Council of Scientific and Industrial Research (CSIR) Year End Review 2024

Significant Scientific & Technical Attainments during the year

- **CSIR-CRRI's REJUPAVE technology deployed in Arunachal Pradesh and Ladakh for high-altitude road construction**

  The indigenous road construction technology "REJUPAVE" developed by CSIR-Central Road Research Institute (CSIR-CRRI), to construct high altitude bituminous roads at low and sub-zero temperature conditions, was successfully utilized by the Border Road Organization (BRO) for high-altitude bituminous roads construction on China Border in state of Arunachal Pradesh. The technology has also been used by the BRO's project Vijayak in Kargil to construct high-altitude bituminous roads on the Drass-Umbala-Sankoo Road in Drass, Ladakh.

- **India's First National Highway Steel Slag Road section on NH-66 Mumbai-Goa National Highway inaugurated**

  V.K. Saraswat, Member (S&T), NITI AAYOG inaugurated India's First National Highway Steel Slag Road section on NH- 66 Mumbai-Goa National Highway on 15 January 2024. JSW Steel, under the CSIR-CRRI technological guidance, has constructed the 1 km long four lane steel slag road section on Indapur-Panvel Section of NH-66 Mumbai-Goa. For construction of this road around 80,000 tons of CONARC

Steel slag were converted as processed steel slag aggregates at JSW Steel Dolvi, Raigad plant.

- **CSIR's technical contributions in construction of Ram Mandir, Ayodhya and 'Surya Tilak' for Lord Ram on every Ram Navami**

The construction of Shri Ram Mandir, Ayodhya, has been technically assisted by CSIR. The "Surya Tilak" system has been designed by CSIR-Central Building Research Institute (CSIR-CBRI) and it will channel the ray on the idol's forehead from 12 noon for about six minutes. Every Ram Navami, an intricate network of lenses and mirrors will be used to channel a ray of sunlight in the sanctum sanctorum of the Ram temple in Ayodhya and converged on the forehead of Ram Lalla as "Surya Tilak". The Ram Mandir in Ayodhya has been meticulously engineered to endure seismic events that occur once every 2,500 years.

- **CSIR-NIO, Goa launches underwater vehicle, C-Bot, to monitor coral reefs**

CSIR launched the coral monitoring autonomous underwater vehicle, Coral Reef Monitoring and Surveillance Robot, or C-Bot, for long-term monitoring of coral reefs, developed by CSIR-National Institute of Oceanography (CSIR-NIO), Goa. The C-Bot, can reach depths of 200 meters.

- **India's first Lithium battery recycling pilot facility Inaugurated**

India's first Lithium Battery Recycling Plant installed under CSIR's Bulk Chemical Mission at CSIR-National Metallurgical Laboratory (CSIR-

NML), Jamshedpur was inaugurated. The initiative aligns with the Atmanirbhar Bharat vision, contributing to self-reliance in battery manufacturing. The Lithium Battery Recycling Plant at CSIR-NML is poised to contribute significantly to India's efforts towards environmentally responsible and resource-efficient technologies.

- **Successful Flight Tests of High-Altitude Pseudo Satellite**

CSIR-National Aerospace Laboratories (CSIR-NAL) successfully flew a prototype of a new-generation unmanned aerial vehicle (UAV), High-Altitude Pseudo Satellite (HAPS) that can fly at great heights, about 20 km from ground, runs entirely on solar power, and can remain in the air for months. The primary utility of HAPS vehicles is in the field of surveillance and monitoring, and other situations, like disaster management, wherein it can be very useful.

- **CSIR in partnership with KPIT, developed India's first indigenously built Fuel Cell Vessel**

India's first indigenously developed hydrogen fuel cell catamaran built by the Cochin Shipyard Limited (CSL) based on the Fuel Cell Technology of CSIR and KPIT, was launched. Built at a cost of Rs18 crore, the ferry will be handed over to the Inland Waterways Authority of India by the CSL after rigorous trials.

- **CSIR-NIIST Develops Sustainable Technology for Organic Wastewater Treatment**

The CSIR-National Institute for Interdisciplinary Science and Technology (CSIR-NIIST) has made a breakthrough by developing and patenting a sustainable technology for treatment and disposal of organic waste water discharged by hotels, restaurants, catering units and similar businesses, which is a big problem in cities, especially in locations without proper sewerage network. As a sustainable solution, the on-site waste water technology, named NOWA, has the advantage of recovering valuable resources like reuse quality water, bio-energy and organic manure and soil conditioner from waste-water.

