ASSOCIATION OF CHEMISTRY TEACHERS

NEWS LETTER

ISSUE : 27 SEPTEMBER - DECEMBER 2023

Promoting Excellence in Chemistry Education

Association of Chemistry Teachers
News Letter, September - December 2023

Contents of the News Letter : Issue - 27

From Editorial Desk

Prof. Wasudeo Gurnule
Editor
Kamla Nehru Mahavidyalaya,
Nagpur, Maharashtra.

Wishing you in advance the entire fraternity of ACT, a Merry Christmas,a very happy, healthy and prosperous New Year 2024. The present Editorial Board has put in its bit of efforts, to make the newsletter as attractive and informative as possible. We tried to direct the attention of our readers towards advanced research trends taking place across the globe so as to motivate them to take up initiative in re-orienting themselves towards advanced topics of research and teaching methods. We are bringing the issue of the newsletter with the activities of ACT, articles of current topic, scientific news and reports of international and National activities. We have also included the report of NCCT-2023 held at Science City, Ahmedabad, Gujarat and brief profiles of ACT -2023 award winners. This issue also contains the reports of ACT activities organized by different zones.

I take this opportunity to say many, many thanks to all my Editorial Board Members for their whole hearted co-operation extended to me.

With warm regards to one and all

Members of Editorial Board

Honorary Members of ACT

We have great pleasure in bringing the updated list of honorary members of Association of Chemistry Teachers, who are sources of inspiration, guidance and support in activities of ACT.

The editorial board of ACT News Letter is proud of the academic achievements of these legendary honorary members.

Bharat Ratna Prof. C.N.R. Rao, FRS
National Research Professor : Linus Pauling Research Professor,
Jawaharlal Nehru Centre for Advanced Scientific Research, Jakkur, Bengaluru - 560 064
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Padma Vibhushan Dr. R.A. Mashelkar, FRS
CSIR Bhatnagar Fellow;i Former Director General, CSIR, New Delhi.
President, Global Research Alliance, National Chemical Laboratory, Pune - 411 008.

Dr. Nitya Anand
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Padma Shri Prof. Jai P. Mittal
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Padma Shri Prof. Dr. G. D.Yadav,
National Science Chair, SERB,New Delhi
Emeritus Professor of Eminence, Institute of Technology, Mumbai
Former Vice Chancellor, Institute of Technology, Mumbai
Email : gdyadav@gmail.com

Prof. Dr. A. K. Bakhshi
Chairman, National Resource Centre for Chemistry, MoE, GOI
Chairman, Guru Angad Dev Teaching Learning Centre for e-Learning,
SGTB Khalsa College, University of Delhi, Delhi
Founder Vice Chancellor, PDM University, Bahadurgarh, Haryana
Email : akbakhshi@yahoo.com

Prof Dr John Warner
Father of Green Chemistry and Coauthor of 12 Principles of Green Chemistry with
Prof Paul Anastas President and Chief Technology Office, Warner-Babcock Institute for
Chief Chemistry President, Beyond Benign
Distinguished Professor of Green Chemistry,Monash University,USA
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Report of Activities of ACT

Young scientists of CPS International School, Morena showcases innovation

Recently, CPS International School, Morena organized a Science Exhibition in collaboration with Association of Chemistry Teachers (ACT), TIFR, c/o Homi Bhabha Center for Science Education, Mumbai. The inauguration ceremony was graced by the School Chairman and Chief Guest, Mr. Mahesh Singh Tomar. During the event, School Principal Dr. Umesh Chandra Jain addressed the students, emphasizing that science and technology constitute the backbone of any nation, and societal development is impossible without them.

A total of 250 students from Class 3rd to 10th actively participated in presenting their innovative projects and models. Some of the notable science models exhibited include a Robotic Hydraulic Machine, Lazer Cleaner, Chandrayaan, Times of Angle, Motorboat, Solar System, and Solar Energies.


Dr APJ Abdul Kalam **Albert Einstein** **Nikola Tesla** **Isaac Newton**

The exhibition featured the presence of little pre-primary children who portrayed various renowned scientists


ShowTime:

To foster interest in the field of science, a movie depicting the life of former President of India, Dr. A.P.J Abdul Kalam, was screened for the students. Additionally, an Inter House Digital Science Quiz was organized, with students from class 6 to 8 enthusiastically participating in the competition.

The Science Exhibition served as a platform for students to showcase their creativity and scientific knowledge, fostering a spirit of curiosity and innovation. It not only encouraged active participation but also contributed to the overall development of scientific temperament among the students.

Report on

One Day Seminar on "Energy Resources for Environmental Remediation"

Organised by

Department of Chemistry, School of Sciences
Kalasalingam Academy of Research and Education (KARE)
&
Association of Chemistry Teachers-Mumbai

The one day National Level seminar on **"Energy Resources for Environmental Remediation"** was organized on hybrid mode (both offline and online) by the Department of Chemistry, Kalasalingam Academy of Research and Education on 2nd December, 2023. This seminar was sponsored by Association of Chemistry Teachers (ACT), Mumbai.

Welcome address by Dr. M. Swaminathan

Book releasing by Chancellor, Dr. K. Sridharan

Dr. M. Swaminathan, Convener of the Seminar welcomed the delegates and participants. The seminar was inaugurated by Dr. V. Vasudevan, Registrar, KARE. The chancellor Dr. K. Sridharan gave a presidential address and released the Tamil version of the book on "Hydrogen-An eco-friendly future fuel". Dr. Mannam Krishnamurthy, Chief Educative Dean, Varsity Education (P) Ltd., Hyderabad, addressed the salient features of the book and Dr. E. R. Nagarajan, Convener and HOD of Chemistry proposed vote of Thanks.

Presidential address by Chancellor, Dr. K. Sridharan

Book release and distribution

Receiving book copy by AGM, Sri Chaitanya group of institutions, Madurai

Seminar Delegates

Dr. Mannam Krishnamurthy, Chief Educative Dean, Varsity Education (P) Ltd., Hyderabad, delivered a lecture on "Hydrogen: The Eco-friendly Future Fuel". Dr. M. Matheswaran, Professor, National Institute of Technology, Tiruchirapalli delivered a lecture on "Bio-electrochemical Systems for Environmental and Energy Applications". After the lunch break, Dr. Naresh Kumar Sharma, Associate Professor Department of Biotechnology KARE, spoke on "Biotreatment for Bioenergy". A good interaction was there after the lectures both offline and online.

Around 150 local participants in offline and 60 participants in online mode participated in the seminar. The seminar ends with fullest satisfaction to all those who are involved in this.

We express our sincere thanks to Association of Chemistry Teachers, our University Management and Venus Herboaromatics or the financial support to conduct this National Seminar in a successful way

Dr. M. Swaminathan,
Convener

Shri Vaishnav Vidhyapeeth Vishwavidhyalya
Report of 2nd National Symposium in Chemistry
"ANKURAN-2023"
"Nanotechnology and its Applications"

The second National Symposium in Chemistry "ANKURAN 2023" was conducted by Department of Chemistry, ShriVaishnavVidyapeethVishwavidyalaya, Indore in collaboration with Association of Chemistry Teachers (ACT) on September 22, 2023. The inaugural session was started with the virtual lamp lighting and SaraswatiVandana. Dr. Kavita Sharma, Coordinator, Ankuran 2023 and Professor, Department of Chemistry threw the light on theme of the symposium. The objective of the symposium was to explore and understand new dimensions in chemistry. She shared that everything in our environment is formed of matter, chemistry is significant in our civilization because it affects our basic needs for food, clothing, shelter, health, energy, clean air, water and solid among other things. Modern health case is founded on many life saving breakthroughs the field of chemistry provided. These include developing new pharmaceuticals, diagnostic tools and better diagnostic equipment such as x-ray machines, MRI imaging, cancer tests and pregnancy kits.

