



CATALYST

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Chemistry News Letter

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Student Achievements

T. Y. B. Sc.. Students' performance at Goa University -Admission Ranking Test



RIVONKER SHUBHAM
Third Rank



GAONKAR RUPESH
Fifth Rank



CRASTO NAVITA
Seventh Rank

Faculty Achievements

Dr. G. K. Naik

Research Paper Published in Elsevier:

Effect of Co substitution on structural and magnetic properties of $\text{Ni}_{0.6}\text{Zn}_{0.4}\text{Fe}_2\text{O}_4$ nano ferrite; Yatin P. Desai, Shantadurga Desai, Disha Sinai Sangoonkar, Manoj M. Kothawale, **G. K. Naik**, Materials Today: Proceedings 46 (2021) 2261-2265, published online on June 21st, 2021.

Advisory Committee Member

Advisory Committee Member for Four days online National workshop "Recent Trends in Organic and Inorganic Chemistry: From Teaching-Learning and Research Perspective" organized by the Department of Chemistry R. E. Society's R. P. Gogate College of Arts and Science and R. V. Jogalekar College of Commerce, Ratnagiri- 415 612 (Maharashtra), in association with "Royal Society of Chemistry" West India Section, Mumbai from April 03rd - 06th April 2021.

Participation in Webinars

- International Webinar on "Empowering Diversity in Science", organized by Department of Chemistry, Kamla Nehru Mahavidyalaya, Nagpur (Maharashtra) and Association of Chemistry Teachers (ACT), C/O Homi Bhabha Centre for Science Education (TIFR) Mumbai held on February 9th, 2021 in Collaboration with International Union of Pure and Applied Chemistry (IUPAC), Global Women's Breakfast
- One week Faculty Development Programme on "Functional Materials for Engineering Applications" sponsored by the Centre for Excellence in Advanced Materials Research, TEQIP-III, organized by B. M. S. College of Engineering, Bengaluru-19, an Autonomous Institute affiliated to V.T.U, Belgavi, during February 15th - 19th, 2021, in association with MJP Rohilkhand University, Bareilly.
- International Webinar on "Innovations in Science and Technology", (IWIST-2021) organized by Department of Chemistry, Smt. Narsamma Arts, Commerce and Science College, Kiran Nagar Amravati (Maharashtra) and Association of Chemistry Teachers (ACT), C/O Homi Bhabha Centre for Science Education (TIFR) Mumbai held on February 27th, 2021.
- National Webinar on "Innovations in Materials Science and Green Technologies", organized under the aegis of MHRD-Design Innovation Centre, Centre for Converting Technologies, University of Rajasthan, Jaipur, held on March 31st, 2021.
- One-week online Faculty Development Programme on "Essential Skills and Technologies for Quality Research", organized by Library and Information Centre, P.E.S. College of Engineering, Madya, Karnataka -571401, an Autonomous Institute affiliated to V.T.U, Belgavi, during March 03th - April 04th, 2021
- International Webinar on "Sub sustainable Chemistry", (IWSC-2021) organized Association of Chemistry Teachers (ACT), C/O Homi Bhabha Centre for Science Education (TIFR) Mumbai held on March 18th, 2021
- Four days online National workshop "Recent Trends in Organic and Inorganic Chemistry: From Teaching-Learning and Research Perspective" organized by the Department of Chemistry R. E. Society's R. P. Gogate College of Arts and Science and R. V. Jogalekar College of Commerce, Ratnagiri- 415 612 (Maharashtra), in association with "Royal Society of Chemistry" West India Section, Mumbai from April 03rd - 06th April 2021.
- One Week Online STTP "Design Thinking as Strategic Tool for Innovation and Creating Start-up", sponsored by GUJCOST and ICSII, and organized by the "Mechanical Engineering Department" IITE, Indus University, Ahmedabad (Gujrat), during April 19th, - 23rd 2021.

Chemistry of Football

— Khushi Nitin Prabhudesai (F. Y. B. Sc.)

Football, or Soccer, is one of the most common sport in existence. This stems mainly from the nature of the game requiring no aides to playing, such as sticks, bats or clubs; simply the football itself. The most common football is arranged in a “Buckyball” configuration consisting of twenty hexagons and twelve pentagons. The “Buckyball” shape is named after the architect and designer Buckminster Fuller, who pioneered geodesic dome architecture.