- **CSIR-NEIST Discovers A New Flowering Plant, "Begonia Narahari" in Arunachal Pradesh; named 'Narahari' to honour former Director**

CSIR-North East Institute of Science and Technology (CSIR-NEIST), Jorhat in collaboration with University of Science and Technology Meghalaya (USTM), have discovered a new flowering plant named "Begonia Narahari" in the Lohit district of Arunachal Pradesh. After meticulous examination and comparison with known Begonia species

worldwide, the researchers confirmed its identity as a previously undescribed and new species within the genus Begonia. The species has been named "Begonia Narahari", to honour Prof G Narahari Sastry, the former director of CSIR-NEIST, Jorhat, for his remarkable efforts in establishing the Germplasm Conservation Centre for the bio-resources of Northeast India and his dedication to the region's welfare.

- **CSIR-CDRI Introduces Distinctive Oral Pill for Accelerated Fracture Healing**

CSIR-Central Drug Research Institute (CSIR-CDRI) has come out with an oral pill to help fasten the process of healing after a fracture. The institution is currently working on two bone healing entities, namely CDRI-1500 and CDRI-399. Necessary approvals from drug regulatory bodies have been received and the phase-1 clinical trials for CDRI-1500 will begin soon.

- **CSIR-IMTech Identified Promising Molecule for Parkinson's Cure**

CSIR-Institute of Microbial Technology (CSIR-IMTech) has discovered a molecule which could lead to developing a cure for Parkinson's, a neurodegenerative disease. The study, till now only carried out on mice, has shown promising results for one molecule. The researchers have filed an international patent for four molecules that have potential to provide cure for the disease.

- **CSIR-NAL transferred the final set of Engine Bay Door (EBD) parts for Tejas Mk1A to HAL**

CSIR-NAL handed over the third and final set of engine bay door (EBD) parts for the Tejas Mk1A, to Hindustan Aeronautics Limited (HAL). HAL had entered a Transfer of Technology (ToT) agreement with CSIR-NAL in November 2023, to manufacture Bismaleimide (BMI) EBD for the series production of Light Combat Aircraft Tejas Mk1A.

- **CSIR-CCMB develops new rice variety immune to Yellow Stem Borer**

CSIR-Centre for Cellular & Molecular Biology (CSIR-CCMB) and ICAR-Indian Institute of Rice Research (IIRR) in collaboration have developed a rice variety resistant to Yellow Stem Borer (YSB), a major pest in India that can cause up to 60% loss in rice production. The new research addresses these gaps by identifying key biomolecules involved in YSB resistance. This breakthrough is expected to significantly reduce the dependency on chemical pesticides, enhance rice yields, and provide a persistent solution to the YSB threat throughout the rice growing season.

- **CSIR-CMERI Unveils Electric Tiller for Sustainable Farming**

Electric Tiller designed and developed by CSIR-Central Mechanical Engineering Research Institute (CSIR-CMERI) was introduced .Tailored for small to marginal farmers, constituting over 80% of India's farming community, the tiller promises reduced operational costs and promotes sustainable farming practices. The Electric Tiller prioritizes user comfort and environmental sustainability, boasting enhanced torque, reduced

vibration, and zero exhaust emissions. Equipped with electronic controls and ergonomic handling, the Electric Tiller marks a significant milestone in agricultural machinery, aiming for a more sustainable and efficient farming future.

- **CSIR-NAL Advances Towards High-Altitude Platform (HAP) Development**

CSIR-NAL successfully test-flew a subscale High-Altitude Platform (HAP) to 25,000 feet on 7May 2024. HAPs, operating at 18-20 km above Earth, offer capabilities like surveillance, earth imaging, and telecommunications at a fraction of satellite costs, complementing satellite technology. Extensive ground tests and an additional sub-scale flight are planned over the next 18 months to refine the full-scale HAP prototype, aiming for unprecedented endurance and performance in high-altitude platforms.

- **CSIR-CIMFR's Controlled Blasting Process used in the construction of Tunnel-2, the longest tunnel in Mumbai Suburban Railway Network**

CSIR-Central Institute of Mining and Fuel Research (CSIR-CIMFR) guided the Mumbai Railway Vikas Corporation (MRVC) with the rock blasting process during the construction of Tunnel-2 (Wavarle Tunnel), the longest tunnel in the Mumbai Suburban Railway Network, as part of the Panvel-Karjat railway project under the Mumbai Urban Transport Project 3 (MUTP-3).