Dr. K. N. Guruprasad, Dean, Faculty of Sciences addressed the gathering and emphasized on the new possibilities of research in nanotechnology. Dr. D. V. Prabhu, General Secretory, Association of Chemistry Teachers also addressed the gathering and appreciate the organizers and participants. He provided insights for the Association of Chemistry Teachers. The Chief Guest of the session was Dr. DebdattaRatna, Scientist G, Head Division of Polymers, NMRL, DRDO. He acknowledged the organizers for choosing a highly pertinent topic 'Nanotechnology and its Applications'. He elaborated on the naval applications of nanomaterials during his addressand explained the wide dimensions in chemistry. Words of thanks in inaugural session was given by Dr. SupriyaVyas, Co-coordinator, Ankuran 2023, Assistant Professor, Department of Chemistry.After Inaugration, the technical session was commenced under the chairpersonship of Dr. AshutoshShukla, Coordinator, ShriVaishnav Institute of Forensic Science.The symposium was open for students of undergraduate, postgraduate disciplines of chemistry, physics, and biotechnology, as well as research scholars and faculty members. The first speaker of the technical session was Prof. M. Swaminathan, Professor, Nanomaterials Laboratory, International Research Centre, Kalasalingam University, Krishnankoil. He highlighted the significance of nanomaterials in the context of energy and environmental applications. Prof. Swaminathan explained the vital role of nanomaterials in the field of catalysis and solar photoreactors. He encouraged the research based on nanoscience and paved the way for fabrication of photocatalyst with the aid of nanomaterials.

The second eminent speaker was Dr. Navin Chandra G. Shimpi, Professor, Department of Chemistry, University of Mumbai, Mumbai. He provided the information about various nanofibers as potential electrode materials and explained the future scope of NFs for applications such as drug delivery, tissue engineering, and energy storage devices.He also shared information that polyimide-amide NFs can be prepared for applications in aerospace due to their exceptional mechanical, thermal, and chemical resistant properties. The last speaker of technical session was Dr. Wasudeo B. Gurnule, Professor and Head, Department of Chemistry, Kamla Nehru Mahavidyalaya, Nagpur. The subject he addressed was functional nanomaterials in the service of mankind. He detailed the process of achieving desired properties by transforming materials into the nanoscale.

Dr. UjlaDaswani, Assistant Professor, Department of Chemistry, took on the role of moderating the inaugural and technical sessions.

Report on

Two Days Training Programme of Science Teachers

by

Royal Society of Chemistry (RSC), UK, through
Dr. Yusuf Hameed Inspirational Science Programme

in collaboration with

Mahatma Gandhi Vidyamandir, Nashik

and

Adivasi Seva Samittee, Nashik

and

Association of Chemistry Teachers (ACT)

The 2 Days Training Programme of Science Teachers by Royal Society of Chemistry (RSC), UK, through Dr. Yusuf Hameed Inspirational Science Programme in collaboration with Mahatma Gandhi Vidyamandir, Nashik and Adivasi Seva Samittee, Nashik and supported by Association of Chemistry Teachers (ACT) was organised at Loknete VyankatraoHiray Arts, Commerce and Science College, Panchavati, Nashik on 3 and 4 October, 2023.

Mrs. Karima Anjum, Teacher Developer, Royal Society of Chemistry, UK of Bangalore was the resource person. The goal of this workshop is to dramatically improve Science teaching by equipping the teachers with the specialist knowledge and skills they need to deliver exciting and engaging Science lessons in the classroom and the ability to pass on this knowledge to their colleagues. The objectives of this project include a) Moving from rote learning to active learning with the help of various active learning strategies b) Design and apply these active learning tools in their regular Science curriculum c) Able to confidently use chemical formulas and write balanced chemical equations with the help of active learning tools d) confidently carry out experiments at micro level with the least resources and minimal risk involved e) Clear common misconceptions, using diagnostic questions, models animated interactive videos f) Develop the evaluation processes and techniques.

This workshop trained the teachers in the use of various activities to support classroom teaching in alignment with NEP 2020 and also guided them in using community resources. Though this workshop was for science teachers, the pedagogical skills have benefited other teachers as well.

Dr. B. S. Jagdale, Principal, Loknete Vyankatrao Hiray Arts, Science and Commerce College, Panchavati, Nashik & Chairman, Board of Studies in Chemistry, SPPU, Pune, presided over the program. In his inaugural speech Dr. B. S. Jagdale expressed his valuable thoughts on need of teaching through demonstration & interactive learning through active participation of the learners. He also gave emphasis on innovative techniques. Mrs. Karima Anjum, Teacher Developer of Royal Society of Chemistry and resource person of workshop from Bengaluru and on behalf of Association of Chemistry Teachers (ACT), Dr. Sudesh Ghoderao, Member of Executive Council were present. Dr. Vishnu Adole, Department of Chemistry and Dr. V. R. Nikam, Dean Science &Technology, Mahatma Gandhi Vidyamandir were also present for the inaugural session.

In the two-day workshop, Mrs. Karima Anjum and Dr Sudesh Ghoderao guided the teachers through various activities based on demonstration in a playful way and healthy atmosphere. Various demonstrations were also shown and all the participants enjoyed the sessions. The three modules covered during workshop are i) Moving towards active learning, ii) Developing active learning techniques and iii) Taking active learning techniques further. A total of 52 science teachers were benefited by this workshop and they were expecting more such workshops in future.

The valedictory session of the workshop was presided over by Prof. Dr. K. H.Kapadnis, Vice Principal of the Loknete Vyankatrao Hiray Arts, Science and Commerce College, Panchavati, Nashik who guided the teachers on this occasion. The LIVE feedback of workshop was given by the participants of the workshop. Mrs. Karima Anjum, Teacher Developer of Royal Society of Chemistry and resource person of workshop from Bengaluru and on behalf of Association of Chemistry Teachers (ACT) Prof. Dr. Sudesh Ghoderao were present. Dr. Deepti Bhutda, CEO, Department of Examination, Mahatma Gandhi Vidyamandir and Mr. Shriram Shirasath, Vice Chairman, Board of Studies, Mahatma Gandhi Vidyamandir registered their special presence. The certificate of participation was distributed at the hands of guests to the teachers participating in the workshop. Dr. Pravin Suryawanshi and Mr. Deepak Hire worked hard to make this program a success. Mrs. Deepti Deore thanked all those who worked hard for the success of the program as well as all those who were present.

