Poornaprajna Institute of Scientific Research

PROMOTED AND MANAGED BY ADMAR MUTT EDUCATION FOUNDATION (AMEF)
Recognised by Dept. of Scientific & Industrial Research (DSIR) Govt. of India & MAHE, Manipal

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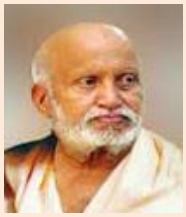
Newsletter

In this issue

In the news

- Four students received the Ph.D. award by MAHE, Manipal.
- Four new industry projects sponsored by Sulzer-GTC, USA, GTC-Vorro, USA, Sravathi AI Technology and Bhat Bio-Tech India were initiated. Overall, 11 sponsored projects were conducted during 2021.
- A 2-year project sponsored by HPCL. Govt. of India on catalyst & process development for CO_2 hydrogenation was successfully completed. Another project by Sravathi Advanced Process Technologies was also successfully executed.
- Eight best presentation awards were received by PhD students in 2021 at National and International conferences.
- One student received Senior Research Fellowship award from CSIR, Govt. of India and the other won the Young Scientist Award 2021 from International Academy of Physical Sciences.
- Two Ph.D. alumni joined as Faculty and Research Officer at IIT-Tirupati and Indian Oil Corporation, GOI respectively. One alumnus got a position in ORCA Computing, Toronto, Canada.
- Four MOUs were signed with prestigious organizations viz. Christ University, St Aloysius College, PES Institute and Intellocopia.



H. H. Sri Vibudhesha Theertha Swamiji, Founder, (1928 - 2009)

H. H. Sri Vishwapriya Theertha Swamiji, Chairman

H. H. Sri Eeshapriya Theertha Swamiji, Vice-Chairman

Vision

To promote and nurture excellence in the fundamental and applied sciences for the advancement of scientific knowledge and the benefit of mankind

From the Director's Desk

It gives me a great pleasure in presenting the 12th volume of Newsletter highlighting the overall research activities of PPISR during 2021. The new year began on a high note by the initiation of important project sponsored by Sulzer-GTC Technology Inc, USA with signing of the agreement in January for a 1-year sponsored project. It is a matter of great pride that the long association with GTC since 2010 with several sponsored projects has been renewed this year after its takeover by Sulzer. Another three projects followed it; GTC Vorro Environmental Services, USA and Sravathi AI Technology, India and Bhat Bio -Tech India.

All these projects brought new areas of research like Electrocatalysis, Gas adsorption and Computational studies. The projects helped to establish required research facilities and expertise in these new areas. Other industry sponsored projects by HPCL and DNTL were continued for the second year. The institute survived the scare of COVID-19 outbreak and the lockdown in the middle of the year by following all the precautions and continued to work with passion and dedication.

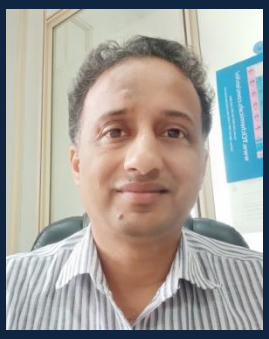
The Institute has published 33 research papers and 2 Book chapters in highly reputed International journals in this year. 8 Research Scholars received best presentation awards in conferences. Shrilakshmi received prestigious CSIR-SRF award in the area of Biological Sciences. Ms. Marilyn DMello, PhD student, received Young Scientist award in Chemistry from International Academy of Physical Sciences. Four students, Dr. Sathyapal R. C., Dr. Kempanna S. K, Dr. Nagendra Kulal from Materials Science and Catalysis and Dr. Shrikant Utagi from Theoretical Sciences were awarded PhD degree by MAHE, Manipal.

Among the important events, 48KW solar power plant at Bidalur campus was inaugurated by MD, Karnataka Bank who provided financial support for this facility. A clean room was built for the establishment of cell culture facility and inaugurated this year. There were MOUs signed with 4 prestigious organizations; Christ University, St Aloysius College, PES Institute of Technology & Management and Intellocopia IP Services to facilitate the collaborative research, organizing conferences and patent filing etc.

On the whole, the year of 2021 was highly productive and successful. All these achievements were possible due to the excellent support and guidance received from H. H. Sri Vishwapriya Theertha Swamiji, H. H. Sri Eeshapriya Theertha Swamiji, AMEF Management and the cooperation from the faculty members, students, and staff of PPISR.

Dr. A. B. Halgeri

Editorial



Every newsletter gives us a glimpse of research progress and scientific achievements made during each passing year. Even though Covid-19 pandemic affected the research progress across the world, students and scientists of PPISR have done extremely well in their areas of research. Overall, 11 sponsored projects have been executed with the addition of 4 new industry projects this year. The academic performance was excellent with 33 publications in high impact journals with average impact factor of 4.4 and 2 book chapters. There were 8 best presentation awards in national and international conferences and a young scientist award to the research scholars which shows the quality of research of our students. The issue covers the research highlights of each group working in different areas of research, publications, research activities and important events and milestones at PPISR.

I am happy to be the Editor of this issue of newsletter to convey to the reader about overall research activities and related events at PPISR in 2021.