Polyurethanes

Football, however, are not made purely out of carbon atoms! The oldest surviving football dates from around 1540 and is constructed from an inner pig’s bladder surrounded by an outer layer of cow hide. It is only half the diameter of a standard football used today. Modern footballs retain a similar construction method with an inflatable bladder and leather exterior. However, these are often made of polymers rather than traditional animal hides. For example, the outer “leather” of a modern football is often made from polyurethanes. Polyurethane monomers are joined through urethane (or carbamate) linkages which are formed when an alcohol reacts with an isocyanate group ($R-N=C=O$) – the alcohol (ROH), or an alkoxide ion (RO^-), is a nucleophile that adds to the electrophile carbon in the isocyanate.

Polyisoprene

Meanwhile the inner “bladder” of the ball is constructed from polyisoprene, formed by polymerisation of isoprene using a Ziegler-Natta catalyst. Different catalysts give different amounts of cis -1,4- and trans- 1,4-polyisoprene – cis-1,4- polyisoprene, which is also called isoprene rubber golf ball coverings.

Poly(butylene terephthalate)

In football there is little danger from a ball impact and players generally wear limited shin guards to protect from tackles. In order to provide adequate protection against fast balls, cricket leg pads that batters and wicketkeepers wear are made from a coating of a high impact polyester, called poly(butylene terephthalate) or PBT. PBT can be formed from a poly condensation reaction (you will see that water is a by-product) between terephthalic acid and butane-1,4-diol. PBT is less rigid than PET (it has a longer flexible carbon chain between the benzene rings), but has a higher impact resistance making it ideal for use in flexible padding.

As with PET, PBT must be mixed or coated with a UV stabilizer such as a benzotriazole; as polymers can be susceptible to breakdown when exposed to intense ultraviolet (UV) radiation. These additives generally absorb UV radiation much more strongly than the polymers that they protect. Therefore, as well as the outer coating of cricket pads providing a flexible and fitting shape, it also offers a high degree of impact and environmental resistance.

Tackle bags

Impact resistance is also crucial in contact sports such as rugby where tackles, especially at higher levels, can hit with considerable force. Training in order to tackle effectively and safely is often done through the use of training pads known as tackle bags. These tackle bags must be able to absorb the force generated by a tackling player whilst protecting the player holding the bag.

In order to remain both light enough to carry yet flexible enough to absorb the force of an incoming tackle, the interior of these bags is constructed from foam polymers.

Chemistry Department Activities

Webinar on “Intellectual Property Rights”

A Webinar on “Intellectual Property Rights” was conducted for faculty and S.Y.B. Sc students of Chemistry on 05.12.2020. The webinar was aimed to acquaint the S.Y.B. Sc. students and teachers on the various aspects of intellectual property rights especially those related to academics and scientific innovations. Dr. Lactina Gonsalves introduced and welcomed the resource person Dr. Reshma Kurangi, who with her vast knowledge of IPR and experience in patent filing and related process enlightened the participants about the need and importance of IPR. The webinar concluded with a vote of thanks proposed by Dr. Sachin Kakodkar.

Webinar on “Intellectual Property Rights”

The webinar on “Swachh Brigade” was conducted for F.Y. B. Sc. and T.Y. B. Sc. students of Chemistry. The webinar was aimed to make students aware about the environmental issues, its impact and the necessary steps to be taken to preserve the ecological balance. Dr. Priyanka Talak introduced and welcomed the resource person Mr. Aman Singh. Aman Singh is a grade 11 student studying in the IB Diploma Programme at Woodstock School, Mussoorie. He started this garbage cleaning initiative in 2021, heartbroken seeing all the garbage that was heartlessly dumped everywhere. He realised that he could not expect his parents or the government to clean up the area, and decided that he must take the initiative to make a change. Thus Swachh Brigade was born, and the organisation spends a few hours every Sunday, cleaning along the coast. Students actively participated in conversation with the speaker. The webinar concluded with a vote of thanks proposed by Dr. Priyanka

FACULTY ACHIEVEMENTS

Dr. Roopa S. Belurkar

- Participated in State level web based lecture series on “Insights of Instrumentation & Characterization techniques” organized by Department of Chemistry, Government College of Arts, Science and Commerce, Khandola, Marcela-Goa, on 10th May, 16-17th June 2021.
- Participated in a Two Day State Level Workshop on Employability Skills: Resume Writing & Interview on 25th and 26th June 2021, organised by the Department of Psychology, Government College of Arts, Science and Commerce Khandola, Marcela-Goa.
- Participated in Webinar on ‘FUNGAL DIMENSION OF GLOBAL BIODIVERSITY’ Organized by Department of Sustainability and Green Initiatives in association with IQAD GCASCK on the occasion of International day for biological diversity 2021 on 22nd May, 2021 organised by Government College of Arts, Science and Commerce Khandola, Marcela-Goa.