Felicitation of Mrs. Karima Anjum, Teacher Developer of Royal Society of Chemistry and resource person of workshop from Bengaluru at the hands of Dr. B. S. Jagdale, Principal, Loknete Vyankatrao Hiray Arts, Science and Commerce College, Panchavati, Nashik & Chairman, Board of Studies in Chemistry, SPPU, Pune

Mrs. Karima Anjum, Teacher Developer of Royal Society of Chemistry and resource person of workshop addressing at the inauguration session

Dr Sudesh Ghoderao, Member, Executive Council of Association of Chemistry Teachers (ACT) distributing the certificate to the participant of workshop

Training session is in progress

Participants at the inauguration session of workshop

Report of NCCT 2023

National Convention of Chemistry Teachers (NCCT 2023) of Association of Chemistry Teachers(India) was held on October 27-29,2023 at Gujarat Science City, Ahmedabad under the Convenorship of Dr. Narottam Sahoo, Advisor and Member-Secretary,Gujarat Council on Science and Technology, GUJCOST, Government of Gujarat, Gandhiinagar. Dr D V Prabhu served as the Co-Convenor.More than 200 teachers and researchers attended the convention.

Dr. Nilesh M. Desai, Director, Space Applications Centre (SAC-ISRO),Ahmedabad was the Chief Guest and delivered the Keynote Address. Padma Shri Prof G. D. Yadav, National Science Chair, SERB, New Delhi, Emeritus Professor of Eminence and Former Vice-Chancellor,Institute of Technology, Mumbai was the Guest of Honour.

Convenor Speech by Dr.N arottam Sahoo

Address by President of ACT Prof. Brijesh Pare

Keynote Address by Dr. Nilesh M. Desai

Address by General Secretary of ACT Prof. D. V. Prabhu

Chief Guest address by PadmaShri Prof. G. D.Yadav

Audience during Inaugural session

The invited lectures delivered were:

1. Green Chemistry-Prof. G. D. Yadav.
2. Chemistry for Sustainable Development-Prof. Dr. J. S. Yadav, Director (Research),IndrashilUniversity,Ahmedabad.
3. Mission Sustainability-Dr C N Pandey, IIT-Gandhinagar, Gandhinagar.
4. Hands on activity- Mr Rajesh Rahangdal and Ms. Manjula Yadav, Nehru Science Centre, Mumbai.
5. Chromatography and Mass Spectrometry : an overview of cutting edge technology towards Green Chemistry- Dr. P. Sivaperumal, Chemical Sciences Division, ICMR-NIOH, Ahmedabad.

6. Role of Science Experimentation in Science Education-Prof Dr P K Joshi, Homi Bhabha Centre for Science Education (TIFR), Mankhurd, Mumbai.
7. Innovative Teaching and Experiments in Chemistry- Dr. Hemant Pande,Formerly Hislop College, Nagpur.
8. India NetZero Target and the role of Chemistry Education -Dr Sukant K Dash,Chemical Sciences, PDEU, Gandhinagar.
9. Once upon a molecule: Teaching Chemistry through narrative-Prof Sriram Kanvah Gundemeda,IIT-Gandhinagar, Gandhinagar.
10. Implications of NEP for Science Education-Principal Dr Ganesh B Pawar, N L Dalmia College of Arts, Commerce and Science, Mira Road, Thane.
11. The Friccohesity Chemistry, a bottom line of molecular economy. Prof Man Singh, Dean, School of Chemical Sciences, Central University of Gujarat, Gandhinagar.
12. Fostering Sustainable Development through Chemistry Education, Research and Outreach programs Dr. Narottam Sahoo.
13. Mind the gap: The opportunities and challenges of Forensic Science for sustainable development Dr. Bhoomika M. Patel, Associate Dean, National Forensic University, Ahmedabad.
14. Our Future Sustainable Development Dr.Umesh Kumar Rustagi,Director,Nehru Science Centre, Mumbai.
15. Visits were arranged to IMAX 3D Theatre, Aquatic and Robotics galleries of Gujrat Science City.

ACT Awards were presented to the distinguished Chemistry teachers of the country including 3 Awards to teachers from Gujarat State.

Group Photo of ACT Award Winners

Papers were presented by some of the participants. Prizes were awarded for the best paper presentations. A commemorative souvenir cum book of abstracts was released to mark the occasion.

The meetings of the Executive Council and General Body of ACT were held on October 27 and 28, 2023 respectively.

ACT is grateful to Dr Narottam Sahoo and Dr Poonam Bhargava Principal Scientific Office, GUJCOST and all their colleagues for their dedicated efforts to make NCCT 2023 a grand success.

Release of Abstract Book

Group Photo of Best Oral and Poster Presenters

Best Oral Presentation Award

ACT AWARDS 2023

1. ACT LIFE TIME ACHIEVEMENT AWARD –2023

Awarded to Padma Shri Prof. G. D. Yadav, National Science Chair, DST, New Delhi and Emeritus Professor of Eminence, Institute of Chemical Technology, Mumbai. Prof. G. D. Yadav is one of the most illustrious chemical technologists of India and has served as the Vice Chancellor of ICT, Mumbai, R. T. Mody Distinguished Professor, Tata Chemicals Darbari Seth Distinguished Professor of Leadership and Innovation and was J. C. Bose National Fellow(DST,GoI).

He has been Conjoint Professor at University of New Castle, Australia, Adjunct Professor at RMIT, Australia and Adjunct Professor at University of Saskatchewan, Canada.He was the Chief Coordinator of Centre for Green Chemistry of University of Mumbai. Prof. Yadav is the President of Indian Chemical Society and Maharashtra Academy of Sciences. He is the Founding Chairman of American Chemical Society India International Chapter.

Padma Shri Prof. G. D. Yadav receiving Act Life Time Achievement Award

The President of India bestowed on Prof. Yadav the prestigious national honour of Padma Shri in 2016.He is the recipient of several National and International honours and is on the editorial board of many prestigious journals.

His research interests are Green Chemistry, Catalysis, Chemical Research Engineering, Nanomaterials and Nano catalysis and Membrane synthesis and applications. He is a much sought after consultant in the chemical industry. His research output is mind boggling:436 peer-reviewed papers with Index 56 and i10Index 243, 309 Conference papers, more than 685 Invited lectures. Ph.D. guided -97.Research projects-70 and Industrial Consultations-70.

Prof. Yadav has always been a pillar of support and help to teachers and students and ACT is proud to present the ACT Life Time Achievement Award 2023 to Prof. G. D.Yadav in recognition of his distinguished contributions to Chemistry Education, Research and Industrial Consultancy.

2. ACT LIFE TIME ACHIEVEMENT AWARD-2023

Awarded to Prof. Dr. Arun P. Joshi, Former Professor and Head, Department of Chemistry, RTM University, Nagpur. He is at present the Secretary of Liberal Education Society, Nagpur.

Prof Joshi received his Ph.D. in Analytical Chemistry from Nagpur University in 1978 and was Alexander von Humbolt Foundation Fellow for Post doctoral research at Gutenberg University, Germany in 1978-80.

He has guided 12 Ph.D. and his research interests are Solvent extraction, Polarography and Stripping voltammetry for trace analysis and Differential polarography of medicinally important compounds

Prof. Dr. Arun P. Joshi receiving ACT Life Time Achievement Award

Prof Joshi has published 70 papers in prestigious journals and has to his credit 6 projects and 7 M Phil projects. He has worked on the National panel of NAAC, Bengaluru and has served as Coordinator of refresher and orientation courses for teachers
Prof Joshi has participated and presented papers in several conferences in Singapore, Poland, Germany and Austria besides India.