Dr. Ganapati V. Shanbhag

Dr. Ganapati Shanbhag and his group work on frontier areas of research in catalysis for the design of novel catalysts for green chemical processes such as valorization of CO_2 to make commercially impotant chemicals such as methanol, carbonates, carbamates and substituted urea, conversion of biomass by-products like glycerol and furfural to value-added chemicals, pore engineering of microporous materials for shape selective catalysis and gas adsorption. The group also works on novel materials design for gas sensors.

Till 2021, the group has published 35 research articles in internationally reputed journals, three book chapters and co-inventors in 4 patents. PhD student, Ms. Marilyn DMello received Young Scientist Award from IAPS. The students received overall 5 best presentation awards at national & international conferences this year. Nagendra Kulal received PhD degree from MAHE Manipal in December 2021 on the PhD topic related to CO_2 valorization reactions. Among them, two works were published in Chemical Engineering Journal (IF: 13.2) and ACS Applied Nanomaterials (IF 5.1) on CO_2 carbonylation reactions to synthesize glycerol carbonate and substituted urea as a part of the CESEM grant sponsored by VGST, Govt. of Karnataka. Two articles on the synthesis of alkyl levulinates from biomass derivative furfuryl alcohol were published in reputed journals. A book chapter on *Chemical Fixation of CO_2* was published by Springer, Singapore. Overall, 11 publications and 2 book chapters have come out of this group in international journals this year and 5 sponsored projects have been executed. Dr. R. Vetrivel, Hon. Professor and an expert in Computational Catalysis initiated the DFT studies at PPISR.

During 2021, 5 sponsored projects were executed by Dr. Shanbhag's Group. The project sponsored by Hindustan Petroleum Corporation Ltd. (HPCL) on "Catalyst and process development for CO_2 hydrogenation to produce methanol" was successfully completed in December 2021. Two new industry projects sponsored by Sulzer-GTC Technology Inc, USA and GTC Vorro Environmental Services, USA were initiated by Dr. Shanbhag. Fourth industry project sponsored by DNTL, Pune on aromatics alkylation is underway. A Govt. project sponsored by VGST under CESEM grant on "Chemical fixation of CO_2 by converting into value-added chemicals" is also under progress. In the midst of COVID-19 pandemic setbacks and hurdles, overall, the group could achieve significantly in sponsored and academic research programmes due to the hard work of all the researchers involved.

Dr. Sanjeev Maradur's group is working on mesoporous materials and metal organic framework (MOF) for catalytic applications. Mr. Sathyapal Churipard R, SRF, the first student from the group, has been awarded PhD on the title "Synthesis and Characterization of Mesoporous Polymers and their Application in Adsorption and Catalysis" by MAHE, Manipal on February 16, 2021. Mr. Kempanna SK, research scholar also received PhD degree on the thesis entitled "Designing Functionalized Mesoporous Materials for Catalytic Conversion of Biomass Platform Chemicals to Value Added Products" by MAHE on 16th November 2021.

The group published a work on Upgrading of lignocellulosic biomass-derived furfural: an efficient approach for the synthesis of bio-fuel intermediates over γ-alumina supported sodium aluminate catalyst. The major findings was published in Molecular Catalysis Journal. Also, the group is working on metal organic frameworks (MOF) catalysis. The MIL-101(Cr) MOF was successfully utilized for olefin-aldehyde condensation for the sustainable synthesis of nopol. Nopol finds various applications in fragrances, in agrochemicals as a pesticide and as an aroma in soaps, detergents and polishes. A manuscript has been communicated to an international journal of high repute. In another work, the Pd/UiO-66 MOF catalyst has been successfully utilized for the selective hydrogenation of phenylacetylene (PA) to styrene (ST) is a pivotal step to eliminate the alkyne impurities and to increase the purity of the monomers in polymer industries. The project is ongoing and soon the results will be communicated for publication. The scope of the Pd/UiO-66 MOF is successfully extended for the One-pot hydrogenation-esterification (OHE) of furfural to furfuryl acetate is a model reaction for upgrading of bio-oil.

Industry sponsored project from Sravathi Advanced Process Technologies, Bengaluru on selective hydrogenation of aromatics with Dr. Maradur as PI and Dr. Shanbhag as Co-PI was successfully completed on Jan 2021. A new research proposal has been submitted to Hindustan Petroleum Green R&D Center for possible funding to work on mesoporous alumina and it is under consideration. One Student from St Aloysius College (Autonomous) Mangaluru worked as summer intern for a period of two months from August to October 2021.

Research Highlights – Materials Science & Catalysis Division

Dr. D. H. K. Murthy's research group has started their research journey at PPISR. Future economy & sustainable energy solutions towards a carbon-neutral society critically depend on the green H_2 production. H_2 is a primary feedstock to industries (petroleum/ammonia/glass/steel) that are key to agriculture, manufacturing & chemical production. In addition, the heat/electrical energy produced by passing H_2 to a fuel cell can be efficiently used to run green vehicles towards a greener planet. However, >90% of the H_2 available today is made from fossil fuels via the expensive steam reforming process that requires stringent reaction conditions. This approach adds to the production cost and releases harmful carbon-based byproducts to the environment. Electrolyzers are promising to produce green H_2. However, they need a significant investment in materials/infrastructure to produce green electricity (which is >75% cost of the green H_2) stored and subsequently passed to an electrolyzer. Hence, to accelerate the implementation of a sustainable hydrogen-based economy, both industries & government are working towards cost-effective green hydrogen production. This research group aims to advance the efficiency & stability of H_2 generation from abundantly available sunlight and water using a photocatalyst. Furthermore, the group innovates novel energy materials using rational insights from computational and spectroscopy tools. In this process, the power of data on energy materials to make a rational choice of photocatalysts through AI/ML approaches is also being conducted. This group closely works with several national and international institutes of high repute in this direction.

