

Cover Letter

22/12/2022

To,
HR Department,
INTONATION, Research Laboratories,
Hyderabad, India

Subject: Application for the research scientist position.

Respected Sir/Madam.,

At the outset, it is my pleasure to introduce myself as Dr. Dattatry Shivajirao Bhosale. Since 1st Sept. 2022, working as a Postdoctoral Researcher at the Department of Chemistry and Biochemistry, Mendel University, Brno, Czech Republic.

My first Postdoc was for a period of 4.5 years (April 2018 - August 2022) from the Department of infectious Diseases and Preventive Medicine, Veterinary Research Institute (VRI) Brno and Faculty of Chemical Technology, University of Pardubice, Czech Republic. The work was concerned with design the novel synthetic route and execute the synthesis of targeted molecules such as Diphyllin analogs, *N*-GalNAc ligands, Boronated chelating ligands, lipids, and functionalization of polymers and conjugate of isoniazid.

I completed my Ph.D. (Organic Chemistry) degree on 28th August 2017 from the Institute of Organic Chemistry and Technology, Faculty of Chemical Technology, University of Pardubice, Czech Republic. The thesis entitled "Selected pyridine derivatives immobilized on colloidal nanosystems (block copolymer and magnetic nanoparticle) for asymmetric Henry reaction and drug delivery application" with Prof. Dr. Miloš Sedlák.

My research experience of 12⁺ years in Organic Chemistry, where I had the opportunity to learn different techniques and work with various kinds of equipment, allows me to have the criteria and critical spirit to begin a new project. Moreover, I worked in five different research institutions (India & Europe). I am confident the knowledge and skills I have gained through the academic and practical application will make me a successful research scientist. I am a disciplined researcher and team player, passionate about the organic synthesis field, and have the will to succeed in projects and make INTONATION, Research Laboratories, Hyderabad, India.

For detailed information about my background, please refer to my enclosed curriculum vitae and research summary. If you need further information, please contact me or Prof. Dr. Miloš Sedlák.

I look forward to hearing from you.

Sincerely Yours,
Dr. Dattatry S. Bhosale

Curriculum Vitae

Dr. Dattatry Shivajirao Bhosale

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Mendel University, Zemedelska-1, 613 00 Brno, Czech Republic

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Mobile: +420 777624437



CAREER OBJECTIVE

I aspire to be associated with a progressive pharmaceutical company, which provides the necessary opportunities and ample scope to exhibit my skills in the domain of synthetic organic chemistry, polymer chemistry, lipid chemistry, carbohydrate chemistry, and asymmetric catalysis.

RESEARCH EXPERIENCE

- | | |
|--------------------------------|--|
| Sept. 2022– Present | Researcher at Department of Chemistry and Biochemistry, Mendel University , Brno & Faculty of Chemical Technology, University of Pardubice, Czech Republic . |
| April 2018– Aug. 2022 | Postdoctoral Researcher at Department of Infectious Diseases and Preventive Medicine, Veterinary Research Institute, Brno & Faculty of Chemical Technology, University of Pardubice, Czech Republic . |
| Nov. 2011– Aug. 2017 | Ph.D. (Organic Chemistry) in Institute of Organic Chemistry and Technology, Faculty of Chemical Technology, University of Pardubice, Czech Republic . |
| Sept. 2010 – Sept. 2011 | Project Assistant in National Chemical Laboratory, Division of Organic Chemistry, Pune, India . During this period, I have worked on the “ <i>Development of novel antifungal agents including hybrid molecules</i> ”, under the supervision of Dr. Hanumant B. Borate (Sci-F). |
| Aug. 2009 – Aug. 2010 | Research Training in Department of Chemistry, Deogiri College, Aurangabad, India . During this period, I have worked on “ <i>Synthesis of β-enamino ketone using sulfated tin oxide (STO) development of novel synthetic methods using nanoparticles as a catalyst</i> ”, under the supervision of Prof. Dr. Rajendra P. Pawar . |
| Feb. 2009 – Aug. 2009 | Research guest work in National Chemical Laboratory, Division of Organic Chemistry, Pune, India . During this period, I have worked on “ <i>Synthesis of biologically active molecules</i> ”, under the supervision of Dr. Subhash P. Chavan (Sci-G). |

EDUCATIONAL QUALIFICATIONS

- Nov. 2011– Aug. 2017** **Ph.D.** in **Organic Chemistry**, Institute of Organic Chemistry and Technology, Faculty of Chemical Technology, University of Pardubice, **Czech Republic**, under the supervisor **Prof. Ing. Miloš Sedlák DrSc.**
Thesis title: “*Selected pyridine derivatives immobilized on colloidal nanosystems for asymmetric Henry reaction and drug delivery application*”
- June 2006 – May 2008** **M.Sc.** in **Organic Chemistry** (61.92%), Department of Chemistry, Maharashtra Udaygiri Mahavidyalaya Udgir, affiliated to S. R. T. M. University Nanded, Maharashtra, **India**.
- June 2003 – May 2006** **B.Sc.** in **Chemistry, Botany, Zoology** (68.57%), Department of Chemistry, Maharashtra Udaygiri Mahavidyalaya Udgir, affiliated to S. R. T. M. University Nanded, Maharashtra, **India**.

PUBLICATIONS

1. “Next-generation pH-triggerable lipid-based nanoparticles (LNPs) to mediate efficient functional delivery of RNAi effectors” Zdeněk Kratochvíl, **Dattatry Shivajirao Bhosale**, Ganesh Selvaraj Duraisamy, Jihao Yu, Melanie Schürz,⁵ Michaela Vojníková, Qiuchen Zhang, Ivana Huvarova, Ivana Lipenská, Luboš Jelinek, Miloš Sedlák, Miroslav Havránek, Lei Fu, Daniel Růžek, Vojtěch Adam, Nicole Meisner-Köber, Zbyněk Heger, Andrew D. Miller (*Manuscript submission stage*).
2. “New and revised synthesis of aminoxylipids for the modular assembly using pH-reversible click chemistry of lipid-based nanoparticles (LNPs) that mediate the efficient functional delivery of therapeutic nucleic acids” Qinchun Zhang, Dongsheng Xie, Jihao Yu, Luboš Jelinek, Miroslav Havranek, **Dattatry S. Bhosale**, Ivana Lipenská, Lei Fu, Andrew D. Miller (*Manuscript submission stage*).
3. “Flexible synthesis of important ionizable lipid for the modular assembly of lipid-based nanoparticles (LNPs) that mediated the efficient functional delivery of therapeutic nucleic acids” Dongsheng Xie, Jiho Yu, Luboš Jelinek, Miroslav Haranek, **Dattatry S. Bhosale**, Ivana Lipenska, Lei Fu, Andrew D. Miller (*Manuscript submission stage*).
4. “Fluorescent turn-on assay for determination of glycosylated proteins from biological samples” Jaroslava Bezdekova, Kristyna Pavelicova, **Dattatry Shivajirao Bhosale**, Silvie Simonovska, Lenka Pavlikova, Jan Bartáček, Jan Svoboda, Miloš Sedlák, Andrew David Miller, Michal Masarik, Marketa Vaculovicova (*Manuscript submitted*).
5. “Diphyllin shows a broad-spectrum antiviral activity against multiple medically important RNA and DNA enveloped viruses” Michal Štefánik, **Dattatry Shivajirao Bhosale**, Jan Havierník, Petra Straková, Martina Fojtiková, Lucie Dufková, Ivana Huvarová, Jiří Saláť, Jan Bartáček, Jan Svoboda, Miloš Sedlák, Daniel Ruzek, Andrew D. Miller, Ludek Eyer, *Viruses*, **2022**, *14*, 345. IF 5.048.