Dr. Manjita R. Porob

- Dr. Manjita R Porob, Associate Professor & Head Department of Chemistry, successfully completed a Five-day online faculty development program on “Research Skills and Techniques” organised by Reva University, Bangalore from 24/5/21-28/5/21.

Ms. Padmini C. Raiker

- Padmini C. Raiker successfully completed a one week Online National Faculty Development Program jointly organised by Guru Angad Dev Teaching Learning Centre & SGND Khalsa College, University of Delhi on “The Road Ahead: NEP and Pedagogies” with A+ grade.
- Padmini C. Raiker in collaboration with Dr. Mainak Banerjee, Dr. Amrita Chatterjee, Dr. Zigmee Bhutia and Akhil Bhosle published a review article entitled “Micellar nanoreactors for organic transformations with a focus on dehydration reactions in water: A decade update” in Scopus indexed Tetrahedron journal of Elsevier publishers.
- Padmini C. Raiker successfully completed a Five-day online faculty development program on “Research Skills and Techniques” organised by Reva University, Bangalore.

Dr. Mayuri M. Naik

- Dr. Mayuri M. Naik** organized a “Poster competition” for all first, second and third year B. Sc. Chemistry students of Parvatibai Chowgule college of Arts and Science, Autonomous to commemorate “National Science Day 2021”. It also aimed to provide a platform to all these Chemistry students to put their innovative ideas into practice on the given theme “Future of Science, Technology and Innovation: Impacts on Education, Skills and Work” through poster. The competition was conducted in online mode from 15th to 24th February 2021. Out of total 10 students who submitted the poster, **Ms. Siddhi Deelip Naik** (S. Y. B. Sc.) won **first prize**, **Mr. Alic Carvalho** (F. Y. B. Sc.) won **second prize** and **Mr. Prathamesh Samant** (T. Y. B. Sc.) won **third prize**.
- Dr. Mayuri M. Naik** participated in the UGC Sponsored “Online Webinar on Ethics & Research” organized by UGC–Human Resource Development Centre, Gujarat University, Ahmedabad on 24th February 2021 from 03:00 – 05:00 pm.
- Dr. Mayuri M. Naik** had participated in One Day Online National Workshop entitled “ICT Tools For Chemistry Teachers” organized by Guru Angad Dev Teaching Learning Centre, SGTB Khalsa College, University of Delhi under the Pandit Madan Mohan Malaviya National Mission on Teachers and Teaching (PMMNMTT) of Ministry of Education on 22nd February 2021 from 04:00 – 06:00 pm.
- Dr. Mayuri M. Naik** participated in the National Webinar on the topic “Bio-inspired Chemistry For Understanding The Role Of Metal Ions In Biocatalysis” organised by Srushti Eco Club in collaboration with Department of Chemistry, Ponda Education Society’s Ravi S. Naik College of Arts and Science, Farmagudi, Ponda-Goa on 28th May 2021.
- Dr. Mayuri M. Naik** participated in E-symposium on “Recent Trends on Applications of Chemistry in Engineering” organized by Department of Chemistry, Sciences and Humanities, Bharat Institute of Engineering and Technology, Ibrahimpatnam, Hyderabad from 4th-6th June 2021.
- Dr. Mayuri M. Naik** participated in Two days online workshop on “Plagiarism and Research Ethics” Under UGC Scheme, STRIDE Component – I (Research Capacity Building) organized by Department of Library, Vinayakrao Patil Mahavidyalaya, Vijapur, Dist. Aurangabad (MS), on 7th-8th June 2021.
- Dr. Mayuri M. Naik** participated in the National Webinar on “A Simple Perspective of Sweet Chemistry and Covid-19 Molecule” organized by the Department of Chemistry, Sadakathullah Appa College (Autonomous), Rahmath Nagar, Tirunelveli, Tamil Nadu on 11 June 2021.
- Dr. Mayuri M. Naik** participated in the International Level Webinar on “Green Organic Chemistry” organized by the Department of Chemistry, Sadakathullah Appa College (Autonomous), Rahmath Nagar, Tirunelveli, Tamil Nadu on 16 June 2021.
- Dr. Mayuri Naik** participated in a State level web-based lecture series on “Insights of Instrumentation & Characterization techniques” organized by Department of Chemistry on 10th May, 16-17th June 2021.
- Dr. Mayuri Naik** had participated in First National E- Conference on “Environment and Sustainable Development” jointly organized by Sardar Patel College of Engineering (SPCE), Bakrol & State NSS Cell of Gujarat on 5th June 2021.