Poornaprajna Analytical Center

Instruments available for external users for sample analysis

Chemisorption instrument [TPD (NH_3/CO_2), H_2-TPR, N_2O-Chemisorption, BEL]; Physisorption instrument (BET Surface area, porosity, BEL); X-Ray Diffractometer (Bruker); FTIR Spectrophotometer (Bruker); Atomic Absorption Spectrophotometer (Perkin Elmer); UV-Vis Spectrophotometer (Perkin Elmer); Fluorescence Spectrophotometer (Agilent); Simultaneous Thermal Analyzer (TGA-DTA, DSC Perkin Elmer); Mechanical property testing (Grain crush strength; Attrition resistance).

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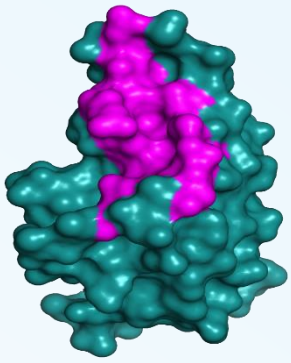
latha@poornaprajna.org, (080) 23611836). For more information visit our website
https://ppisr.res.in/content/poornaprajna-analytical-center

Research Highlights – Theoretical Sciences Division

Dr. R Srikanth's group has explored aspects of non-Markovianity, singularities and semi-Markovianity of open system effects, counterfactuality and indistinguishability in quantum cryptography. Additionally, the possibility is being explored of relativistic effects in quantum information processing, or conversely, quantum information in cosmological situations, where general relativity effects are at the forefront. Other new avenues of research include the potential for noisy intermediate-scale quantum (NISQ) devices used for variational quantum eigensolvers applied to determining the ground state of molecules or the relevant Green's function, as well as for quantum machine learning that could be applied to time series analysis in diverse situations. One of our students, Dr Shrikant Utagi, successfully defended his PhD thesis on Oct 11, with Prof. C. M. Chandrashekhar of IMSc/IISc as the examiner, and was awarded a doctorate subsequently by MAHE. A new student, Ms Charu Gupta, joined the group on Aug 21, 2021 . A series of weekly seminars was organized under the auspices of the Center for Foundational Study (CFS), where external scholar Mr Venkata Rayudu Posina spoke about conceptual mathematics and category theory. There were 5 publications from the group, including work with our PhD students as well as national and international collaborators.

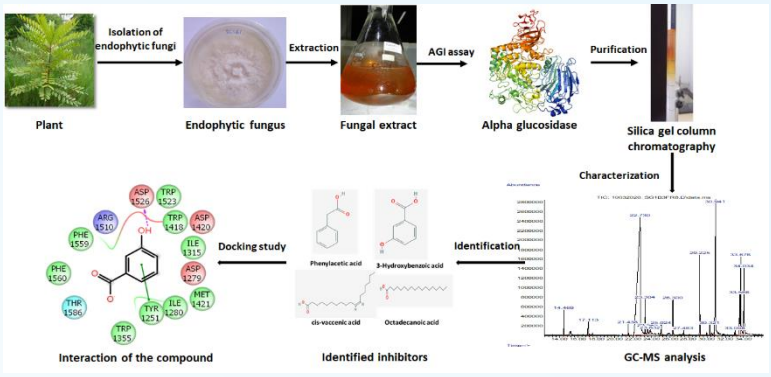
Dr. Sujit Sarkar's group works on topological state of matter, quantum field theoretical method to quantum many-body systems and quantum field theoretical aspect of interacting disorder systems. His group has three PhD students Rahul S., Ranjith Kumar R and Y. R. Kartik, who work on different aspects of the quantum matter problems. The current research interest of his group is to find the relations of bulk-boundary correspondence for Hermitian as well as non-Hermitian systems and also the method of curvature renormalization group for multicritical points. His group has also solved the problem of non-Hermitian quantum field theory. The research publications of his group have appeared in the journal like Phys. Rev. B and Nature Publication Group. His group is involved in active collaborations with other leading groups of India as well as abroad.