6. “Advanced Therapeutics, Vaccinations, and Precision Medicine in the Treatment and Management of Chronic Hepatitis B Viral Infections: Where Are We and Where Are We Going” Ganesh Duraisamy, **Dattatry Bhosale**, Ivana Lipenska, Ivana Huvarova, Daniel Ruzek, Marc P. Windisch and Andrew D. Miller, *Viruses*, **2020**, *12*, 998. IF 5.048.
7. “Magnetically recoverable catalyst for the asymmetric Henry reaction based on a substituted imidazolidine-4-one copper(II) complex supported by Fe₃O₄@SiO₂ nanoparticles” **Dattatry S. Bhosale**, Pavel Drabina, Miloslav Kincl, Milan Vlček, Miloš Sedlák, *Tetrahedron: Asymmetry*, **2015**, *26*, 1300–1306. IF 2.344.
8. “Henry reaction catalyzed by recoverable enantioselective catalysts based on copper(II) complexes of α -methoxypoly(ethylene glycol)-*b*-poly(L-glutamic acid) and imidazolidine-4-one ligands” **Dattatry S. Bhosale**, Pavel Drabina, Jiří Palarčík, Jiří Hanusek, Miloš Sedlák, *Tetrahedron: Asymmetry*, **2014**, *25*, 334–339. IF 2.344. [Highlighted in **SYNFACTS**, **2014**, *10*(6), 0655].
9. “Synthesis and characterization of magnetic nanoparticles Fe₃O₄@SiO₂ decorated with amino groups” Lydie Harmand, **Dattatry Bhosale**, Ludvík Beneš, Jiří Palarčík, Andréa Kalendová, Miloš Sedlák, *Scientific papers of The University of Pardubice, Series A* **2014**, *20*, 191–207.
10. “Synthesis and characterization of a pH-sensitive conjugate of isoniazid with Fe₃O₄@SiO₂ magnetic nanoparticles” Miloš Sedlák, **Dattatry S. Bhosale**, Ludvík Beneš, Jiří Palarčík, Andrea Kalendová, Karel Královec, Aleš Imramovský, *Bioorg. Med. Chem. Lett.*, **2013**, *23*, 4692–4695. IF 2.331.
11. “One-pot synthesis of 4-alkyl-3-aryl-2,6-dicyanoaniline and their use in the synthesis of highly functionalized 2,3,5,6,7- and 2,3,4,5,7-substituted indoles” Sangmeshwar P. Sawargave, Ananada S. Kudale, Jaydeep V. Deore, **Dattatry S. Bhosale**, Jaisingh M. Divse, Subhash P. Chavan, Hanumant B. Borate, *Tetrahedron Lett.*, **2011**, *52*, 5491–5493. IF 2.683.
12. “One-pot synthesis of 2,4,5-trisubstituted imidazoles using MoO₃/SiO₂ an efficient and recyclable catalyst” Sidhanath V. Bhosale, Mohan B. Kalyankar, Santosh V. Nalage, **Dattatry S. Bhosale**, Swati L. Pandhare, Trupti V. Kotbagi, Shubhangi B. Umbarkar, Mohan K. Dongare, *Synth. Commun.*, **2011**, *41* (5), 762–769. IF 1.213.
13. “An expeditious synthesis of bioactive 4-Aryl-3,4-dihydropyrimidines using in situ generated HCl” Sunita B. Shinde, Ambadas B. Rode, Satish A. Dake, **Dattatry S. Bhosale**, Vinayak S. Sonekar and Rajendra P. Pawar, *Int. J. Ind. Chem.*, **2010**, *1* (1), 46–71. IF 0.482.
14. “P₂O₅ mediated rapid condensation of 2-aminothiophenol with aromatic aldehydes at ambient temperature, Santosh V. Nalage, Sidhanath V. Bhosale, **Dattatry S. Bhosale**, Wamanrao N. Jadhav, *Chin. Chem. Lett.*, **2010**, *21* (7), 790–793. IF 0.775.

RESEARCH AREA AND TECHNICAL SKILLS

Laboratory:

Over 12-year's experience in multi-step organic synthesis involving asymmetric synthesis, heterocyclic chemistry, carbohydrate chemistry, peptide chemistry (block copolymer), lipid-synthesis, Fe-based magnetic nanoparticles, asymmetric catalysis (homogeneous/ heterogeneous), organometallic, recycling the catalyst, and drug conjugates for smart pH-dependent drug delivery.

- Excellent skills in designing organic synthetic routes and synthesis of small to complex molecules. Experience in handling moisture-sensitive, light-sensitive reagents, and reactions. Experience scale-up process development from mg to gm scale.
- Expertise in purification techniques: such as flash column chromatography, recrystallization, and distillation.
- Structure elucidation of small to complex organic molecules by advanced spectroscopic methods such as FT-IR, FT-NMR, LCMS and MALDI-TOF, GPC, HPLC, UV/vis, XRD, DLS, BET, SEM, and specific rotation.

Computer:

- Well versed with chemistry-related database search (Sci-finder, Reaxys), software like ISIS Draw, Chem. Draw.

Personal:

- Ability to work and contribute effectively to a collaborative team environment and handle multiple projects.
- Innovative, keen learner, and team player. Multi-tasking with high degree of accuracy and efficiency.

CONFERENCES AND POSTERS

1. Synthesis, characterization, and evaluation of aminoxy and ionizable lipids for the modular assembly of lipid-based nanoparticles for efficient delivery of therapeutic nucleic acid, European symposium on organic chemistry (ESOC-2019) in Vienna at **Austria**, 14th–17th July **2019**, poster no. 218.
2. 11th International conference drug delivery systems at Jesuit college, Telč, **Czech Republic**, on 4th-7th June **2018**.
3. MSCA Marathon at University of Padova in **Italy**, 6th–8th June **2017** (Participated).
4. Magnetically recoverable catalysts for asymmetric Henry reaction, 16th Blue Danube Symposium on Heterocyclic Chemistry (BDHSC-16), Balatonalmádi in **Hungary**, 14th–17th June **2015**, P-07.
5. Henry reaction catalyzed by recoverable enantioselective catalysts based on copper(II) complexes, 20th International Conference on Organic Synthesis (ICOS-20), at Budapest **Hungary**, on 29th June- 4th July **2014**, P-07.
6. Synthesis of recyclable copper(II) complexes derived from poly(ethylene glycol)-*b*-poly(L-glutamic acid) and amine ligands for enantioselective Henry reaction, At 15th Blue Danube

Symposium on Heterocyclic Chemistry (BDHSC-15), at Palacky University in Olomouc, **Czech Republic**, on September 1st–5th, **2013**, P-012.

7. 1st CRSI ZONAL METTING, at National Chemical Laboratory, Pune, Maharashtra, **India**, on 13th–14th May **2011**.
8. National Science Day and International year of Chemistry celebrations **2011**, National Chemical Laboratory, Pune, Maharashtra, India, on 24th–25th February **2011**.
9. ASMNM-2011, National Symposium on “Advances in Synthetic Methodologies and new materials” at Shivaji University Kolhapur, **India**, on January 21st–22nd, **2011**.
10. “Drug Discovery and Nanotechnology” in Department of Chemistry, Yeshwant Mahavidyalaya, Nanded, **India** during January 27th–29th, **2008**, P- DDPP-114.