CHEMISTRY POEM

Hydrogen in the air,
Fluorine in the teeth.
Without oxygen can you even breathe?

Chemicals are everywhere
Some elements are in abundance,
Some of them are rare.

Chemicals are one of life's important fixtures
And everything in life matters,
Yes, those compounds and mixtures.

Look around from tiny ant to huge mass Sun
Everything you see needs space.
If you wanna explore the world,
You better start from atoms and its base.

Life is easier in the name of chemistry
Solving equations is way easier
than theorems and trigonometry.

Exhibit covalent properties in you
Do not be like noble gases
If you want to master the chemistry life
Do not miss your classes.

Komal Band
(T. Y. B. Sc.)

Did you know?

Saya Fernandes
(T. Y. B. Sc.)

Mars appears red, or at least red-orange, is because the Martian surface contains a large amount of rust or iron oxide. The iron oxide forms a rust dust that floats in the atmosphere and sits as a dusty coating across much of the landscape.

'Copper foams' as filter for COVID-19 masks

- Shubham Rivonker (T.Y.B.Sc.)

At the end of 2019, a new type of coronavirus (called SARS-CoV-2) started making people sick with symptoms similar to that of common cold. The World Health Organisation (WHO) declared this disease COVID 19 / Coronavirus 19. It was declared as pandemic when people all around the world started getting infected. The transmission of this disease is through several ways. Tiny droplets known as aerosols contaminate the air and travel on air currents. People started getting infected as they came in contact with these droplets. The risk of transmission was found to be highest when people did not maintain social distancing. Hence, the only way to be away from this deadly virus is by taking all the precautions while the most important thing is to be wearing masks when moving out of the house. Recently, researchers have come up with a new sort of filter for use in masks. Masks made of copper are found to be of lightweight and sturdy in nature. It is easy to clean and can be recycled. The results it showed through tests were of tremendous help as it provided similar protection as that of N95 mask while according to some developers it was that these masks had the ability to trap the bacteria and kill within the masks. It was observed that masks can guard against this virus and these can be made from different materials. With around millions of people being asked to wear masks around the world, many developers began their research in need of identifying new and better filters. Kai Liu was among one such material scientist, who with the help of his team at Georgetown University, Washington D.C., started testing various materials with a view of filtering small particles out of polluted air. The team began to make copper nano wires using templates. The diameter of each wire was typically about 200 nanometers, said Liu. After dumping those wires into ultra pure water, they flash-froze the mix in liquid nitrogen. Further, they put the copper-filled ice in a vacuum chamber. As a result, the loosely packed mass of copper wires were dried. In the end, they heated the mass of wires to 300 °C. These chemical reactions enabled to form a mesh. Unfortunately, according to Liu, the mesh prepared was too fragile and could break at any moment if a person breathed through it. Therefore, the researchers kept trying different ways to make a breakthrough. Later, their team made use of liquid that contained copper ions in which they soaked the weak mesh. By passing electrical current through this it resulted in thickening the mesh due to deposition of more copper onto the nano wires. Further through the tests it was found out that this material could withstand a strong weight without breakdown. It was evident when the material was 85 percent air. Crucially, this 85-percent-air foam filtered out tiny particles. A sample 2.5 milli meters (0.1 inch) thick, was found to capture 97 percent of particles between 0.1 to 0.4 micrometers in diameter. The particles get entrapped as they try to move through the wire maze between the outer and inner edges of the filter. Liu along with his colleagues provided insight of this copper foam in Nano Letters in the month of April.

References

- J. Malloy et al. Efficient and robust metallic nanowire foams for deep submicrometer particulate filtration. Nano Letters. Vol. 21, April 14, 2021, p. 2968. doi: 10.1021/acs.nanolett.1c00050. • World Health Organization. (n.d.). Coronavirus. World Health Organization. https://www.who.int/health-topics/coronavirus#tab=tab_1.
- Perkins, S. (2021, June 25). Copper 'foam' could be used as filters for COVID-19 masks. Science News for Students. <https://www.sciencenewsforstudents.org/article/innovation-copper-foam-could-filter-germs-for-covid-19-masks>.