Research Highlights – Biological Sciences Division



The work at Dr. Ramagopal's lab is mainly aimed at the understanding structure-function relationship of biologically important proteins. We use X-ray diffraction as the main technique to determine the structure of proteins, protein-ligand and, protein-protein complexes. The insights gained from the structural studies will be assessed using other biochemical, bioinformatics biophysical techniques. For example, we pursue research in the structural biology of immune receptors, generate structure-based mutants and measure the affinity of such mutants with their cognate receptors using biophysical techniques. Towards this goal, we have generated several mutants of PD-1 (programmed death-1) and TIGIT (T cell immunoglobulin and ITIM domain) with an aim to create potential lead molecules for T-cell checkpoint blockade immunotherapy. The group also works on enzyme-ligand/substrate complexes, the preferential association of cell surface receptors to understand the signalling mechanism. For example, the structure of LPQH, an immunomodulatory surface lipoprotein of *Mycobacterium tuberculosis,* reveals a distinct fold and provides insights into the evolutionarily conserved patch on its surface, hinting at its important role in the myriad functional role of this protein (see the figure).

Dr. Ananda K. and his research group in the year 2021 mainly focused on natural inhibitors from medicinal plants and their endophytic fungi for glucosidase enzyme inhibition, as one of the major areas and another area of research, was on modifying the insulin and their bio-conjugation to develop an advanced insulin analog for the applications in controlling diabetes. Some of these findings are showing novelty and planning for patents and the remaining are under commu-



-nication for publications in different peer-reviewed journals. There are few small molecules identified as inhibitors of glucosidase enzyme are known for their antidiabetic properties and antioxidant properties which need better authentication before taking them to clinical studies. Another protein known for its use in controlling diabetes is carefully modified using the genetic mutation and achieved a new type of mutant gene, which has a unique sequence and is expected to behave great as an analog. There are two students working for their PhD in this group and one of them presented his colloquium in 2021.

New Industry Sponsored Projects

Amid the crisis in India due to COVID-19 pandemic, PPISR is fortunate to receive a few new industry grants in 2021. A one-year project sponsored by Sulzer-GTC Technology Inc, USA titled "Catalyst & process development for hydrocarbon synthesis via halogen mediation" was initiated by Dr. Ganapati Shanbhag as PI and Dr. D. H. K. Murthy as Co-PI in February 2021. The Sulzer-GTC has sponsored this project after the successful completion of the their previous 8 sponsored projects from GTC during 2010-2019 by Dr. Shanbhag's group. This project also helped in entering a new area of research in electrocatalysis.

A new agreement was signed with GTC Vorro Environmental Services LLC, USA company on "Development and testing of adsorbent materials for sulfide compounds removal" for one year project and was initiated on July 1, 2021 by Dr. Ganapati Shanbhag's group. The adsorbent materials and gas adsorption is a new area of research in PPISR which helped to create facilities and expertise required to execute this project. Weekly review meetings were conducted for these sponsored projects by Sulzer GTC and GTC Vorro online and attended by their respective teams.

Another project sponsored by Sravathi AI Technology, Bengaluru on "Computational discovery of materials and active ingredients through machine learning" was initiated Dr. D. H. K. Murthy in January 2021.

Dr. Ramagopal's group in Biological Sciences obtained a new collaborative programme with Bhat Bio-Tech India on an exploratory project on the identification of natural inhibitors of two SARS-COV-2 proteins.

Publications (2021)

1. N. Kulal, R. Vetrivel, C. S. Gopinath, R. K. Ravindran, V. N. Rao, M. Shetty, R. Shrikanth, D. Rangappa, G. V. Shanbhag, Green route for carbonylation of amines by CO_2 using Sn-Ni-O bifunctional catalyst & theoretical study for finding best suited active sites (2021) *Chemical Engineering Journal*, 129439. (IF: 13.27).

2. K. Jayaramulu, M. E. DMello, K. Kesavan, A. Schneemann, M. Otyepka, S. Kment, C. Narayana, S. B. Kalidindi, R. S. Varma, R. Zboril, R. A. Fischer, A multifunctional covalently linked graphene-MOF hybrid as an effective chemiresistive gas sensor (2021) *Journal of Materials Chemistry A.*, 9, 17434 (IF:12.7).

3. S. Lankipalli, U. A. Ramagopal, Structural perspective on design of decoy immune modulators (2021) *Pharmacological Research*, 170, 105735. (IF: 7.65).

4. C. Aranthady, T. Jangid, K. Gupta, A. K. Mishra, S. D. Kaushik, V. Siruguri, N. G. Sundaram, Selective SO_2 detection at low concentration by Ca substituted $LaFeO_3$ chemiresistive gas sensor: A comparative study of $LaFeO_3$ pellet vs thin film (2021) *Sensors & Actuators B: Chemical*, 329, 129211 (IF: 7.46).

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9. N. A. Koshi, D. H. K. Murthy, S. Chakraborty, S. C. Lee, S. Bhattacharjee, Probing Photoexcited Charge Carrier Trapping & Defect Formation in Synergistic Doping of $SrTiO_3$ (2021), *ACS Applied Energy Materials* (In press) (IF: 6.02).

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11. P. Manjunathan, V. Prasanna, G. V. Shanbhag, Exploring tailor-made Brönsted acid sites in mesopores of tin oxide catalyst for β-alkoxy alcohol and amino alcohol syntheses (2021) *Scientific Reports*, 11, 15718 (IF: 5.13).

12. R. R. Kumar, Y. R. Kartik, S. Rahul, S. Sarkar, Multi-critical topological transition at quantum criticality, (2021), *Scientific Reports*, 11**,** 1004 . (IF: 5.13).