PERSONAL DETAILS

Date of birth	: 5 th June 1984	Languages	: English, Hindi, Marathi
Nationality	: Indian	Passport no.	: R 8148162
Marital status	: Married	Permanent address	: At-Indral, Post-Lasona, Tal-Deoni, Dist-Latur, 413 519, Maharashtra, India

REFERENCES

1. **Prof. Ing. Miloš Sedlák, DrSc.**
Institute of Organic Chemistry and Technology, Faculty of Chemical Technology, University of Pardubice, Studentska 573, 532 10 Pardubice, **CZECH REPUBLIC**.
E-mail: milos.sedlak@upce.cz
Tel. No.: +420 46 603 7506 (7012)
2. **Prof. Andrew D. Miller**
Department of Chemistry and Biochemistry, Mendel University, Brno, Zemědělská, **CZECH REPUBLIC**.
E-mail: miller@0365.mendelu.cz
Tel. No.: +420 777357253
3. **Dr. Subhash P. Chavan (Ret. Scientist-G)**
Former Head,
Division of Organic Chemistry, National Chemical Laboratory, Dr. Homi Bhabha road, Pashan, Pune 411008, (MH) **INDIA**.
E-mail: sp.chavan@ncl.res.in
Tel. No.: +91-20-2590 2289
4. **Dr. H. B. Borate (Ret. Scientist-F)**
Division of Organic Chemistry, National Chemical Laboratory, Dr. Homi Bhabha road, Pashan, Pune 411008, (MH) **INDIA**.
E-mail: hb.borate@gmail.com
Tel. No.: +91

I hereby confirm the information provided by me is true is the best of my knowledge.

Sincerely,

Dr. Dattatry Shivajirao Bhosale

Research Summary

1. Postdoctoral Researcher at Department of Chemistry and Biochemistry, Mendel University, Brno & University of Pardubice, Czech Republic. [Sept. 2022 – Present]

The second postdoctoral researcher work was mainly concerned with the synthesis of targeted lipids. The completed lipids derivatives such as lyso-TTA-PC, lyso-*t*-TTA-PC (Figure 1), lipid-C₁₈tAO-surfactant (Scheme 1) and the functionalization of PEG polymer (Scheme 2). The lipid-based nanoparticles (LNPs) are currently used in formulation and click chemistry applications and in drug delivery applications.

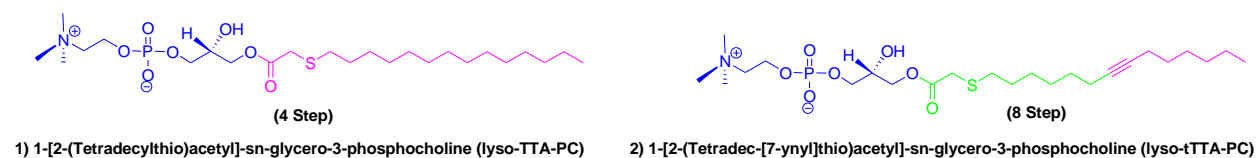
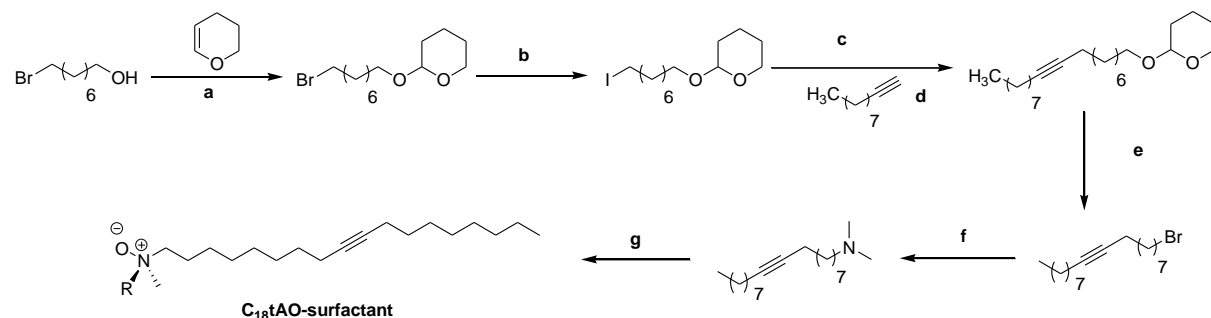


Figure 1. Synthesis of lipid derivatives

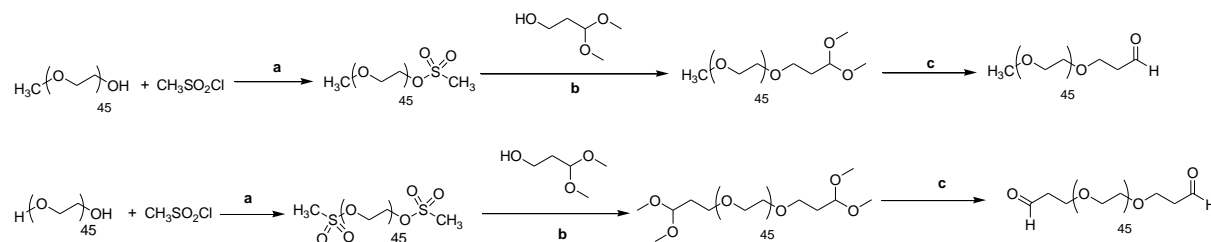
a) Synthesis and characterization of lipid-C₁₈tAO-surfactant



Scheme 1. Reagents and conditions: a) PPTs, dry DCM, 0 °C to rt, 24 h; b) NaI, Acetone N₂, reflux, 24 h; c) 1-Decyne, *n*-BuLi, N₂, dry-THF, 0 °C, 6 h; d) HMPA, 0 °C, 24 h; e) PPh₃.Br₂, PPh₃, DCM, 0 °C to rt, 24 h; f) Dry-DMF, K₂CO₃, dimethyl amine, N₂, rt, 48 h; g) Na₂WO₄, 30% H₂O₂ in H₂O, CH₃CN, N₂, 0 °C to rt, 24 h.

Publication: Manuscript submission stage.

b) Synthesis and functionalization of PEG-derivatives



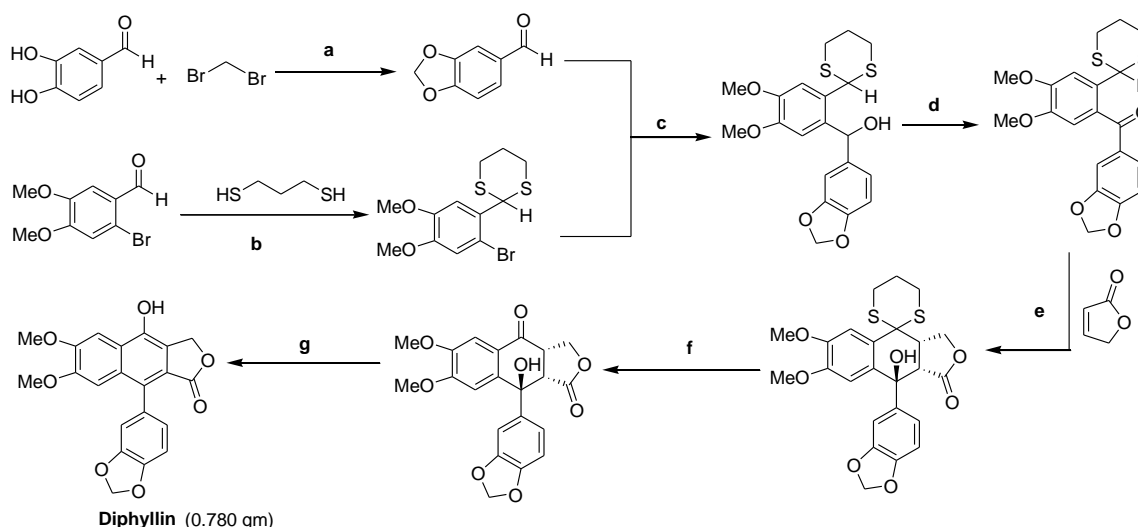
Scheme 2. Reagents and conditions: a) N₂, reflux, 75 h; b) K₂CO₃, CH₃CN, N₂, reflux, 65 h; c) Acid hydrolysis, rt, 1h.