ACT is proud to present the ACT Life Time Achievement 2023 to Prof Arun P Joshi

3. ACT SHRI ANUPAM SINHA BEST CHEMISTRY TEACHER AWARD -2023

Awarded to Dr. Lakhya Jyoti Borthakur of Nowgong College (Autonomous), Nagaon, Assam. He has 16 years of teaching experience of undergraduate classes, Prof Borthakur has organized several Chemistry related activities to motivate and inspire students to pursue Chemistry as a career-talks,articles,seminars,conferences and projects.

He has written 18 popular Chemistry articles in Assamese. Though an undergraduate teacher, he is a recognised research guide of Gauhati University and has to his credit 17 research papers,3 research projects,2 textbooks and 2 book chapters. Prof Borthakur has participated in 2 workshops related to the Indian National Chemistry Olympiad.

ACT is proud to present the ACT Shri Anupam Sinha Best Chemistry Teacher Award 2023 to Dr Lakhya Jyoti Borthakur

Dr. Lakhya Jyoti Borthakur, receiving ACT Shri Anupam Sinha Best Chemistry Teacher Award

4. ACT BEST WOMAN CHEMISTRY TEACHER AWARD 2023

Awarded to Prof. Dr. P.Shyamala, Head, Department of Chemistry, Andhra University, Visakhapatnam, AP. She has 17 years of teaching experience. Her research interests are Chemical kinetics, Chemical modelling and Sea water quality monitoring. She has to her credit 92 papers,8 research projects and 2 books. Dr Shyamala is the Chief Editor of Research Journal of Chemistry and Environment. She has participated in 32 conferences and 10 refresher courses ACT is proud to present the ACT Best Woman Chemistry Teacher Award 2023 to Prof. P. Shyamala.

Prof. Dr.P. Shyamala, receiving ACT Best Woman Chemistry Teacher Award

5. ACT PROF. LALLAN SINGH AWARD FOR BEST PG CHEMISTRY TEACHER(STATE UNIVERSITIES)-2023

Awarded to Prof. Dr .Hari Babu Bollikolla, Department of Chemistry,Andhra Kesari University, Ongole, AP. Dr Hari Babu Bollikola has 23 years teaching experience .His research interests are Organic synthesis, Molecular interactions in Ionic liquids,Method development and validation of drugs and Nanomaterials and Nano catalysts and has published 235 papers in reputed journals,4 books and 18 book chapters. He has organized 39 subject related activities including UGC sponsored national seminars and has participated in 136 conferences and seminars.

In recognition of his achievements Dr. Hari Babu Bollikola has been the recipient of 21 awards. ACT is proud to honour Dr Hari Babu Bollikola with the ACT Prof Lallan Singh Best Chemistry Teacher Award (State Universities)-2023.

Prof. Dr. Hari Babu Bollikolla, receiving ACT Prof. Lallan Singh Award for Best PG Chemistry Teacher

6. ACT PROF DR BHUPENDRA SAHAI SAXENA AWARD FOR BEST PG CHEMISTRY TEACHER -2023

Awarded to Prof. Dr. Ravin Manohar Jugade, Department of Chemistry, RTM Nagpur University, Nagpur. Dr Jugade has 23 years of teaching and research experience. He is the Chairman of the Board of Studies in Chemistry, RTM University, Nagpur. He has guided 9 students for Ph.D. and published 74 papers in the areas of Biosorbents, Drug analysis and Wastewater treatment. He has contributed immensely to Chemistry education by way of E courses in Inorganic Chemistry,70 invited lectures and presentations. He has to his credit 7 books, 5 research projects and many popular articles.

ACT is proud to honour Dr. Jugade with the ACT Prof. Dr. Bhupendra Sahai Saxena Award for Best PG Chemistry Teacher-2023.

On behalf of Prof. Dr. Ravin M. Jugade Prof. Aswar, receiving ACT Prof. Dr. Bhupendra Sahai Saxena Award for Best PG Chemistry Teacher

7. ACT PROF. PINKI B PUNJABI AWARD FOR OUTSTANDING CONTRIBUTION TO RESEARCH IN CHEMICAL SCIENCES-2023

Awarded to Prof. Dr. Shouvik Chattopadhyay, Chemistry Department of Chemistry, Jadavpur University, Kolkata. Prof. Chattopadhyay has over 18 years of teaching and research experience. His research interests are Synthesis and characterization of Transition and non-Transition metal complexes of Schiff bases and Supra molecular architecture. He has guided 16 PhDs and has authored 249 papers in prestigious journals like Dalton Transactions and Journal of Molecular Structure.

He is a Fellow of the Royal Society of Chemistry, London, UK and is included in the top 2% scientists as per Stanford University Report 2023. ACT is proud to present the Prof Pinki B. Punjabi Award 2023 for Outstanding Contribution to Research in Chemical Science to Prof. Shouvik Chattopadhyay.

Prof. Dr. Shouvik Chattopadhyay, receiving ACT Prof. Pinki B Punjabi Award for Outstanding Contribution to Research in Chemical Sciences

8. ACT PROF. P. R. SINGH AWARD FOR OUTSTANDING CONTRIBUTION TO CHEMISTRY EDUCATION -2023

Awarded to Prof. Md. Harunar Rashid, Associate Professor, Department of Chemistry, Rajiv Gandhi University, Arunachal Pradesh. Prof. Harunar Rashid has been deeply involved in organizing subject related activities to popularize Chemistry. He has organized the Salter's Chemistry Camp in January 2019 at Rajiv Gandhi University and has been actively involved in syllabus framing. He has published 35 papers and articles and has 8 patents to his credit. ACT has great pleasure in presenting the ACT Prof P R Singh Award for Outstanding Contribution to Chemistry Education 2023 to Prof Md. Harunar Rashid.

Prof. Md. Harunar Rashid, receiving ACT Prof. P. R. Singh Award For Outstanding Contribution To Chemistry Education

Break the Ice:
A fun story and the Science of dry ice

A telewise learning powered by stories event was organized at **Bernards Township Library,** Basking Ritze, NJ, United States**, on 8th November at 18.30 hrs** for primary school children. In person science heroes show was presented and demonstrated by **Mr. Braden Drown,** president, Teleios Technologies LLC, Western Governors University, United States, with several exciting experiments, exploring wondrous effects of frozen carbondioxide.

Dr. Mannam Krishnamurthy, Secretary, ACT South Zone from Varsity Education Mgmt Ltd, Hyderabad, India acted as subject guest and gave an initial brief presentation on the three states of matter and six possible changes in the physical states. The live event covering the concept of sublimation process was attended by about 60 school children and witnessed by another 50 elders. Participants could learn adventure and discover from themselves just how cool science can be. Dr. Mannam and Mr. Braden, at the beginning of the show with simple apparatus and chemicals, in the backdrop.

**Dr. Mannam (from ACT) acted as subject guest for the show,
'Break the Ice: a fun story and the science of dry ice', by Branden Drown, President,
Teleios Tech LLC, at Basking Ridge Township Library, NJ, USA**

Paramagnetic Metal-Organic Framework Composites and Their Applications

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Due to very distinctive characteristics, smart piezoelectric materials are of remarkable attention. Using piezoelectric materials, mechanical energy may be changed into electrical energy and vice versa. In the category of piezoelectric materials, there are mono and polycrystals, composites, and polymers. Due to its biocompatibility and biodegradability, piezoelectric materials have made progress in recent years in the uses of biomedical devices, tissue engineering, actuators, sensors and other medical devices are all being investigated. Piezoelectric sensors and actuators can transform flow rate, pressure, and other variables to produce or consume energy. This chapter explores the use of smart materials in the design of medical equipment and sheds light on the current use of the piezoelectric effect in the medical sector.