13. N. Kulal, R. Vetrivel, N. S. G. Krishna, G. V. Shanbhag, Zn-Doped CeO_2 Nanorods for Glycerol Carbonylation with CO_2 (2021) *ACS Applied Nano Materials* 4, 5, 4388–4397 (IF: 5.09).

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26. Y. R. Kartik, Rahul S, Ranjith Kumar R and Sujit Sarkar, Study of curvature and torsion for dierent symmetry classes (2021) *Pramana - Journal of Physics*, 102: 49. (IF: 2.21).

27. S. Rahul, R. R. Kumar, S. Sarkar, Emergence of quantum phases for the interacting helical liquid of topological quantum matter (2021) *Pramana - Journal of Physics* 95: 94 (IF: 2.21).

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33. M. E. Dmello, S. B. Kalidindi, Cerium based UiO-66 Chemiresistor for the detection of Carbon dioxide (2021) *Journal of International Academy of Physical Sciences*, 25 (4) 567-577.

Book Chapters

1. G. V. Shanbhag, N. Kulal, B. J. Vaishnavi, Heterogeneous catalysis for chemical fixation of CO_2 via carbonylation reactions, In: Goel M., Satyanarayana T., Sudhakar M., Agrawal D.P. (eds) Climate Change and Green Chemistry of CO_2 Sequestration. *Green Energy and Technology*. Springer Nature (2021).

2. S. B. Kalidindi, M. E. DMello, V. R. Bakuru. "Metal–Organic Frameworks & Their Host–Guest Chemistry." In *Supramolecular Chemistry in Corrosion and Biofouling Protection*, CRC Press, (2021).

Highlights of Research Activities

Best presentation awards

1. Mr. Shankar Kundapura received *Award for Science Story Communication* organized by DST AWSAR for the story titled "Reprogramming the Immune System to Fight Cancer" in February 2021.

2. Ms. Chethana A. won the *Best ORAL Presentation Award* for the paper titled "Selective SO_2 detection at low concentration by Ca substituted $LaFeO_3$ thin film sensor" in the 5th International Conference on Recent Advances in Material Chemistry organized by SRM University, Tamil Nadu, India during February 18- 20, 2021.

3. Ms. Chethana A. received *Best ORAL presentation award* for her paper titled "Efficient Chemiresistive CO Sensor Based on Nano Structured Ta_2O_5-SnO_2 Composite" in the National webinar on "Recent Advances in Solid State Chemistry and Allied Sciences" organized by the Department of Chemistry, Central University of Kerala, in association with ACT & ISCAS during 16 – 17, August 2021.

4. Ms. Vaishnavi B. J. secured the *Best ORAL presentation award* in the "National Webinar on Recent Advances in Solid State Chemistry and Allied Sciences" organized by Central University of Kerala in association with ACT and ISCAS on 16 – 17, August 2021 for the presentation titled "Biomass derivative furfuryl alcohol conversion to furfuryl acetate over solid acid catalysts: Adsorption studies using DFT".

5. Mr. Nagendra Kulal received *Best ORAL presentation award* at 1st online international conference ETCSCP- 2021 on the research paper titled "Green route for carbonylation of amines by CO_2 with Sn-Ni bifunctional catalyst: How to predict the best active sites?" organized by Indian Institute of Chemical Engineers (IIChE) and Catalysis Society of India (CSI) Bengaluru Chapter during 26 – 28, August, 2021.

6. Mr. Shankar Kundapura won *LIGHTNING TALK award* at the meeting "OMICS-in Redefining Modern Biology" which is a 13th Annual Meeting of Proteomics Society during October 21-23, 2021.

7. Ms. Marilyn DMello won *BEST ORAL presentation award* at Virtual International Conference on, "Molecules to Materials" (MTM - 2021), organized by SVNIT, Surat on 17th & 18th December 2021. Ms. Marilyn gave an oral presentation on the topic- Design and Development of Metal-Organic Framework based Materials for Gas sensing applications.

8. Mr. Ranjith Kumar won *Best POSTER presentation award* at the 65th DAE Solid State Physics Symposium (DAE-SSPS 2021) organized by Department of Atomic Energy during December 15-19, 2021.

Senior Research Fellowship award

Mrs. Shrilakshmi S., Biological Sciences Division was awarded the prestigious Senior Research Fellowship from CSIR, Govt. of India in February 2021. She is working on "Rational modification of insulin for therapeutic applications" under the guidance of Dr. Ananda K.

Young Scientist award

Ms. Marilyn Dmello won prestigious Young Scientist award in Chemistry from International Academy of Physical Sciences based on oral presentation and research contribution write up presented during 27th International Conference of International Academy of Physical Sciences organized by ICT, Mumbai in association with International Academy of Physical Sciences (Prayagraj, India) during October 26-28, 2021.

Ph.D. Thesis Submission

Mrs. Swetha Lankipalli submitted her thesis titled "*Structure guided modification of B7-1 and B7-2 for potential use in immunotherapy and novel insights on B7-2 oligomerization*" to MAHE, Manipal on September 1, 2021. She is the student of Dr. Udupi Ramagopal from Biological Sciences Division.

Highlights of Research Activities

❖ Overall, 11 sponsored projects from industry and Govt. agencies were executed at PPISR in the year 2021.