Publication: Manuscript preparation stage.

2. Postdoctoral Researcher at the Department of Infectious Diseases and Preventive Medicine, VRI, Brno, & University of Pardubice, Czech Republic [April 2018 – August 2022]

The first postdoctoral work was mainly concerned with the synthesis of targeted molecules. The successfully completed projects such as the synthesis of diphyllin, boronate chelate-ligand, liver-receptor *N*-GalNAc-ligand, functionalization of PEG-polymers, and synthesis of m-PEG₅₀₀₀-*b*-PLL-INZ conjugate (Scheme 3, 4, 5, 6,7).

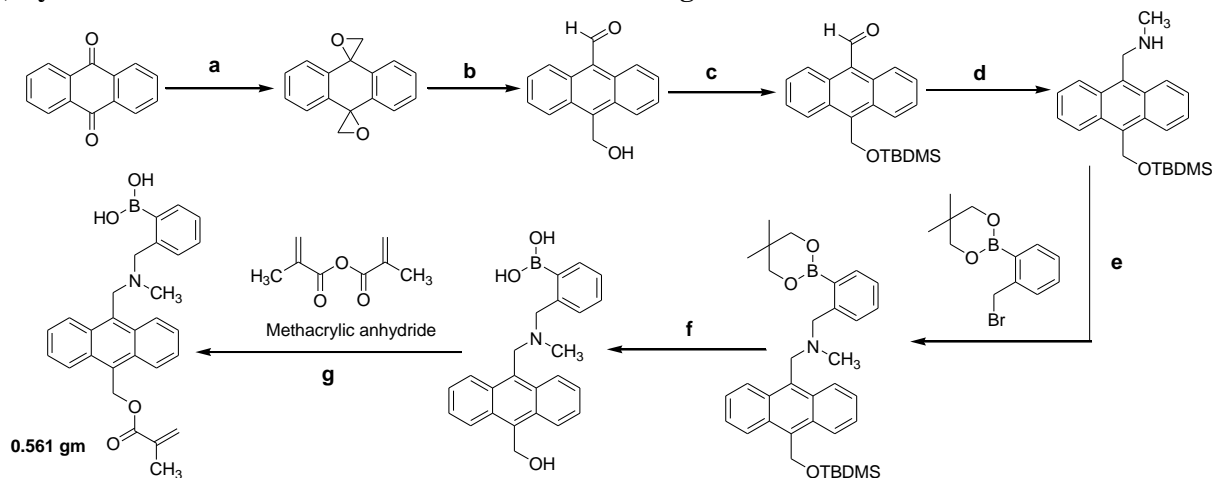
a) Synthesis and characterization of diphyllin derivatives for anti-viral studies



Scheme 3. Reagents and conditions: a) K_2CO_3 , CH_3CN , N_2 , reflux, 65 h; b) 90°C , 24 h; c) *n*-Bu-Li, THF, N_2 , -78°C to rt, 2 h; d) MnO_2 , CH_2Cl_2 , rt, 16 h; e) LiHMDS, THF, N_2 , -78°C to rt, 1 h; f) HgO , HgCl_2 , CH_3CN , reflux, 3 h; g) *p*-TsOH, benzene, reflux, 16 h.

Publication: *Viruses*, **2022**, *14*, 345.

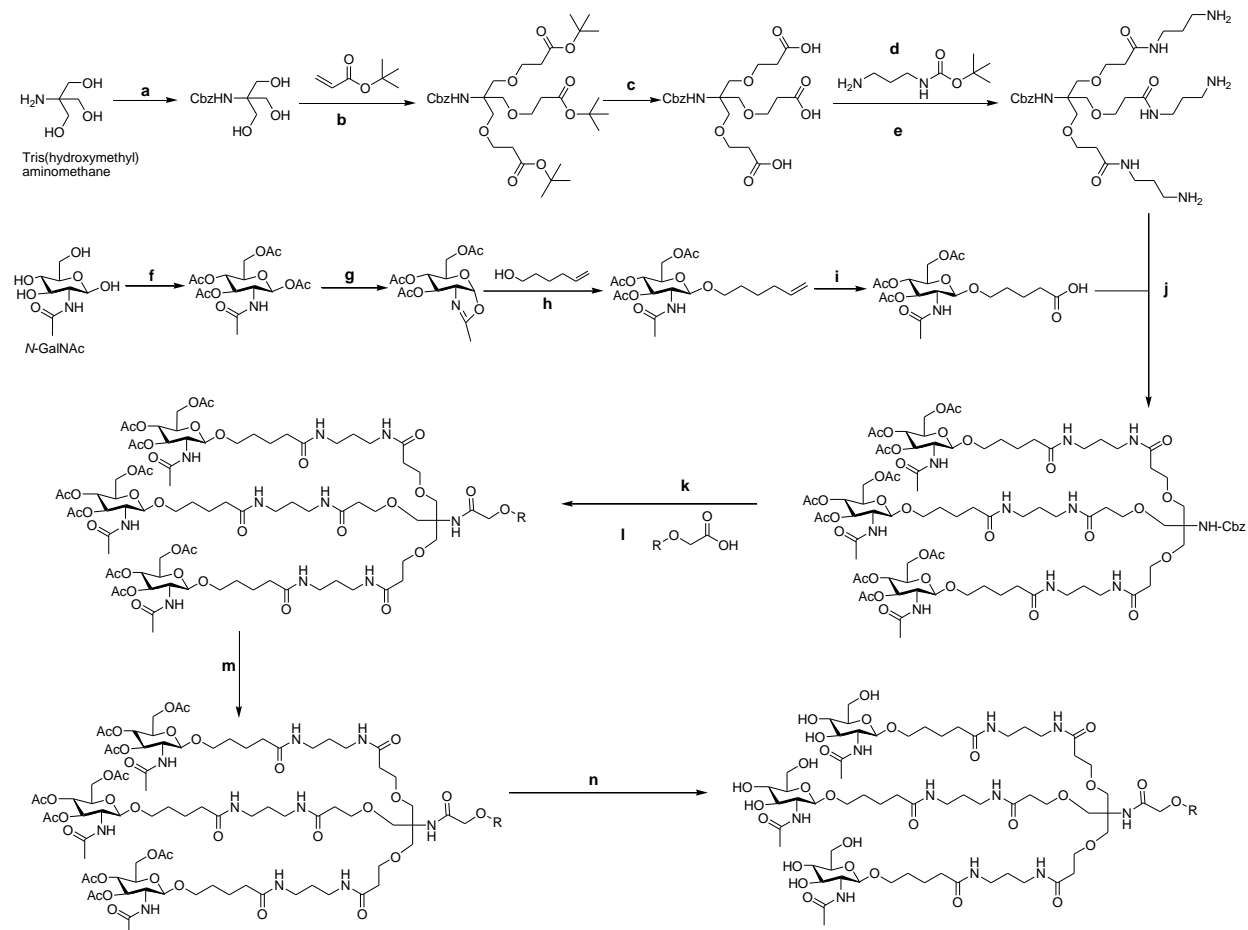
b) Synthesis and characterization of boronate chelate-ligand



Scheme 4. Reagents and conditions: **a)** DMSO, $(\text{CH}_3)_3\text{S-I}$, NaH, N_2 , rt in dark, 4 h; **b)** LiBr, CH_3CN , 60°C , 17 h; **c)** DMF, TBDMSCl, Imidazole, rt, 20 h; **d)** i) MeOH, CH_3NH_2 , N_2 , 24 h; ii) NaBH_4 , MeOH, 3 h; **e)** K_2CO_3 , CH_3CN , N_2 , reflux, 25 h; **f)** TBAF, THF, rt, 25 h; **g)** Methacrylic anhydride, DMAP, DCM, 48 h.