Second life for plastics as biodegradable surfactants

— Jesher Miranda (S. Y. B. Sc.)

Scientists at the Institute for Cooperative Upcycling of Plastics (iCOUP), an Energy Frontier Research Center led by Ames Laboratory, have recently discovered a chemical process to convert discarded plastics into biodegradable, valuable chemicals. The process has great potential to create a sustainable and economically favorable lifecycle for discarded plastics. The researchers worked on the deconstruction of polyolefins, which represent more than 50% of the plastics discarded in the world and include almost all kinds of products.

"Plastics, and especially polyolefins, are materials you could call too successful. They are fantastic, strong, lightweight, thermally stable, chemically resistant for all the applications that we use them for, but the problem comes when we don't need them anymore," said iCOUP Director Aaron Sadow.

The chemical construction of polyolefin plastics makes them tough and durable i.e., long strong chains of carbon-carbon bonds. But this also makes it difficult to break them down. These polymers lack the chemical groups that can be targeted in depolymerization processes. Moreover, the existing depolymerization processes result in products with less value, less usable components which makes the whole process less economically feasible.

The new process uses what science already knows about depolymerization. The process starts by breaking a few carbon-carbon bonds. Once a few bonds are broken, the shortened polymer chains are transferred to an aluminium end group to form reactive species (intermediate). The catalysts and reactions for this new process are related to those used in alkene polymerization. Finally, the intermediates are converted into fatty alcohols or fatty acids, or used in other synthetic chemistry, to create chemicals or materials that are valuable. As the process is catalytically controlled, desirable product chain lengths can be targeted for synthesis. Moreover, the end products are completely biodegradable.

References:

- DOE/Ames Laboratory. "Plastics could see a second life as biodegradable surfactants." ScienceDaily. ScienceDaily, 15 April 2021. www.sciencedaily.com/releases/2021/04/210415133139.htm

Eminent Alumnus



Dr. Priya Karmali

Priya Karmali currently serves as Vice President of Technology Innovation and Development at Arcturus Therapeutics located in San Diego, California, USA. In her current position, she heads research and development efforts for LUNAR® technology, Arcturus' lipid mediated nucleic acid delivery system. With over 20 years of experience in the field of lipid mediated nucleic acid delivery from discovery to development, Priya has led drug product development of multiple RNA based therapeutics that are currently in various phases of clinical trials. Prior to Arcturus, Priya held positions of increasing responsibility at Regulus Therapeutics, California, USA and Nitto Denko (currently Nitto Biopharma), California, USA in leading drug product development for miRNA and siRNA therapeutics. Priya received her PhD in Chemistry from the Indian Institute of Chemical Technology, Hyderabad, India where her doctoral research was focused on development of novel liposomal nucleic acid delivery systems for use in non-viral gene therapy and DNA vaccination. Priya completed her Bachelor of Science in Chemistry from Department of Chemistry, Parvatibai Chowgule College, Goa, India and Masters in Organic Chemistry from Goa University, Goa, India. She pursued her postdoctoral research at Sanford-Burnham-Prebys Medical Discovery Institute, La Jolla, California, USA focusing on developing targeted nanoparticles for drug delivery. Priya is an author and co-inventor on over 40 scientific publications and patents. She has been recipient of Certificate of Merit from Goa University for Securing First Rank in B.Sc. in Goa University, Lions Club of Margao Silver Jubilee Endowment Cash Prize from Goa University for Securing First Rank in B.Sc. in Goa University, Coca Cola Gold Medal and Coca Cola Cash Prize from Goa University for Ranking First in Class in M. Sc. Chemistry Examination, S. K. Paknikar Research & Education Trust Endowment Cash Prize from Goa University for securing the Highest Marks in Organic Chemistry in M. Sc. Examination, Xth Indian Council of Chemistry Conference Endowment Cash Prize from Goa University for securing the Highest Marks in Chemistry M. Sc. Examination. She was awarded Doctoral Research Fellowship by the University Grants Commission, Government of India, in the year 2000 (through NET - an all India competitive test). She was selected as a top reviewer in pharmaceutical sciences for the year 2010 by Elsevier.

Editorial Team: Dr. Sachin B. Kakodkar (Asst. Prof), Dr. Manjita R. Porob (Head, Department of Chemistry)

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