❖A two-year collaborative project sponsored by Hindustan Petroleum Corporation Ltd. (HPCL), Govt. of India on "*Catalyst and process development for CO_2 hydrogenation to produce methanol*" was successfully completed in December 2021. Dr. Ganapati Shanbhag was PI and Dr. R. Vetrivel was Co-PI for this project.

❖ An industry project sponsored by Sravathi Advanced Process Technologies, Bengaluru on *"Selective ring hydrogenation of aromatics"* was successfully executed by Dr. Sanjeev Maradur in 2020-2021.

❖ Mr. Kirana M. P. presented his PhD thesis colloquium titled "*Studies on alpha-glucosidase inhibitors isolated from medicinal plants and their endophytic fungi*" on August 25, 2021. He is the student of Dr. Ananda K.

❖ PhD thesis colloquium of Mr. Rahul S., student of Dr. Sujit Sarkar, Theoretical Sciences Division on "Studies on edge states for Hermitian and non-Hermitian topological systems" was held on September 29, 2021.

❖Dr. A. B. Halgeri was the Chief Guest and also delivered a key note lecture at the National Workshop on *Advanced Research in Nanomaterials & Nanocomposite* at PES Institute, Shivamogga on 30th September 2021.

❖ Dr. Sanjeev Maradur delivered an invited talk in Online Symposium on *"Multifacets of Chemistry Research-2"* organized by Amrita Vishwa Vidyapeetham, Kollam, Kerala on 18th September 2021.

❖Dr. Srikanth was an invited speaker at the IISER, Kolkata meeting QIQT 2021 (14 June to 18 July, 2021), where he spoke on the topic "Operational reality of quantum nonlocality"

❖Dr. Ananda K. delivered a lecture on "Analysis of bioactive compounds by High Performance Liquid Chromatography" in the virtual National workshop on chromatography and spectroscopy, which was held at Devchand College, Kolhapur, Maharashtra.

❖Dr. D. H. K. Murthy delivered an invited talk on "*Let's go green: Hydrogen production and application to industries & energy sectors*" conducted by Sai Vidya Institute of Technology, Bengaluru on 23rd July 2021.

❖Dr. D. H. K. Murthy was a resource person during the Half Yearly Research Review Meeting (RRM) at Department of Chemistry, M.S. Ramaiah Institute of Technology (MSRIT) Bengaluru and also gave invited talk on "The status and prospects of green hydrogen to the energy sector" on 10th July 2021.

❖Dr. D. H. K. Murthy delivered a tutorial lecture to undergraduate students of National College, Bengaluru on the topic of *Renewable Energy* on 1st September 2021.

❖Mr. Nagendra Kulal, Mr. Kempanna S. K., Ms. Vaishnavi B. J. and Mr. Sujith S. gave ORAL presentations on their respective research in the area of Heterogeneous catalysis in virtual *UK Catalysis Conference 2021* during 6 – 8th January 2021organized by Queen's University Belfast, United Kindom.

❖Ms. Vaishnavi B. J., Ms. Bhavana B. K, Mr. Nagendra K. and Mr. Sujith S. presented their research findings by ORAL presentations at ETCSCP-2021, an international conference organized jointly by Indian Institute of Chemical Engineers (IIChE) and Catalysis Society of India, Bengaluru Chapter during 26 – 28, August, 2021.

❖Mr. Sujith, Ms. Vaishnavi, Ms. Chethana gave Oral presentations at National Webinar on *Solid State Chemistry & Allied Sciences* organized by Central University of Kerala and ISCAS during 16 – 17 August 2021.

❖Ms. Chethana A. presented a paper entitled "*Highly efficient chemiresistive CO sensor based on nano structured Ta_2O_5-SnO_2 composite material*" in the International Conference on Nanoscience and Nanotechnology (ICONN-2021) organized by SRM Institute of Science & Technology during February 1 – 3, 2021.

❖ Seven new PhD students from Materials Science & Catalysis Division participated in six-month *Orientation Programme in Catalysis* organized by NCCR, IIT-Madras, Chennai January-June, 2021.

❖ Four MSc students and one faculty from St. Aloysius College, Mangaluru completed their 2-month MSc project/ faculty internship programme at PPISR during August-October, 2021.

❖ Dr. Ganapati Shanbhag was invited by MVJ College of Engineering, Bengaluru to become a member of the Advisory Board & Member of the Research council of Department of Chemistry in March 2021.

New positions for Ph.D. alumni of PPISR

This year, a few of the Ph.D. alumni of PPISR got prestigious positions in Government and private organizations. Dr. Aravinda S. (Ph.D. in 2017) joined as *Asst. Professor* at Dept. of Physics, Indian Institute of Technology (IIT)-Tirupati. Dr. Manjunathan P. (Ph.D. in 2018) joined as *Research Officer* at Indian Oil Corporation, Govt. of India, Faridabad. Dr. Omkar S. (Ph.D. in 2015) was recruited as *Quantum Architecture Developer* at ORCA Computing, Toronto, Canada. A few other alumni joined as post doctoral fellows in prestigious universities in India and abroad.