Publication: Patent and manuscript submitted.

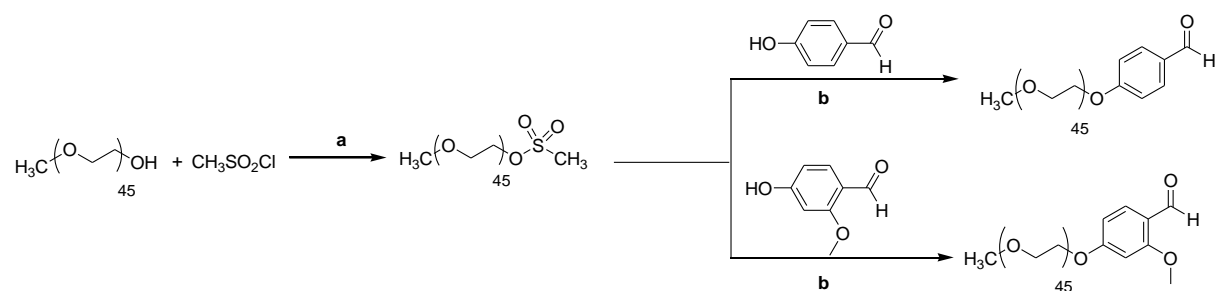
c) Synthesis and characterization of *N*-GalNAc-ligand for lipid-based nanoparticles (LNPs)

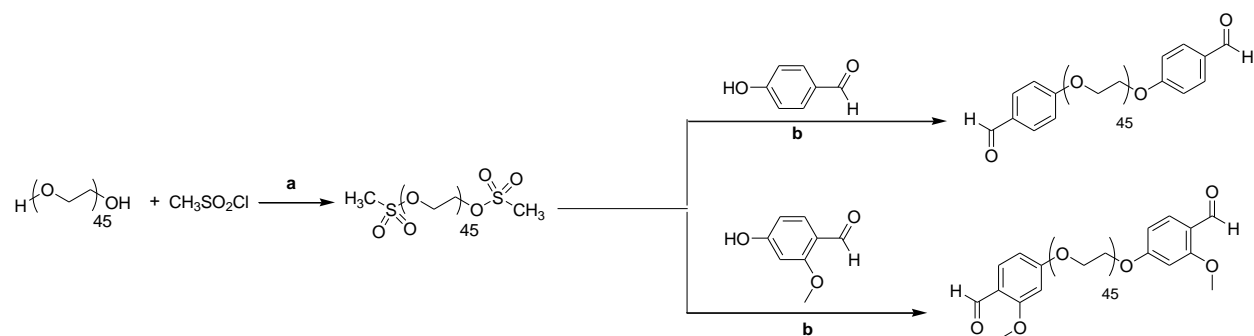


Scheme 5. Reagents and conditions: **a)** Cbz-Cl, Na₂CO₃, THF, N₂, 0 °C, 24 h; **b)** NaOH (5 mol solution), DMSO:H₂O (9:1), rt, 48 h; **c)** HCOOH, rt, 18 h; **d)** EDCI·HCl, HOBT, DIPEA, CH₂Cl₂, N₂, 0 °C to rt, 24 h; **e)** TFA, CH₂Cl₂, N₂, 0 °C to rt, 24 h; **f)** Ac₂O, Pyridine, rt, 24 h; **g)** TMSOTf, CH₂Cl₂, N₂, 60 °C, 24 h; **h)** TMSOTf, molecular sieves, DCE, reflux, 48 h; **i)** NaIO₄, RuCl₂, H₂O:DCM:CH₃CN (1:1:1), rt, 24 h; **j)** EDCI·HCl, HOBT, DIPEA, CH₂Cl₂, N₂, 0 °C to rt, 24 h; **k)** H₂, Pd/C, CH₂Cl₂, rt, 24 h; **l)** DMAP, HBTU, DMF:CH₂Cl₂ (1:1), N₂, 0 °C to rt, 24 h; **m)** TFA, CH₂Cl₂, rt, 24 h; **n)** CH₃NH₂, EtOH, rt, 24 h.

Publication: Manuscript submitted.

d) Synthesis and functionalization of PEG-derivatives

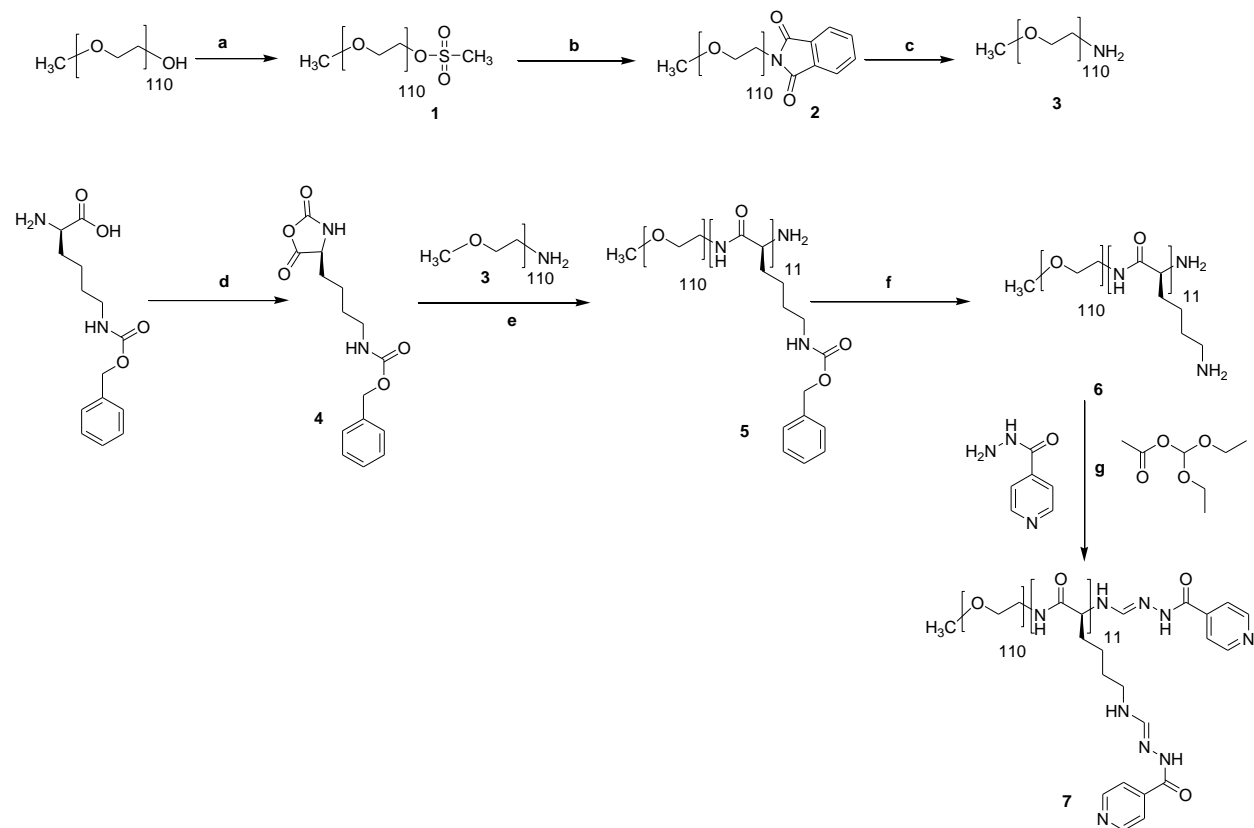




Scheme 6. Reagents and conditions: **a)** reflux, 75 h; **b)** K₂CO₃, CH₃CN, N₂, reflux, 65

