guided four students for their master's dissertations.
- Participated as volunteer in organization of different workshops and conferences at University of Pune, Pune and Bhabha Atomic Research Centre, Mumbai, India.
- Participated in various cultural and sport activities.

PERSONAL DETAILS

- Date of Birth : 19th September 1985
- Family Status : Married (father of 2 children)
- Nationality : Indian

LANGUAGES

English (Fluent), Hindi (Fluent), Marathi (Native), Italian (Beginner), German (A2)

REFERENCES

1. **Dr. Rudolf Struis**
   Senior Scientist
   Chemical Processes and Materials Research group,
   Energy and Environment Research Department,
   Paul Scherrer Institute,
   Villigen 5232, Switzerland
   Email: rudolf.struis@psi.ch
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2. **Prof. P. K. Mohapatra**
   Scientific Officer (H)
   Head and Professor
   Actinide Chemistry Section,
   Radiochemistry Division,
   Bhabha Atomic Research Centre,
   Mumbai-India 400 085
   Email: mpatra@barc.gov.in
   Phone: +91 22 25594576

3. **Prof. Christian Ludwig**
   Professor and Head
   Chemical Processes and Materials Research group,
   Energy and Environment Research Department,
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4. **Prof. Vaishali S. Shinde**
   Professor in Organic Chemistry,
   Garware Research Centre,
   Department of Chemistry,
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5. **Prof. Dilip. D. Dhavale**
   Professor in Organic Chemistry and Former Head
   Department of Chemistry,
   University of Pune,
   Pune-411007, (India).
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