Activities In The Institute

Ph.D. Degree Awards

Dr. Sathyapal R. Churipad: Dr. Sathyapal was awarded PhD on "*Synthesis and characterization of mesoporous polymers and their application in adsorption and catalysis*" by Manipal Academy of Higher Education (MAHE), Manipal on February 16, 2021 under the guidance of Dr. Sanjeev P. Maradur.

Dr. Shrikant Utagi: The open defense of the Ph.D. thesis by Shrikant titled *"Aspects of quantum non-Markovianity in quantum information processing"* was held on October 11, 2021 and the PhD degree was awarded by MAHE, Manipal. His PhD thesis was supervised by Dr. Srikanth R., Theoretical Sciences Division.

Dr. Kempanna S. Kanakikodi: Ph.D. open defense viva of Kempanna was held on November 16, 2021 and was awarded the degree by MAHE subsequently. He conducted his PhD work on *"Designing functionalized mesoporous materials for catalytic conversion of biomass platform chemicals to value added products"* under the guidance of Dr. Sanjeev Maradur.

Dr. Nagendra Kulal: Nagendra was awarded Ph.D. degree by MAHE, Manipal after successfully defending his thesis during Ph.D. Viva on December 22, 2021. He completed his PhD work on "*Metal oxide based acid-base bifunctional catalysts for chemical fixation of CO_2 via carbonylation reactions*" under the guidance of Dr. Ganapati V. Shanbhag.

MOU signed with reputed organizations

1) Christ University, Bengaluru: Dr. Fr. Abraham V. M., Vice chancellor of Christ University along with Dr. Anil Joseph Pinto, Registrar and Dr. Gurumurthy Hegde, Director, CARD, CU along with senior officials visited PPISR on 6th December, 2021 for signing an MOU with PPISR.

2) St. Aloysius College, Mangaluru: Rev. Fr. Dr. Praveen Martis, Principal and Dr. Ronald Nazareth, HOD, Postgraduate Studies & Research in Chemistry signed MOU with PPISR on 23rd September 2021.

3) PES Institute of Technology and Management, Shivamogga signed MOU with PPISR in October 2021.

4) Intellocopia IP Services, Bengaluru: Mr. Narendra Bhatta, Founder, Intellocopia and Dr. A. B. Halgeri, Director, PPISR signed an MOU and NDA in the interest of respective organizations.

Virtual International Conference

PPISR under the leadership of Dr. A. B. Halgeri organized 1st Online International Conference on "Emerging Trends in Catalysis for Sustainable Chemical Processes along with MSRIT and Dayananda Sagar College of Engineering, under the aegis of IIChE, BRC and Catalysis Society of India BC from 26th to 28th August 2021 on a virtual platform. There were 8 plenary lectures from eminent scientists from academia and industry from India and abroad. Several oral and poster presentations from research scholars was also organized. Dr. Ganapati Shanbhag worked as Organizing Secretary for this conference.

Research Orientation Workshop

Poornaprajna Institute of Scientific Research and Poornaprajna College and Post Graduate Centre, Udupi organized a 3-Days Workshop on Orientation: Research & Development from 30-12-2020 to 01-01-2021 under Science Association and Internal Quality Assurance Cell on a virtual platform. The programme was inaugurated with the blessings of HH Sri Vishwapriya Theertha Swamiji, Chairman AMEF. The faculty and senior research scholars of PPISR gave lectures to the undergraduate science students to introduce some of the frontier research topics and create interest in young minds about research.

State Level Workshop

PPISR and Poornaprajna College (PPC) and Post graduate centre Udupi jointly organized a state level workshop on "*Scope of Research in Basic Science- Apprentice with Scientists*" for three days during December 27-29, 2021 at Poornaprajna College Udupi for undergraduate students. There were 11 lectures by faculty and research scholars of PPISR on various research topics in the area of materials science, catalysis, biological sciences and quantum physics. The programme was inaugurated by Prof. B. S. Sherigara, former V.C., Kuvempu University and the valedictory programme was graced by H. H. Sri Vishwapriya Theertha Swamiji.

Outstanding contribution awards by AMEF

Admar Mutt Education Foundation inducted two awards from 2021 to recognize outstanding contribution from the faculty and students of PPISR. In this year, Dr. Ganapati V. Shanbhag, received *Outstanding Scientist Award* for his achievements in the field of Research during *the last decade* and was honored by the Chairman of PPISR H. H. Sri Vishwapriya Theertha Swamiji during Annual General Body Meeting of AMEF & AMEC on November 28, 2021. Ms. Marilyn DMello, was honored with *Best Research Scholar* award for the outstanding performance during her 4 years research at PPISR.

Inauguration of Cell Culture Room

A clean room built for establishment of human cell culture facility was inaugurated by H H Vishwapriya Theertha Swamiji on Aug 01, 2021. A. B. Halgeri, Prof K Srihari and Sri Sreenivasa Rao were present on this occasion. These studies need a cell culture facility to evaluate the bio efficacy of therapeutic molecules. The cell culture room materials were donated by, Mr. Madhusudhan from Nano Clean Control Solutions. The culture room is less than 10000 particle clean room and going to be a future cell culture facility.