Introduction

Due to the features of piezoelectric materials as sensors and actuators as well as their capacity to produce and detect ultrasound, they are used in a wide range of medical applications. In hospitals, a lot of piezoelectric devices are frequently employed for both medical treatment and diagnosis. As piezoelectric materials have high potential. Its intelligence has made it a crucial topic of interest for worldwide researchers and a plethora of fresh, cutting-edge medicinal applications reports on the materials are released frequently. Some of the gadgets are still under research, while others are commercially available.

When subjected to mechanical stress, piezoelectric materials produce an electric current. We are aware that a variety of materials, including bone, proteins, crystals (like quartz), and ceramics (like lead, zirconate, and titanate), exhibit piezoelectric properties. Known as piezoelectric materials, a family of organic and inorganic compounds, predominantly polymers, have the capacity to transform electrical energy into mechanical force and the opposite. In the crystal structures of dielectric materials, piezoelectricity coexists with ions. The polarisation of the materials, which alters linearly with applied force, is what creates the electrical field in the material. The piezoelectric effect in organic materials is primarily caused by the orientation and molecular structure of piezoelectric polymers.

Diverse mammalian tissues, hair, hooves, wool and horns, which are made of -keratin and aligned -helical structures, exhibit piezoelectricity. Many components of the muscles and skeletal tissues are made of collagen. Collagen is distinguished by spiral and helical fibril structures. Every collagen fibril displays a lateral piezoresponse along the fibril axis. As a result, numerous tissues in nature, including bones, ligaments, cartilage, and tendons are piezoelectric. An estimated 20 billion euros are spent annually on piezoelectric medical devices, a substantial portion of which are piezoelectric sensors and actuators. It is feasible to

utilise the mechanical energy to support tiny size devices. Applications for piezoelectric technology, which incorporate biological structure interactions, constitute a ground-breaking rapid development.

Organic materials are the best options for functional materials in medical applications even if they have lower piezoelectricity than inorganic materials. Various technologies, including micro- and nanoscaled medical devices, can use organic smart materials.

Piezoelectricity

A family of materials known as piezoelectric materials undergo an electrical polarisation while under stress; this phenomenon is known as the direct piezoelectric effect. The polarisation direction of ferroelectric materials, a subclass of piezoelectric materials, may be changed by an externally applied electric field. A large electric field must be applied to support the dipoles in a ferroelectric centred piezoelectric compounds in order to trigger this response scaffolds and ferroelectric made biomedical equipment. Therefore, materials are exposed to such poling procedure before application. In order to astound the abundance of arbitrarily orientated domains within the material, that is finished with the aid of exposing the materials to an electric powered subject above the coercive subject (Ec) of the material, usually at accelerated temperatures, to facilitate dipole and domain alignment inside the electric powered subject course, as proven in Figure 1(a). When the fabric has reached room temperature, the poling field is withdrawn, however the electric field is kept in location. This poling method produces net piezoelectric response and bulk polarisation. As a result of the circuit's exchange in polarisation after poling, the utility of pressure causes an triggered price and a brief present day that can float in an external circuit as proven in Figure1.

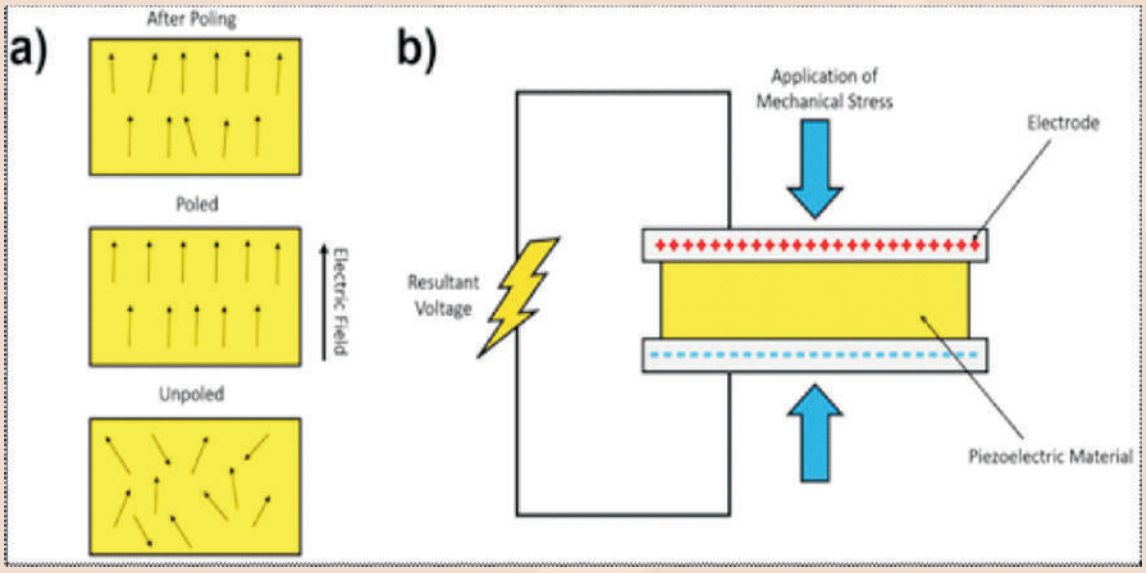

Figure 1 (a) after applying an electric field above its coercive field (Ec), piezoelectric dipoles in a ferroelectric material align, leaving behind a residue polarisation (Pr) (b) Illustration of the direct piezoelectric effect, in which a charge is produced by a mechanical load that is applied. Courtesy

Medical Applications of Piezoelectric Materials

Blood Pressure Monitor

During cardiac surgery, the pressure sensor may be utilized to continually monitor blood pressure in addition to measuring it. Thin films of PVDF or PZT are employed as the piezoelectric material in the sensor. The sensor is positioned both on the wrist or mid-arm to hit upon blood pressure for suitable backing and a strap with Velcro are furnished to safely preserve the sensor across the wrist or the arm. The sensor's electronic components, such as the voltage amplifier Figure 2.

Figure 2 (a) Piezoelectric blood pressure monitor fixed on the wrist. Courtesy: Wade D. Peterson, David A. Skramsted, and Daniel E. Glumac, Reproduced from the website: www.phoenix.tc-ieee.org. (b) Pro-Wave's piezoelectric blood pressure sensor. Courtesy: Pro-Wave Electronic Corp.

Piezoelectric Heartbeat Monitor

The medical industry uses the piezoelectric sound sensor, which is simply a piezoelectric microphone, as a heartbeat monitor. It is possible to use the piezoelectric microphone as a heartbeat monitor. Either an internal or external amplifier may be built into the gadget. A small disc-shaped sensor is firmly fastened to the patient's chest and the output can be seen on CRO or recorded on a strip chart recorder.

Biosensors

Using piezoelectric biosensors, different chemicals, biological, or microbes structures can be found. Piezoelectric biosensors were prepared using constituents with extraordinary acoustic velocities. Examples include an ethionamide sensor that is extremely selective and sensitive and is guided by molecular modelling, acoustic biosensors made of aluminium nitride (AlN) that offer present time reaction and computed data, and an AlN biosensor that is highly sensitive for detecting pesticide residues. Low detection limits, a strong linear response, and exceptional repeatability are all features of piezoceramic sensors. A range of specific biological processes, such as genetic hybridization, may be observed using AlN piezoelectric biosensors, which may provide details on the kinetics of the process. AlN sensors can also be used to monitor protein ligand interfaces or antigen-antibody binding.