Publication: Manuscript preparation stage

e) Synthesis and characterization of m-PEG₅₀₀₀-*b*-PLL-INZ conjugate



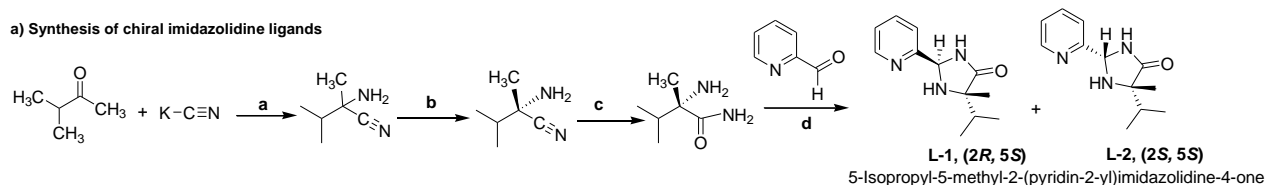
Scheme 7. Reagents and conditions: a) CH₃SO₂Cl, 70 °C, 75 h; b) Potassium phthalimide, 70 °C, 96 h; c) NH₂NH₂·H₂O, EtOH, reflux, 5 h; d) COCl₂, THF, 40 °C, 4 h; e) m-PEG-NH₂, DMF, 40 °C, 50 h; f) TFA, rt, 24 h; g) CH₃CN, N₂, 55 °C, 25 h.

Publication: Manuscript preparation stage

3. Doctoral (Ph.D.) study work at University of Pardubice, Czech Republic [Nov. 2011 – Aug. 2017]

In first part of study, I developed polymer supported version of **catalyst -1/2** (Scheme 9). A synthetic route to (2*R*, 5*S*) or (2*S*, 5*S*)-5-isopropyl-5-methyl-2-(pyridine-2-yl)imidazolidine-4-one was achieved from readily available non chiral starting material methyl isopropyl ketone (Scheme 8).

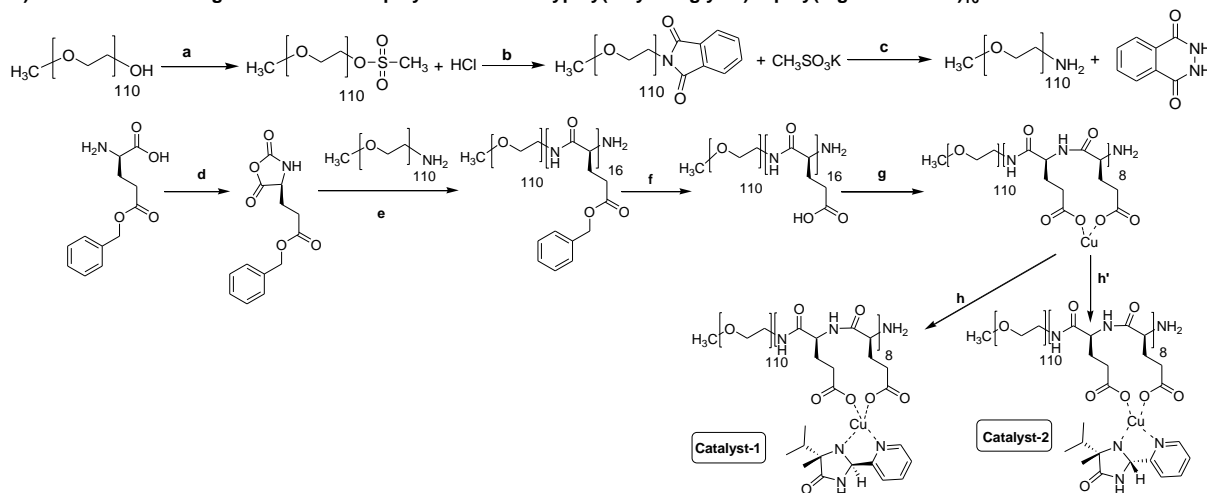
a) Synthesis of chiral imidazolidine ligands



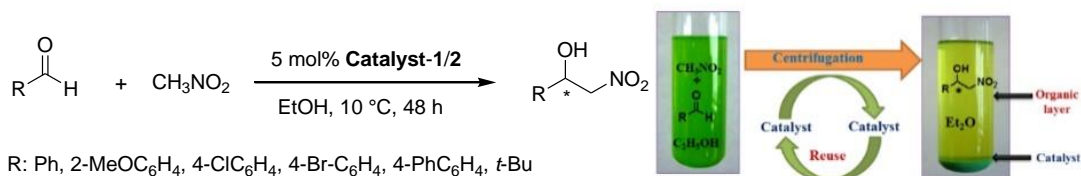
Scheme 8. Reagents and conditions: **a)** NH_3 , CH_3COOH , 40°C , 7 h; **b)** L-(+)-Tartaric acid, NaOH; **c)** H_2O , H_2SO_4 ; **d)** 2-Pyridinecarboxaldehyde, CH_3OH , CH_3COOH , reflux, 7 h.

Henry reaction was performed by using a catalyst-1/2 to obtain the corresponding (*R*)-2-nitroalcohols with high chemical yield (70–98%) and high enantioselectivity (61–92% ee) (Scheme 10). The catalyst **1/2** was successfully recycled up to 10 catalytic cycles while retaining high yield and enantioselectivity.

b) Immobilization of ligand on diblock copolymer of methoxypoly(ethylene glycol)-*b*-poly(L-glutamic acid)₁₆Cu salt



Scheme 9. Reagents and conditions: **a)** $\text{CH}_3\text{SO}_2\text{Cl}$, 70°C , 75 h; **b)** Potassium phthalimide, 70°C , 96 h; **c)** $\text{NH}_2\text{NH}_2\cdot\text{H}_2\text{O}$, EtOH, reflux, 5 h; **d)** COCl_2 , THF, 40°C , 4 h; **e)** m-PEG- NH_2 , DMF, 40°C , 48 h; **f)** Pd/C, THF, 20 bar H_2 , rt, 24 h; **g)** CuCO_3 , H_2O , rt, 24 h; **h)** Ligand-1, EtOH, rt, 24 h; **h')** Ligand-2, EtOH, rt, 24 h.

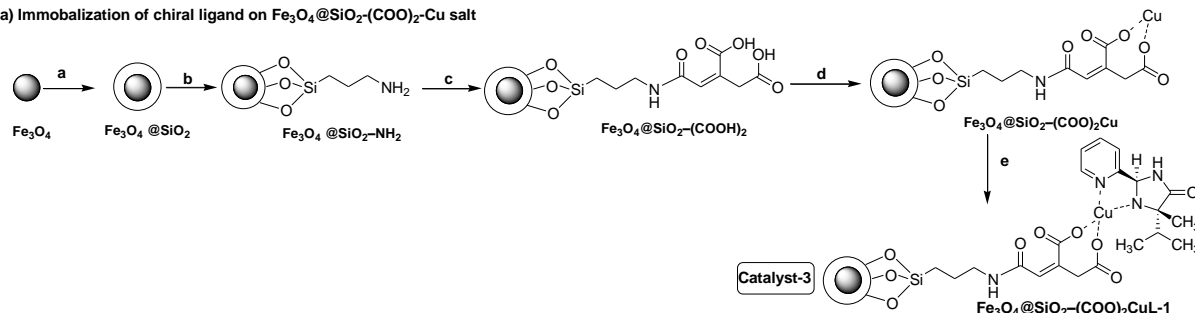


Scheme 10. Asymmetric Henry reaction catalyzed by polymer supported semi-homogeneous catalyst-1/2.