Inauguration of Solar Power Plant

Karnataka Bank Limited, under the CSR green initiative scheme, provided a financial support of Rs 25 lakhs for the installation of 48 KW Solar Power Plant at PPISR Bidalur campus. After the successful installation and commissioning, Shri Mabahaleshwara M. S., MD and CEO inaugurated the Solar power plant in the august presence of H. H. Sri Vishwapriya Theertha Swamiji on February 20, 2021

Founder's Day conference

Founder's Day was celebrated at PPISR in fond remembrance of Founder late H. H. Sri Vibudhesha Theertha Swamiji on July 1, 2021 at Bidalur campus. Director Dr. A. B. Halgeri delivered an overview and inaugural speech. Dr. D. H. K. Murthy gave a preamble on PPISR Founder. This was then followed by scientific presentations by doctoral students of PPISR on various topics covering historical background and current research in specific areas.

Safety Lecture and training

A lecture by Sri M. Chandrashekhar, Consultant JNCASR and former Security Officer at IISc was organised on September 16, 2021 on the safety in labs. He suggested many reasons for the safety issues from fire, explosions and chemical reactions that would appear frequently in the labs. He also provided useful tips on the measures of safety in the campus. A mock drill on the usage of fire extinguishers was also displayed during his visit.

Activities In The Institute

PPISR Activity Forum

Students of PPISR initiated a few extracurricular activities and formed 'PPISR Activity Forum', a platform to nurture and perform the creative skills by the members of PPISR. The forum was inaugurated by Sri H. H. Vishwapriya Theertha Swamiji in February 2021. In two editions of this activity forum many paintings, sketches, write-ups, poems etc by students and faculty were displayed. This forum provides an opportunity to showcase one's hidden talent in different fields.

AMEF Board of Trustees Meeting

Admar Mutt Education Foundation Board of Trustees meeting was held on November 28, 2021. Trustee members discussed on different issues related to the PPISR. Dr. A. B. Halgeri presented the overall highlights of PPISR research activities and all the Trustee members highly appreciated the achievement of PPISR and overall progress of all the research activities. H. H. Sri Vishwapriya Theertha Swamiji, Chairman, AMEF presided over the meeting. The PhD awardees of PPISR during 2021, Dr. Sathyapal, Dr. Kempanna and Dr. Shrikant were honored by Sri Swamiji on this occasion.

Invited talks

There were several invited lectures and webinars by distinguished speakers conducted at PPISR during 2021. Some important lectures are as follows. Dr. Vikas Garg, Prayasta 3D Inventions Pvt Ltd, Pune gave a talk on "*Principles & Applications of 3D printing";* Dr. Makarand Pimplapure from Markspeed Technologies gave a talk on *Introduction to process intensification;* Dr, Swathi Kadaba, Scientist, Saint-Gobain India gave a lecture on "*Flexible Electronics";* There was a lecture on "*How to turn an idea into patent" by* Dr. K. T. Varughese, Conclavit, Bengaluru; Dr. Sudarsanam Putla, Scientist from CSIR-NCL gave a webinar on "*Role of catalytic converters and nanosized catalysts for auto-exhaust purification";* Dr. Arun Basrur former Head R&D in Sud Chemie India gave offline lecture on "*Methods of supported metal catalyst preparation".* Dr. Yuvaraj from Sravathi AI Technology *gave a talk on "Transition States & Why to find them?".* In addition to invited talks, there were periodical weekly seminars by faculty and research scholars of PPISR.

Visitor's Views

Dr. Fr. ABRAHAM V. M., Vice Chancellor, Christ University, Bengaluru: Christ University delegation is immensely happy and impressed with the research activities at PPISR. Your dedication and passion for research is praiseworthy. Let it inspire our country to develop a culture of research in our land and solve our problems. Best wishes and congratulation.

REV. Dr. PRAVEEN MARTIS S. J.– Principal, St. Aloysius College, Mangaluru: I am very much impressed by Poornaprajna Institute of Scientific Research. I am also an old student of Poornaprajna College, Udupi, the founder institute of PPISR. I thank Prof. A. B. Halgeri, the Director of PPISR for organizing the collaboration meeting today and I congratulate all the professors for their continued support to our students from St. Aloysius college (Autonomous) Mangaluru.

Dr. ARUN BASRUR, Technical Consultant (Catalysis), Ex-Head-R & D, Sud-Chemie India Pvt. Ltd.: I am impressed to see the facilities at PPISR. The students and Researchers are very enthusiastic. The atmosphere is informal and very conducive for creativity. The institute has demonstrated its capabilities through sponsored projects and scientific collaborations with reputed companies (Industries) and institutions (Scientific Institutions). I wish the Director Dr. Anand B. Halgeri and team at PPISR and look forward to the institutes success and growth to new heights with my very best wishes.

Dr. BASAVARAJAPPA Y. H., Professor & Head, Dept. of Mechanical Engineering, PES Institute of Technology & Management, Shivamogga: It was a golden opportunity for us to interact with all your research scholars and the work done by them is really most interesting and useful to the society. The research facilities available are really excellent and they are most useful to the research scholars of other institutes. I thank Dr. Halgeri Sir and his team for giving an opportunity to share and sign the MOU for collaborative research works.