Tissue Engineering

The literature thoroughly assesses and tests piezoelectric actuator-sensor systems for tissue

engineering. Due to their stress, conventional tissue engineering actuators and sensors must be regularly removed from the frame. To avoid having to delay the instrument, it is possible to use short digital biological sensors with excellent mechanical characteristics. Breast cancer cell survival may be impacted by piezoelectric nanoparticles exposed to ultrasonic frequencies.

Healthcare Monitoring

The physiological processes of human organisms can be dynamically measured in real time using piezoelectric sensors for medical monitoring. Non-invasive biosensors transmit data from interstitial fluids, perspiration, tears, or saliva for illness detection [15].The development of electronic skin (or "e-skin") for use in medical monitoring systems is another development.E-skin has been utilised in numerous medical applications, including wearable sensors and illness diagnosis, because of its exceptional qualities. Some devices' colour can change thanks to pressure biosensors that mimic the chameleon's skin. E-skin, for instance, may communicate with another pressure sensor. A composite made of reduced graphene and polyvinylidene fluoride (PVDF) was utilised to create piezoelectric artificial skin. High conductivity PVDF/GO films were cast and annealed to obtain a high proportion of -phase.

Actuators in Tissue Engineering and Devices

A significant class of piezoelectric motion-controlling devices are medical actuators (Figure 3) .Advanced research is used to create the designs of piezoelectric actuators. Despite the fact that piezoelectric forces are frequently quite weak, piezoelectric actuators have been modified for a variety of applications with minimal displacement. Flexible tissue actuators for piezoelectric devicescan be utilised to encourage tissue regeneration and is biocompatible. According to certain reports, certain intelligent actuators may be able to restore an organ that has been lost in human organisms. Shape-memory polymers (SMP) and shape-memory alloys (SMA) can be stimulated to activate them, whilst textile actuators can replicate the motion of the human body.

A number of articles have discussed using PLLA tweezers to treat thrombus. The tweezers show a great capacity to capture silica compounds when they are injected into a blood artery in the form of biodegradable fibres. By using jet spinning and alternating current (AC) voltage, fibres were created. These piezoelectric tweezers appear to be strong prospects for nanomedicine and tissue engineering applications because of the aforementioned characteristics and great sensitivity. Nanocomposites with oriented polymer fibres, which serve as the actuators and sensors in piezoelectric materials, can be created.

Silver nanoparticles can be added to small sensor-actuator systems to provide strain sensing. These devices can also be used to produce signals, ultrasonic energy, drilling equipment, and to convert vibration into electrical energy and electrical energy into mechanical energy. Numerous industrial products use piezoelectric actuators, including components for phones, sophisticated music systems, and musical instruments. Piezoelectric actuators are extensively researched in the medical field for use in endoscope lenses, tiny pumps, and other applications.

Additionally, 3D fibrous piezoelectric scaffolds can support osteogenic differentiation and be employed with stimulation during in-vitro experiments. Piezoelectric materials with low voltage output, however, encourage chondrogenic differentiation. The study concludes by demonstrating improved chondrogenicdierentiation by electromechanical stimulation. In comparison to mechanical actuation, electromechanical actuation is more effective.

According to reports, the electrospinning process's settings have a significant impact on the characteristics of nanofiber actuators. The method may be improved to produce intelligent PVDF bio-actuators for energy harvesting. Results revealed that fibroblasts grew exactly in the direction of the fibres. Due to their electric impact, such intelligent scaffolds can be used in neural tissue engineering for the regeneration of the nervous system.

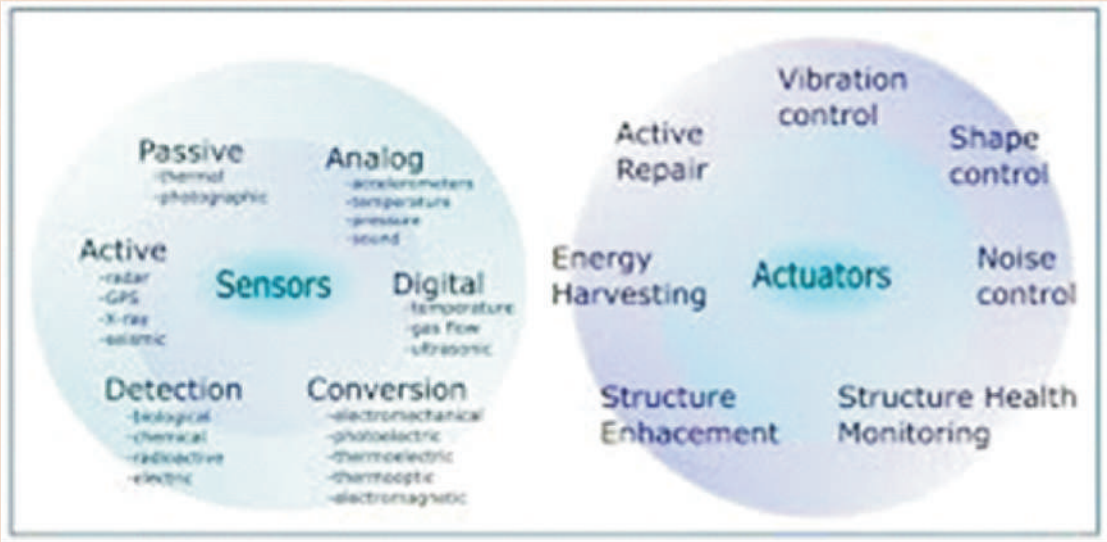

Figure 3 Applications of actuators and sensors
Courtesy: Angelika Zaszczyn'skaet. al. Polymers 2020, 12, 2754;

Ultrasonic Imaging

The 1920s saw the introduction of piezoelectric ultrasonography, which was later applied to the assessment of mitral valve disease in the 1950s. Today, echocardiography is the gold standard for a quick assessment of the heart muscle and valves. Living beings have had endocardial piezoelectric crystals implanted along a number of the coronary heart's axis on the way to locate altered left ventricular-arterial coupling, which takes place before pump malfunction in early coronary heart failure. Now that surgeons are using transducer-tipped catheters for ultrasound biomicroscopy, it's miles reasonable to expect that piezotechnology might also in the future because of entire digital heart show based on ultrasound imaging. Last however not least, paintings is being performed on a piezo-based sensor that may convert heartbeats into visuals.

Piezoelectric cardiac assistance devices and micropumps for drug delivery

Due to their high efficiency and ease of miniaturisation, piezoelectric gadgets are best candidates for usage of implantable medicinal drug pumps. A peristaltic piezoelectric micropumps device prototype were advanced and produced. This piezoelectric micropump has an adjustable stroke quantity and can minimise energy whilst maintaining a regular glide rate across extensive backpressure variety. PZT micro-pumps may be utilised to supply specific volume higher awareness medicines to the systemic flow due to the fact they are able to displace unique amounts of extraordinarily small volumes.