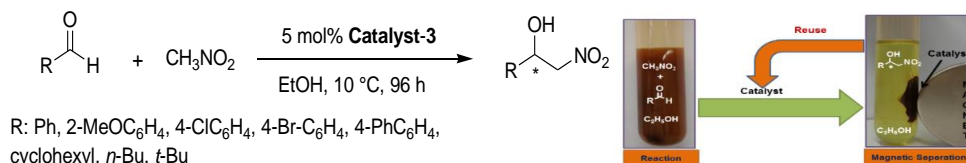
Publication: *Tetrahedron Asymmetry*, **2014**, 25, 334-339. Highlighted in *SYNFACTS*, **2014**, 10(6), 0655.

In second part of study, I developed magnetically recoverable catalyst-3 (Scheme 11) for the asymmetric Henry reaction and obtained the corresponding (*R*)-2-nitroalcohols with high chemical yield (82–99%) and with high enantioselectivity (68–94% ee) (Scheme 12). The MNPs supported catalytic systems were convenient route to recycle up to ten cycles through solid-phase separation.

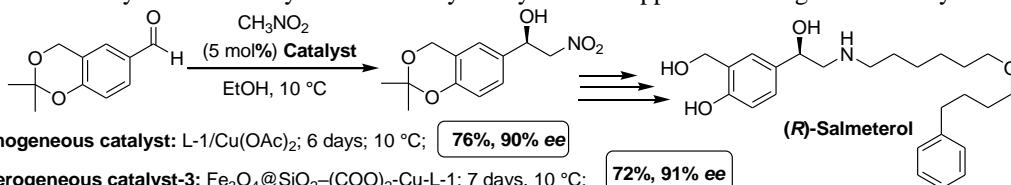
a) Immobilization of chiral ligand on $\text{Fe}_3\text{O}_4 @ \text{SiO}_2 - (\text{COO})_2\text{-Cu}$ salt



Scheme 11. Reagents and conditions: **a)** TEOS, 25% $2\text{NH}_3 \cdot \text{H}_2\text{O}$, EtOH, 40°C , 4 h; **b)** APTES, *p*-TSA, Toluene, reflux, 24 h; **c)** *Cis*-aconitic anhydride, pyridine, 25°C , 48 h; **d)** EtOH: H_2O , $\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2$, rt, 24 h; **e)** Ligand-1, EtOH, rt, 24 h.



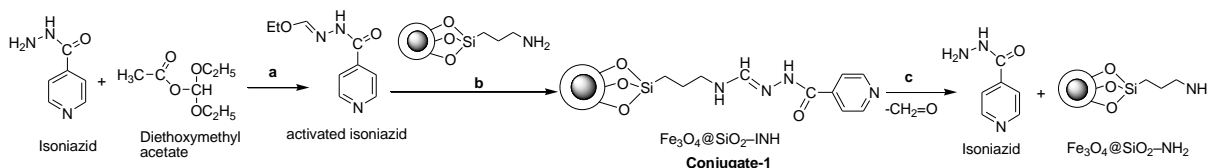
Scheme 12. Asymmetric Henry reaction catalyzed by MNPS supported heterogeneous catalyst-3.



Scheme 13. Enantioselectivity of homogeneous catalyst and heterogeneous catalyst-3 in the preparation of (*R*)-1-(2,2-dimethyl-4H-benzo[*d*-1,3]dioxin-6-yl)-2-nitroethanol.

Publication: *Tetrahedron Asymmetry*, **2015**, *26*, 1300-1306.

In the third part study, the synthesis of a pH-sensitive conjugate of isoniazid with $\text{Fe}_3\text{O}_4 @ \text{SiO}_2$ nanoparticles according to scheme 11. The release of isoniazid from the nanoparticles of the conjugate-1 under *in vitro* conditions were studied in solutions of the hydrochloric acid and phosphate buffer at 37°C (Scheme 14).

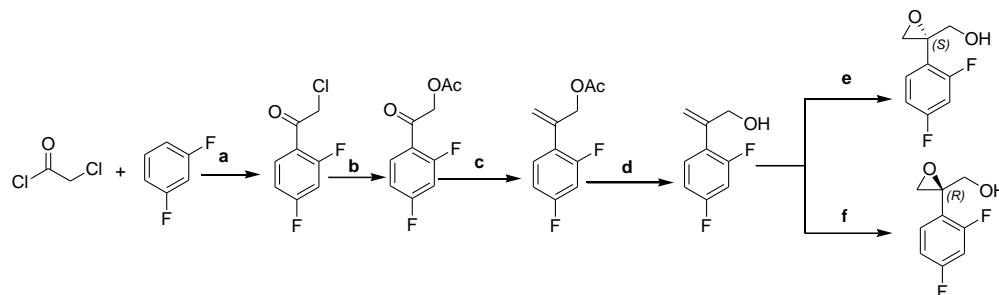


Scheme 14. Reagents and conditions: **a)** CH_3CN , 55°C , 30 min; **b)** $\text{Fe}_3\text{O}_4 @ \text{SiO}_2 - (\text{CH}_2)_3\text{-NH}_2$ (**17**), EtOH, ultrasonication 450 W 20 min, 25°C , 48 h; **c)** pH different buffer solution at 37°C

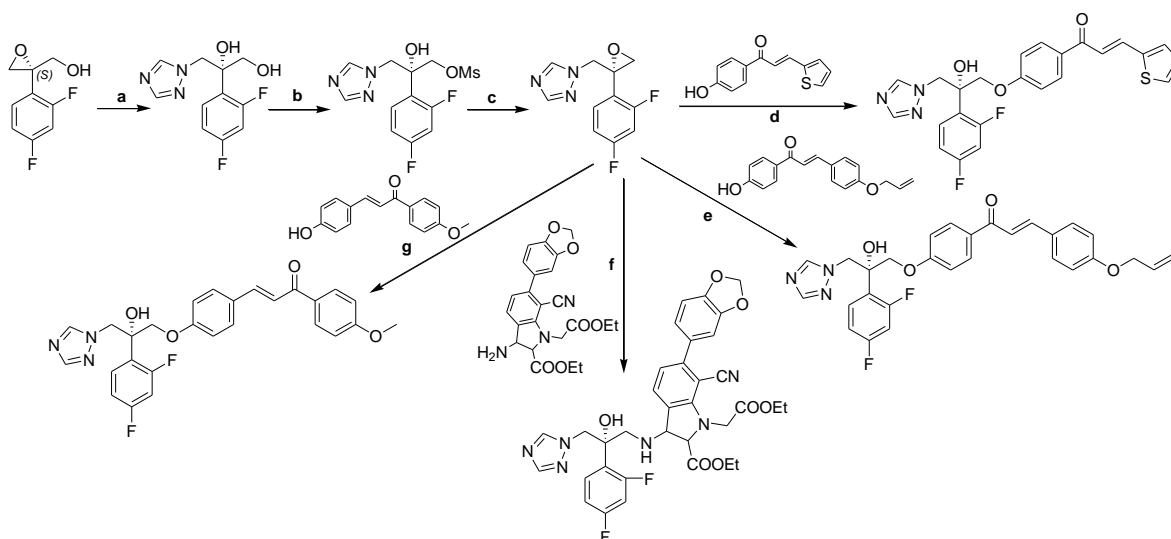
Publication: *Bioorg. Med. Chem. Lett.*, **2013**, *23*, 4692–4695.

