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**FORUM FOR INDIAN
SCIENCE DIPLOMACY**

SCIENCE DIPLOMACY NEWS ALERTS | 16-30 NOVEMBER 2021 | ISSUE 74

www.fisd.in

NEWS ALERT

Forum for Indian Science Diplomacy

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[Methane from carbon dioxide](#)

Scientists from the King Abdullah University of Science and Technology (Thuwal, Saudi Arabia) used a nickel-containing metal-organic framework (Ni-MOF-74) as their starting material for producing an efficient, economical catalyst for the photothermal methanation of CO₂. Controlled pyrolysis of this material at 600°C decomposed the Ni-MOF-74 to form uniform finely distributed nickel nanoparticles embedded in a porous graphitic carbon matrix. The resulting material, named Ni@C, demonstrated a high rate of conversion and high selectivity for methanation under artificial UV, visible, and IR light. In a continuous process in a flow-type reactor, the efficiency of the catalyst remained stable over a period of more than 12 hours.

[New group of antibacterial molecules identified](#)

Researchers at Karolinska Institutet, Umeå University, and the University of Bonn have identified a new group of molecules that have an antibacterial effect against many antibiotic-resistant bacteria. Since the properties of the molecules can easily be altered chemically, the hope is to develop new, effective antibiotics with few side effects. The team tested a large number of chemical compounds for their ability to lyse pneumococci, bacteria that are the most common cause of community-acquired pneumonia. After a careful follow-up of active compounds from this screening, the researchers found that a group of molecules called THCz inhibits the formation of the cell wall of the bacterium by binding to lipid II. The molecules could also prevent the formation of the sugar capsule that pneumococci need to escape the immune system and to cause disease.

[Technology for large-scale low cost energy storage](#)

Researchers at Linköping University have developed a system for energy storage that uses wood-based lignin electrodes in rolled form, and a new type of water-based electrolyte. The technology is safe, cheap and sustainable and the power density is 5 kW/kg. The electrodes are manufactured from wood-based material in a printing press. The polyelectrolyte consists of a highly concentrated water-based polymer, potassium polyacrylate. The electrodes are made of biopolymer lignin (as positive electrode) and polyimide mixed with conductive carbon (as negative electrode). The self-discharge rate is less than 0.5 V in 100 hours. The new technology uses cheap raw materials which cost less than 1 USD/kg and are readily available and non-flammable materials, and the technology can be scaled up to large batteries. It is a sustainable solution for large-scale and safe energy storage.

[Weekly exposure to deep red light in the morning can improve declining vision](#)

UCL Researchers have found that just three minutes of exposure to deep red light once a week, when delivered in the morning, can significantly improve declining eyesight. The exposure to longwave deep red light 'switched on' energy producing mitochondria cells in the human retina, helping boost naturally declining vision. There was, on average, a 17 per cent improvement in participants' colour contrast vision when exposed to three minutes of 670 nanometre (long wavelength) deep red light in the morning and the effects of this single exposure lasted for at least a week. However, when the same test was conducted in the afternoon, no improvement was seen. This could help with eye health and lead to affordable home-based eye therapies, helping millions of people globally with naturally declining vision.

[New technique improves conversion of carbon dioxide into liquid fuels](#)

Researchers at Lawrence Berkeley National Laboratory (Berkeley Lab) have developed a promising route for turning CO₂ emissions into a fuel feedstock by using modified

copper catalysts to assist the reaction. They used thin layers of ionomers, polymers that allow certain charged molecules (ions) to pass through while excluding others. They coated the surface of the copper catalyst with two common ionomers, Nafion and Sustainion. The researchers applied a thin layer of each ionomer, as well as a bilayer of both ionomers, to copper films supported by a polymer material, forming membranes that they could insert near one end of an electrochemical cell. For the two-layer case, they found that carbon-rich products accounted for 80 per cent of the energy consumed by the reaction—up from 60 per cent in the un-coated situation. The researchers found that pulsing the voltage achieved a 250 per cent increase in carbon-rich products compared to uncoated copper and a constant voltage. The next step is to scale up production of the coated catalyst and optimize the process.

COVID-19

COVID-19 (WORLD)

[Deer can carry the coronavirus](#)

Researchers from Penn State University have found that more than 80 percent of Iowa's wild and captive white-tailed deer population tested positive for SARS-CoV-2 between late November 2020 and January 2021 of this year. This discovery raises the possibility of animal reservoirs for SARS-CoV-2 and for an evolved version of the coronavirus to jump back into humans. Recent genome sequencing of SARS-CoV-2 present in white-tailed deer indicated that related groups of virus variants found in the animals mapped closely to those circulating in humans. Although the deer appear to be asymptomatic for now, researchers concern is that the coronavirus could continue to evolve as it passes from deer to deer and could eventually return to humans as something far more virulent and evasive of our natural (and vaccinated) immunity. This work highlights the need to carry out comprehensive SARS-CoV-2 surveillance of other susceptible animals such as deer, mice, mink etc.