Ablation of Tumour Cells Using High-Intensity Focused Ultrasound (HIFU)

Numerous cancer forms have been effectively treated with high-intensity focused ultrasound (HIFU). Due to absorption, when high-intensity ultrasound is concentrated at a location on human tissue, the tissue can quickly reach a high temperature. This results in tissue destruction or necrosis in the targeted location without damaging the tissues around it. HIFU can therefore be used to eliminate tumours.

Single-element PZT transducers are not ideal for producing high-intensity focused ultrasound since the PZT element has to be concave in form and rather big in size. Large PZT plates are carved into deep grooves to create array transducers, which are capable of producing high intensity and precise focusing.

In the frequency range of 200 kHz to 10 MHz and with an acoustic output of 10–30 W/cm2, high-intensity piezoelectric 1-3 composite transducers have been created. How many components there are in the transducer vary from 64 and more than 200 components. The capability of the transducers capable of producing high temperatures up to roughly 85°C and sharp focusing. The characteristics of HIFU transducers, including their frequency and the input power, focal length, and transducer head define the the volume of heat produced in that region. Standard HIFU transducers function in the 1 to 10 MHz range and have F-numbers between 1-1.5. The movement of the transducer is observed using the live picture of the tumour.

Therapeutic Ultrasound-Treatment of Injury, Muscular Pain, and Bone Fracture

For the treatment of wounds and bone repair, a piezoelectric transducer produces a low intensity ultrasonic field. Researchers have made an effort to provide empirical support for ultrasound's capacity to mend broken bones. But no solid study demonstrating the healing properties of ultrasonography has been published as of yet. In the majority of real-world instances, using ultrasound to repair fractures or ease muscle problems is done in conjunction with other traditional therapies.

The ultrasound employed in the procedures has a frequency of 1-3 MHz and a low intensity of less than 3 W/cm2. Both pulsed and continuous ultrasound have been applied. The therapy lasts for a short while. Some of the hypotheses put up to support the therapeutic effects of ultrasound include:

The moderate warmth caused by high-frequency vibrations travelling through the tissue reduces pain and speeds up the healing process. Ultrasound improves collagen's extensibility, which can aid in the repair of damaged tissues. Ultrasound also enhances metabolism and boosts blood flow.

Sports-related injuries necessitate quick recovery. In these situations, ultrasonic therapy is used in the hopes of lowering swelling and imitating the healing process. Ultrasonic devices are used by physiotherapists to treat arthritic, joint, and muscle discomfort. It is thought that the ultrasound-induced vibrations provide a massaging and gently heating impact.

Phaco Emulsification-Cataract Surgery

The maximum famous method of cataract surgery is referred to as phaco emulsification, which involves shattering the damaged lens into portions with an ultrasonic subject. A tiny piezoelectric transportable ultrasonic transducer with a pointed titanium micro-

tip, an irrigation-aspiration gadget with tiny channels, a field for fluids, and the vital electrical manipulate machine make up the instrument. Through a very little corneal incision, the hand held transducer is placed into the attention. Around forty kHz is the operating frequency of the transducer. To create ultrasonic discipline bursts at the titanium tip, the ultrasonic area is pulsed with pulse frequencies among 4 and four hundred Hz. Small portions of the cataract-affected lens are broken off by way of the vibrating micro-tip. A fluid is created to enter the attention concurrently.

Energy Harvesting

The creation of several implanted medical electronics (IMEs), which can enhance human life quality and perhaps even lengthen longevity, has been sparked by the significant improvements in microelectronics over the past few decades. As diagnostic and therapeutic tools, IMEs may now be implanted in a variety of human body areas. These implanted electronics might provide a variety of body component diagnostic tools and support therapy for such disorders.

Despite tremendous advancements in IME manufacture and use since Siemen's invention of the first pacemaker in 1958, there are still a number of difficulties that must be overcome.

To lessen their impact on human activities, it is strongly desired to create IMEs with reduced dimensions and weights. The most dependable power source for IMEs is widely acknowledged to be batteries. The highest amount of battery system miniaturisation is challenging to attain, nevertheless, due to present technical restrictions. Another significant obstacle is the short battery life. For instance, the deep brain stimulators and cardiac pacemakers' electric pulse-generating batteries need to be changed or maintained after 3-5 years of operation.

Recent studies have shown that the physiological milieu and bodily activities may harvest energy in vivo and charge internal devices. Energy-autonomous implanted electronic devices are another way to miniaturise technology. These gadgets draw their power directly from the patient or from nearby artificial or natural sources. There have been reports of a number of methods for converting energy from thermal, mechanical, and chemical sources in living organisms, including electrical potentials from glucose oxidation, inner ear, muscular contraction, and organ vibration (39-43).

For example, it is described on an energy harvester made of lead zirconatetitanate (PZT) that can store energy from the normal beating of the heart and other internal organs. Chromium (Cr) and gold (Au) layers on ribbons serve as an electrode in this particular device. Another illustration may be a medical device energy harvester that uses gold (Au) electrodes atop lead magnesium niobate-lead titanate (PMN-PT) films to safeguard medical equipment.

Academic Participation of ACT Members

1. **Prof. M. Swaminathan**, EC Member of ACT South Zone, delivered a Talk on "Significance of Nanomaterials in the Context of Energy and Environmental Applicationswith Activated Charcoal" in National Symposium in Chemistry, on Nanotechnology and Its Applications(ANKURAN-2023) organized by ShriVaishnavVidyapeethVishwavidyalaya, Indore on 22nd September 2023.
2. **Prof. Wasudeo Gurnule**, Secretary of ACT West Zone, Delivered Invited Talk on "Functional Nanomaterials in the Service of Mankind"in National Symposium in Chemistry, on Nanotechnology and Its Applications(ANKURAN-2023) organized by ShriVaishnavVidyapeethVishwavidyalaya, Indore on 22nd September 2023.
3. **Prof. Wasudeo Gurnule**, Secretary of ACT West Zone, Delivered Invited Talk on "Research Methdology" in the Inaugural session of 'Chemistry Club" organized by Nabira Mahavidyalaya, Katol, Dist Nagpur, 30th September 2023.
4. **Prof. Wasudeo Gurnule**, Secretary of ACT West Zone, Delivered Invited Talk on "Environmental Science" in State Level Student Seminar Competition organized by National Academy of Science, (NASI), Nagpur Chapter and Mahatma Gandhi Arts, Commerce and Science College, Armori on 7th October 2023.
5. **Prof. Wasudeo Gurnule**, Secretary of ACT West Zone, Delivered Invited Talk on "Climate Change, Corrective Actions and Human Responsibility" in2nd Commemoration Lecture in the memory of "LATE PROF SHARAD KUMAR VAJPAIorganized by IQAC and Chemical Association Chaitnya Science and Arts College, Palmgarh, Chattisgarh, on 14th October 2023.
6. **Prof. Wasudeo Gurnule**, Secretary of ACT West Zone, Delivered Invited Talk on "Research Methodology and IPR in Chemistry" in Inaugration of Chemical Society, organized by Department of Chemistry, BrijlalBiyani Science College, Amravati, Maharashtra, on 14th September 2023.
7. **Prof. Wasudeo Gurnule**, Secretary of ACT West Zone, Delivered Invited Talk on "Materials in the Service of Mankind" in International Workshop, organized by International University, Erbil, on 15th October 2023.
8. **Prof. Wasudeo Gurnule**, Secretary of ACT West Zone, Delivered Invited Talk on "Innovations and IPR" in National Webinar on Innovation and IPR(New IPR-2023), organized by Department of Chemistry, Jagat Arts, Commerce and Science College, Goregaon and Society for Promotion of Material Science, Nagpur, Maharashtra, on 23rd October 2023.
9. **Prof. Wasudeo Gurnule**, Secretary of ACT West Zone, Delivered Invited Talk on "Future Opportunities in Chemistry Subject" in Installation of Science Club, organized by Department of Chemistry, Santaji Mahavidyalaya, Nagpur, on 16th October 2023.
10. **Prof. Wasudeo Gurnule**, Secretary of ACT West Zone, Delivered Invited Talk on "Advanced Functional Nanomaterials" in Installation of Chemical Society, organized by Department of Chemistry, DRB Singhu Mahavidyalaya, Panchpaoli, Nagpur, on 12th September 2023.