4. Project assistant work at National Chemical Laboratory, Pune, India [Sept. 2010 – Sept 2011]

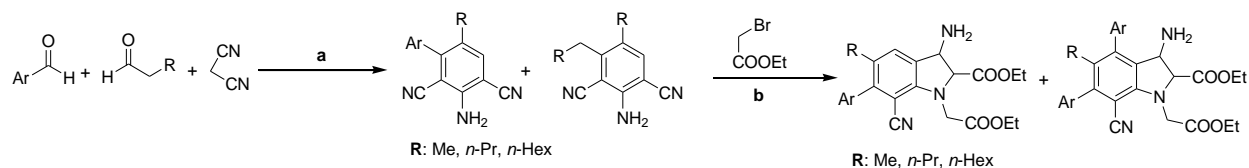
During the project assistant-II work period, I have worked on “*Development of novel antifungal agents including hybrid molecules*”, under the supervision of Dr. Hanumant B. Borate (Sci-F). I was involved in design and synthesis of new chemical entities to explore their potential as antifungal agent (Scheme 15, 16 and 17).



Scheme 15. Reagents and conditions: **a)** AlCl_3 , DCM, 0 °C to rt, 24 h; **b)** CH_3COONa , NaI, 3 h; **c)** $\text{Ph}_3\text{PCH}_2\text{Br}$, NaHMDS, THF, 0 °C to rt, 5 h; **d)** KOH, H_2O :1,4-Dioxane (1:1), 24 h; **e)** L(-)-DET, Titanium(IV) isopropoxide, TBHP, DCM, -20 °C, 48 h; **f)** D(+)-DET, Titanium(IV) isopropoxide, TBHP, DCM, -20 °C, 48 h.



Scheme 16. Reagents and conditions: **a)** 1,2,4-Triazole, NaH, DMF, 0 °C to rt, 24 h; **b)** MsCl , Et_3N , DCM, 0 °C, 3 h; **c)** NaH, DMF, 0 °C, 3 h; **d)** K_2CO_3 , TBAB, EtOAc, reflux, 4 h; **e)** K_2CO_3 , TBAB, EtOAc, reflux, 4 h; **f)** K_2CO_3 , TBAB, EtOAc, reflux, 4 h; **g)** K_2CO_3 , TBAB, EtOAc, reflux, 4 h.

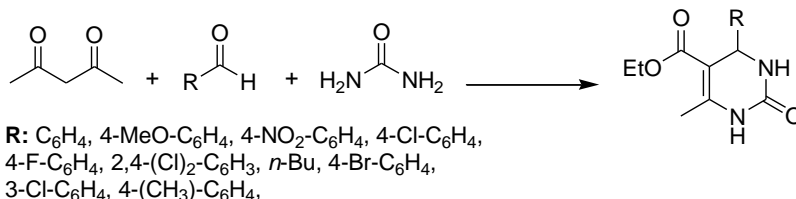


Scheme 17. Reagents and conditions: **a)** Morpholine, DMF, 80 °C, 12 h; **b)** KOH, CH_3CN , rt, 2 h.

Publication: *Tetrahedron Lett.*, **2011**, *52*, 5491–5493.

5. Research Training at Department of Chemistry, Deogiri College, Aurangabad, India [Aug. 2009 – Aug. 2010]

During the research training period, I have worked on “*Synthesis of β -enamino ketone using sulfated tin oxide (STO) development of novel synthetic methods using nanoparticles as a catalyst*” and “*Synthesis of bioactive 4-Aryl-3,4-dihydropyrimidines using in situ generated HCl*” (Scheme 18), under the supervision of Prof. Dr. Rajendra P. Pawar.

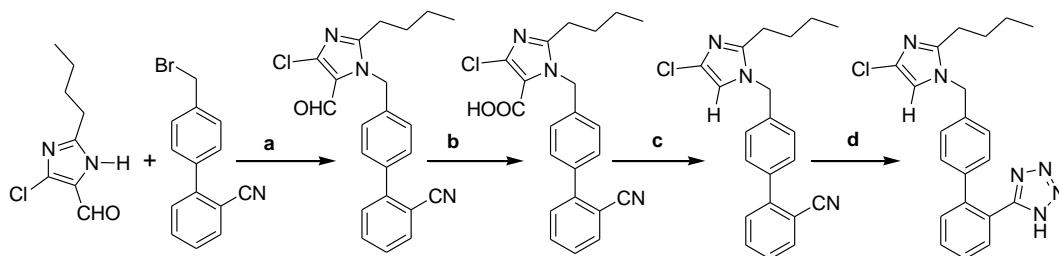


Scheme 18. Reagents and conditions: TCT, H₂O, 100 °C, 25 min.

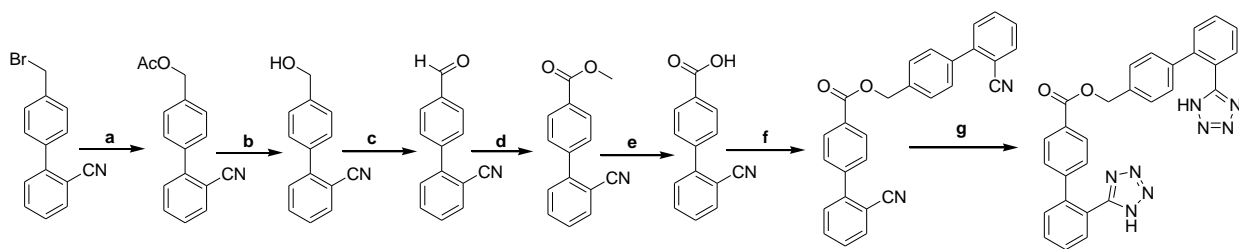
Publication: *Int. J. Ind. Chem.*, **2010**, 1 (1), 46–71.

6. Research guest work at National Chemical Laboratory, Pune, India [Feb. 2009 – Aug. 2009]

During the research guest work period, I worked on “*Synthesis of biologically active molecules*”, under the supervision of **Dr. Subhash P. Chavan** (Sci-G). I was involved in design and synthesis of novel biologically active molecules (Scheme 19 and 20).

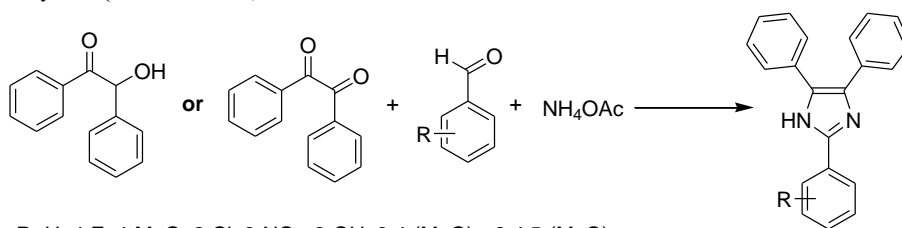


Scheme 19. Reagents and conditions: **a)** TBAB, 15% NaOH, toluene, rt, 16 h; **b)** NaClO₂, NaH₂PO₄, CH₃CN, H₂O₂, rt, 5 h; **c)** Cu-powder, quinoline, reflux, 5 h; **d)** NaN₃, Bu₃SnCl, toluene, reflux, 74 h.



Scheme 20. Reagents and conditions: **a)** NaI, NaOAc, DMF, 110 °C, 15 h; **b)** K₂CO₃, MeOH, rt, 5 h; **c)** MnO₂, DCM, rt, 14 h; **d)** Oxone, MeOH, rt, 15 h; **e)** KOH, THF:H₂O, reflux, 3 h; **f)** Starting bromo compound, NaI, K₂CO₃ DMF, 60 °C, 12 h; **g)** NaN₃, Bu₃SnCl, DMF, reflux, 72 h.

Also, during my research work, I worked with Dr. Mohan K. Dongare, Catalysis Division, NCL. During this period, I worked on “*Synthesis of imidazoles by using $\text{MoO}_3/\text{SiO}_2$ an efficient and recyclable catalyst*”(Scheme 21).



Scheme 21. Reagents and conditions: 20% $\text{MoO}_3/\text{SiO}_2$, CH_3CN , 80 °C, 4 h.

Publication: *Synth. Commun.*, **2011**, 41 (5), 762–769.