- **CSIR-IICT Develops new process to Manufacture High-Energy Rocket Propellant**

CSIR-Indian Institute of Chemical Technology (CSIR-IICT) in collaboration with Premier Explosives Ltd., has successfully developed an indigenous process to produce the key material used in CL-20, a high-energy propellant. CL-20 offers superior performance over traditional propellants like RDX and HMX, boasting a higher energy release and better oxidiser-to-fuel ratio, crucial for rockets and missiles. The breakthrough enables India to achieve self-sufficiency in propellant development for defence and space applications, marking a significant stride towards technological independence.

- **CSIR-CCMB Develops Non-Invasive Blood Test for Early Breast Cancer Detection**

CSIR-CCMB and Regional Cancer Centre (RCC), Thiruvananthapuram have identified a cost-effective, non-invasive method to detect breast cancer using a drop of blood. MicroRNA (miRNA) signatures have been analysed in hundreds of cancer samples, identifying 439 miRNAs linked to invasive breast cancer, with 107 as potential biomarkers for different types and stages of the disease.

- **CSIR-IGIB and LVPEI Develop Enhanced CRISPR-Cas9 System for Precision Genome Editing**

CSIR-Institute of Genomics and Integrative Biology (CSIR-IGIB) and LVPEI, along with collaborators, have developed an enhanced CRISPR-Cas9 based genome editing system, which is more precise and efficient

than existing technologies. The edited and validated Cas9 protein from Francisellanovicida (FnCas9), creating enFnCas9, showed normal protein expression and no detectable off-target alterations, proving the efficacy and safety of the enFnCas9-based CRISPR tool for precise genome editing. This development is a significant step towards therapeutic applications for genetic disorders in the Indian population, highlighting the importance of advancing gene correction tools for clinical use and market authorization.

- **CSIR Launches National Mission on Sustainable Packaging Solutions**

The CSIR has launched a National Mission on Sustainable Packaging Solutions. The mission, coordinated by CSIR-NIIST, Thiruvananthapuram, involves a consortium of eight partnering CSIR labs and industry partners. The mission aims to address sustainable packaging demands by developing advanced packaging materials, smart recycling, and reuse methods. It seeks to transform the packaging industry to be smart, affordable, and reliable, incorporating advanced testing and monitoring facilities.

- **Tata International and CSIR-CLRI Launch Eco-Friendly Phoenix Leather**

Phoenix Leather, developed in collaboration of CSIR-Central Leather Research Institute (CSIR-CLRI) and Tata International, has been introduced as an eco-friendly product in the Earth care Leather range of Tata International. The patented "GENOCORIUM" process converts

leather trim waste into high-quality reconstituted leather sheets, reducing water pollution and greenhouse gas emissions.

- **CSIR-IMTECH Develops Promising SARS-CoV-2 Vaccine**

CSIR-IMTech, Chandigarh, in collaboration with Centre for Infectious Disease Research (CIDR), IISc, Bengaluru and National Institute of Immunology (NII), New Delhi developed a protein subunit-based vaccine candidate, IMT-CVAX, showing "near-complete protection" in preclinical studies. IMT-CVAX is an engineered trimeric spike protein antigen designed to combat SARS-CoV-2 variants, generating robust immune responses in preclinical tests on mice and hamsters. The vaccine's large-scale production is feasible, with efficient storage in standard refrigerators, making it ideal for mass immunization. IMT-CVAX has been internationally patented, and the study shows its potential to provide long-lasting immunity against future SARS-CoV-2 infections.

- **CSIR-NAL Unveils Indigenous Kamikaze Drones for India's Defence**

CSIR-NAL has unveiled the development of swadeshi Kamikaze Drones, capable of flying up to 1,000 kilometers with home-built engines, enhancing India's defense capabilities. The Indian kamikaze drone, measuring 2.8 meters in length and carrying a 25 kg explosive charge, can hover for up to nine hours before striking its target. Powered by a 30-horsepower Wankel Engine developed by CSIR-NAL, the drone

can operate in GPS-denied environments and navigate using India's NAViC system.

- **CSIR Floriculture Mission Empowers Women in Ramban, J&K with Marigold Farming**

  Women in Ramban district, J&K, are increasingly adopting marigold farming under CSIR's Floriculture Mission. The initiative, led by CSIR, provides training, guidance, and free seeds and helps women shift from traditional maize farming to more lucrative, convenient, and environmentally friendly marigold cultivation.