Scientists Create First-Ever Battery Using Haemoglobin

Researchers at the Chemical Institute for Energy and the Environment (IQUEMA) at the **University of Cordoba** have developed a battery that employs haemoglobin to facilitate electrochemical reactions, maintaining functionality for approximately 20 to 30 days.

Haemoglobin is a protein present in red blood cells and is responsible for conveying oxygen from the lungs to the different tissues of the body (and then transferring carbon dioxide the other way around). It has a very high affinity for oxygen and is fundamental for life, but, what if it were also a key element for a type of electrochemical device in which oxygen also plays an important role, such as zinc-air batteries?

Researchers at the University of Cordoba have developed a new type of battery using haemoglobin as a catalyst in zinc-air batteries

This is what the Physical Chemistry (FQM-204) and Inorganic Chemistry (FQM-175) groups at the University of Córdoba (UCO) wanted to verify and develop, together with a team from the Polytechnic University of Cartagena, after study by the University of Oxford and a Final Degree Project at the UCO demonstrated that haemoglobin featured promising properties for the reduction and oxidation (redox) process by which energy is generated in this type of system.

Thus, the research team developed, through a Proof of Concept project, the first biocompatible battery (which is not harmful to the body) using haemoglobin in the electrochemical reaction that transforms chemical energy into electrical energy.

The Mechanism and Advantages of the Haemoglobin Battery

Using zinc-air batteries, one of the most sustainable alternatives to those that currently dominate the market (lithium-ion batteries), haemoglobin would function as a

catalyst in such batteries. That is, it is a protein that is responsible for facilitating the electrochemical reaction, called the Oxygen Reduction Reaction (ORR), causing, after the air enters the battery, oxygen to be reduced and transformed into water in one of the parts of the battery (the cathode or positive pole), releasing electrons that pass to the other part of the battery (the anode or negative pole), where zinc oxidation occurs.

As UCO researcher Manuel Cano Luna explains: "To be a good catalyst in the oxygen reduction reaction, the catalyst has to have two properties: it needs to quickly absorb oxygen molecules, and form water molecules relatively easily. And haemoglobin met those requirements." In fact, through this process, the team managed to get their prototype biocompatible battery to work with 0.165 milligrams of haemoglobin for between 20 and 30 days.

In addition to strong performance, the battery prototype they have developed boasts other advantages. First of all, zinc-air batteries are more sustainable and can withstand adverse atmospheric conditions, unlike other batteries affected by humidity and requiring an inert atmosphere for their manufacture.

A Spectrum of Innovation: MIT Chemists Synthesize Colorful Organic Molecules

MIT researchers have improved the stability of acenes, molecules with potential in semiconductors and light-emitting diodes.

The molecules, known as acenes, could be useful as organic light-emitting diodes or solar cells, among other possible applications. Chains of fused carbon-containing rings have unique optoelectronic properties that make them useful as semiconductors. These chains, known as acenes, can also be tuned to emit different colors of light, which makes them good candidates for use in organic light-emitting diodes.

Challenges and Breakthroughs in Acene Stability

The color of light emitted by an acene is determined by its length, but as the molecules become longer, they also become less stable, which has hindered their widespread use in light-emitting applications.MIT chemists have now come up with a way to make these molecules more stable, allowing them to synthesize acenes of varying lengths. Using their new approach, they were able to build molecules that emit red, orange, yellow, green, or blue light, which could make acenes easier to deploy in a variety of applications.

MIT's Novel Approach

"This class of molecules, despite their utility, have challenges in terms of their reactivity profile," says Robert Gilliard, the Novartis Associate Professor of Chemistry at MIT and the senior author of the new study. "What we tried to address in this study first was the stability problem, and second, we wanted to make compounds where you could have a tunable range of light emission."MIT research scientist Chun-Lin Deng is the lead author of the **paper**, which was published on December 5 in the journal *Nature Chemistry*.

Colorful and Efficient Molecules

Acenes consist of benzene molecules — rings made of carbon and hydrogen — fused together in a linear fashion. Because they are rich in sharable electrons and can efficiently transport an electric charge, they have been used as semiconductors and field-effect transistors (transistors that use an electric field to control the flow of current in a semiconductor).

Recent work has shown that acenes in which some of the carbon atoms are replaced, or "doped," with boron and nitrogen have even more useful electronic properties. However, like traditional acenes, these molecules are unstable when exposed to air or light. Often, acenes have to be synthesized within a sealed container called a glovebox to protect them from air exposure, which can lead them to break down. The longer the acenes are, the more susceptible they are to unwanted reactions initiated by oxygen, water, or light.

To try to make acenes more stable, Gilliard decided to use a ligand that his lab has previously worked with, known as carbodicarbenes. In a study published last year, they used this ligand to stabilize **borafluorenium ions**, organic compounds that can emit different colors of light in response to temperature changes.

For this study, Gilliard and his co-authors developed a new synthesis that allowed them to add carbodicarbenes to acenes that are also doped with boron and nitrogen. With the addition of the new ligand, the acenes became positively charged, which improved their stability and also gave them unique electronic properties.

Using this approach, the researchers created acenes that produce different colors, depending on their length and the types of chemical groups attached to the carbodicarbene. Until now, most of the boron, nitrogen-doped acenes that had been synthesized could emit only blue light.

"Red emission is very important for wide-ranging applications, including biological applications like imaging," Gilliard says. "A lot of human tissue emits blue light, so it's difficult to use blue-fluorescent probes for imaging, which is one of the many reasons why people are looking for red emitters."

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9	Ajit Kumar Sharma	2579	Jawahar Navodaya Vidyalaya Sametri TAT. Dehgam, Dist.- Gandhinagar (Gujarat) - 382 315
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15	Dr. Ravibabu Ambadas Tayade	2585	Department of Chemistry, The Institute of Science, Mumbai - 400032
16	Dr. Amita Chaudhary	2586	A-108, Chemical Engineering Department, IT, Nirma University - 382481
17	Dr. Jay Prakash Singh	2587	S/o-Braj Kishor Singh, Madhopur, Jalalpur Bazar, Chapra,Saran, Bihar - 841412
18	Nanduri Pardh	2588	QIS College of Engineering & Technology, Vegamukkapalem, Andhra Pradesh - 523272
19	Dr. Chakka Kiran Kumar	2589	Dept. of Chemistry, QIS College of Engineering & Technology, Pondur Road, Ongole - 523272
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ACT NEWS LETTER

ISSUE - 27 SEPTMBER - DECEMBER 2023