- **CSIR-IHBT Empowers Farmers in Meghalaya with Aromatic Crop Training**

  A team from the CSIR-Institute of Himalayan Bioresource Technology (IHBT), Palampur, in collaboration with the Institute of Natural Resources (INR), Shillong, conducted training-cum-awareness program on agro and processing technologies of aromatic crops from 3-4September 2024. The farmers were provided practical training on agronomic practices and post-harvest processing of aromatic crops suitable for Meghalaya's climate, which have significant potential to improve livelihoods in the region. The team also visited the farm fields and provided hands-on demonstrations and assess the current state of aromatic grass cultivation.

- **CSIR-SERC Conducts Load Deflection Test on Pamban Rail Bridge Centre Span**

Load deflection test on the New Pamban Bridge was carried out by Rail Vikas Nigam Limited (RVNL) in collaboration with CSIR-Structural Engineering Research Center (CSIR-SERC), Chennai. The trial was conducted using twin GOC WDG4D locomotives from the Golden Rock Shed. The purpose of the test was to assess the structural integrity and performance of the bridge under load conditions. The health monitoring using the state of the art sensing technologies, monitoring systems and control stations along with health assessment tools have been established by CSIR-SERC on the navigational vertical lift span of the bridge.

- **CSIR-NCL and CeNS Develop New Piezoelectric Nanocomposite for Energy Harvesting**

CSIR-National Chemical Laboratory (CSIR-NCL), Pune in collaboration with Centre for Nano and Soft Matter Sciences (CeNS), Bengaluru, have developed a new piezoelectric polymer nanocomposite for security alert system, enhancing energy harvesting in flexible electronics. This development was based on the finding that metal oxide nanomaterials with appropriate crystal structure and surface properties when used as fillers in a polymer composite lead to a significant enhancement in the piezoelectric response.

- **CSIR-CFTRI Collaborates with McDonald's to Launch Multi-Millet Buns**

CSIR–Central Food Technological Research Institute (CSIR-CFTRI) launched a multi-millet bun in collaboration with McDonald, as part of the National Nutrition Week program, taking a step towards enhancing the health and nutrition profile. The nutritional buns are made of five nutrient-rich millets like bajra, ragi, jowar, proso and kodo. The millets are sourced locally, from various regions including Gujarat, Maharashtra, Karnataka, Rajasthan, Tamil Nadu, Madhya Pradesh and Chhattisgarh. The CSIR-CFTRI's multi-millet bun was launched by McDonalds in Mumbai, with a focus on the customer base in South and West India, initially. Wheat flour has been replaced by 22 per cent millets. The millets have been sourced from more than 5,000 farmers across India, the initiative has potential to uplift and empower the farmers of the country.

- **CSIR-CCMB Develops Rapid Test for Sickle Cell Anaemia**

CSIR-CCMB, Hyderabad has developed an accurate, rapid, and affordable molecular test for screening sickle cell anaemia (SCA). This test uses indigenously developed reagents and is designed to better detect the prevalence of this genetic disease, which affects a significant portion of both the tribal and mainland populations in the

- **CSIR-CBRI to Address the Structural Stability of Airports**

In response to a series of structural failures at various airports, including the partial collapse of a canopy at Terminal 1 (T1) of Delhi's

Indira Gandhi International Airport in June, the Ministry of Civil Aviation has assigned CSIR-CBRI for advising airport operators across the country on structural safety and integrity. The decision to engage CSIR-CBRI follows several concerning incidents, including canopy collapses at Jabalpur and Rajkot airports in June. CSIR-CBRI will guide the structural aspects of airport infrastructure, ensuring operators take necessary precautions to prevent such occurrences in the future. The Ministry of Civil Aviation also plans to organizing technical workshop for airport operators with the involvement CSIR-CBRI, where experts from the institute will provide specialized training on structural safety and resilience.

- **CSIR-CSIO develops AI-powered Drone for Automatic Target Identification**

CSIR-Central Scientific Instruments Organisation (CSIR-CSIO) has developed a drone-mounted software framework to enable automatic detection of objects like humans, bunkers and tanks from optical images and pinpoint their exact location. The framework is meant to enhance UAV capabilities in surveillance and automation. Unlike the video or still feed from an airborne drone, which is viewed and analysed by controllers to locate objects or targets, in the current technology the system itself identifies the desired objects based on the task at hand.

- **CSIR-NAL and HAL to support India's Aircraft Design and Manufacturing**

  CSIR-NAL and HAL will collaborate with industry leaders to drive the development of domestic aircraft design and manufacturing, an initiative of Ministry of Civil Aviation supporting *Aatmanirbhar Bharat*.

- **CSIR-NCL's Enhanced Oxygen Systems for MiG-29 Fighter Jets**

  CSIR-NCL has upgraded the On-Board Oxygen Generation System (OBOGS) for MiG-29 jets, boosting oxygen supply during high-altitude missions. The project for the Indian Navy aimed to improve pilot safety. Zeolite-based technology in OBOGS has an enhanced 85% pure oxygen, up from 30%, due to a specialized rejuvenation process developed by CSIR-NCL. Tests in Goa confirmed the upgrade, with about 54 kg of zeolite material rejuvenated for multiple MiG-29 jets. Indigenous zeolite production ensures system longevity, supporting Navy operations with locally sourced, enhanced oxygen solutions.

- **CSIR's first-of-its-kind initiative for development of Indian Breast Cancer Genomic Atlas (IBCGA) for India-Specific Cancer Resources**

  CSIR-CCMB is developing the Indian Breast Cancer Genomic Atlas (IBCGA) by mapping nearly 1,000 breast cancer tumor genomes across India. This first-of-its-kind initiative aims to identify molecular features specific to Indian breast cancer cases, which could enhance clinical management and treatment options.

- **CSIR-4PI Tracks India-Tibet Tectonic Movements with Precision GPS Stations**

India's tectonic plate is subducting under the Tibetan plate, causing gradual land loss and elevation gain in the Himalayas. CSIR-Fourth Paradigm Institute (CSIR-4PI)has set up GPS reference stations at Hanle (Ladakh) and Bengaluru to monitor these movements precisely. Data from these stations helps scientists understand strain build-up and earthquake potential in the Himalayan region.

- **CSIR-CEERI, C-DOT Collaborate for Development of Multiport Switch for Future Telecom Systems**

CSIR-Central Electronics Engineering Research Institute (CSIR-CEERI) has partnered with C-DOT to develop a "Multiport Switch with Tuneable Impedance Matching Network," aiming to cover 2G, 3G, 4G, and 5G bands with a single broadband antenna. Funded by the Telecom Technology Development Fund (TTDF), the project supports Indian startups and R&D institutions in creating advanced telecom solutions.

- **CSIR-NML Transfers Advanced PCB Recycling Technology to Nova sensa Pvt. Ltd.**

CSIR-NML has transferred its advanced PCB recycling technology to Novasensa Pvt. Ltd., New Delhi, with aim to tackle e-waste crisis. The process adheres to zero-waste principles, reducing pollution and conserving natural resources by recovering critical materials from e-waste.

- **CSIR-NIIST Launches 'Jaivam', an Eco-friendly and High-speed Composting of Organic Waste**

The CSIR-NIIST, Thiruvananthapuram has developed a microbial consortium, named 'Jaivam,' for facilitating a clean and speedy composting process and producing good quality compost for agricultural use. The development of Jaivam and similar R&D initiatives by CSIR-NIIST will help address challenges such as greenhouse gas emission (methane and nitrous oxide) from bulk composting facilities and improve the compost quality through bio-augmentation.

- **CSIR-NGRI Discovers Potential Geothermal Reservoir in Eastern Ladakh**

CSIR-National Geophysical Research Institute (CSIR-NGRI) has uncovered a potential new geothermal reservoir in eastern Ladakh, opening opportunities for sustainable energy development in the region. The research was conducted along the Ukdungle-Hanle-Koyul-Fukche profile, where NGRI scientists used magneto telluric surveys to map the crustal structure over a 40 km stretch.

- **Asia's First Highway with Bio-Bitumen Surface Inaugurated**

Hon'ble Union Minister for Road Transport and Highways, Shri Nitin Gadkari, inaugurated a 1km stretch of Asia's first highway with a bio-bitumen blended surface developed using CSIR-CRRI technology. The trial patch begins near the 'Kamptee 22Km' milestone on Jabalpur-Nagpur route. The project will help cut pollution from stubble burning

as the source of bio-bitumen comes from easily available crop stubble, which farmers can sell instead of torching the residue.

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