[New Omicron variant found](#)

Scientists have detected cases of a new variant of SARS-CoV-2, in southern Africa, Botswana, Hong Kong, Europe, and other countries. Omicron (B.1.1.529) has an unprecedentedly large number of mutations in the part of its genome that encodes a key section of its spike protein, which the virus uses to infect host cells. This suggests that the immune protection afforded by vaccines may be less affective against Omicron. There are around 50 mutations across the entire genome of the virus and more than 30 in the part that codes for its spike. There are a large number of changes, about 15 within the receptor-binding domain (RBD) of the new variant. The Omicron genome also has a cluster of mutations associated with more efficient entry into host cells and enhanced transmissibility. In addition, it has a mutation associated with resistance to the body's first line of defense against newly encountered pathogens, known as the innate immune system. On November 26, 2021, the World Health Organization (WHO) trusted source designated B.1.1.529 a variant of concern and gave it the name Omicron (the 15th letter of the Greek alphabet).

COVID-19 (INDIA)

[India to export 50 million doses of Covid-19 vaccine Covovax to Indonesia](#)

The Indian government has permitted export of 50 million doses of Covovax, a COVID-19 vaccine produced by the Serum Institute of India (SII), to Indonesia. According to the sources, the SII submitted an application seeking grant of emergency use authorization for Covovax and it is still awaiting approval from the Indian drug regulator. M/s PT Indofarma Tbk, Indonesia wants to purchase these quantities. This export will not affect COVID-19 vaccine supplies to India as a huge stock of Covishield

is available to meet requirements of the country. The SII had obtained permission to manufacture and stock Covovax on May 17. US-based vaccine maker Novavax Inc had announced a licence agreement with the SII for the development and commercialization of Covovax (NVX-CoV2373), its COVID-19 vaccine candidate, in low and middle-income countries including India.

New Covid-19 variant: India on alert

The central Government of India instructed all states and Union Territories (UTs) to ensure rigorous screening and testing of travellers from South Africa, Hong Kong and Botswana, where multiple cases of a Covid-19 variant B1.1.529 have been reported in Botswana (3 cases), South Africa (59 cases) and Honk Kong (1 case). Samples of travellers turning positive are sent to designated genome sequencing laboratories promptly. This variant is reported to have a significantly high number of mutations, including of the spike protein structure, the target of many vaccines, and thus, has serious public health implications. The contacts of these international travellers must also be closely tracked and tested as per existing guidelines.

Effectiveness of COVISHIELD vaccine

Indian researchers led by the Translational Health Science and Technology Institute (THSTI) evaluated the real-world vaccine effectiveness of Covishield during the SARS-CoV-2 infection surge between April and May, 2021 in India. Comparing 2379 cases of confirmed SARS-CoV-2 infection and 1981 controls, the vaccine effectiveness against SARS-CoV-2 infection in fully vaccinated individuals was found to be 63 per cent. The vaccine effectiveness of complete vaccination against moderate-to-severe disease was much higher at 81 per cent. Scientists also observed that the Spike-specific T-cell responses were conserved against both the delta variant and wild-type SARS-CoV-2. Such cellular immune protection might compensate for waning humoral immunity against the virus variants and prevent moderate-to-severe disease and need for hospitalization.

INDIA – SCIENCE & TECHNOLOGY

Therapeutics to treat Autism Spectrum Disorder

Indian researchers have developed a compound called ‘6BIO’ that can provide a better method to treat Autism Spectrum Disorder (ASD). The researchers have determined the potency of the compound in a pre-clinical mice model. This is the first compound that has been proved in pre-clinical evaluation to have the potential for improving daily activities like learning and recollecting new tasks in patients with ASD/intellectual disability (ID). The administration of 6BIO restores the neuronal function, learning and memory, and reduces epileptic seizures in mice.

India launches the 41st Scientific Expedition to Antarctica

India has successfully launched the 41st Scientific Expedition to Antarctica with the arrival of the first batch of its contingent of 23 scientists and support staff at the Indian Antarctic station Maitri. Four more batches will be landing in Antarctica by mid-January 2022. The 41st expedition has two major programs. The first program encompasses geological exploration of the Amery ice shelf at Bharati station. The second program involves reconnaissance surveys and preparatory work for drilling of 500 meters of ice core near Maitri. The ice core drilling will be done in collaboration with the British Antarctic Survey and the Norwegian Polar Institute. The Indian Antarctic program began in 1981 and has completed 40 scientific expeditions, and built three permanent research base stations in Antarctica, named Dakshin Gangotri (1983), Maitri (1988) and Bharati (2012). The National Centre for Polar and Ocean Research (NCPOR), Goa - an autonomous institute under the Ministry of Earth Sciences manages the Indian Antarctic program.

MoU for India's first Medical Robotics Centre

The Indian Institute of Technology Delhi and Indraprastha Institute of Information Technology (IIIT), Delhi have tied up to set up India's first Medical Robotics Centre (MCC) at IIIT Delhi. The MCC will be a technology-enabled medical simulation and training facility for young resident doctors. It will act as a validation centre for research outcomes in the area of healthcare robotics and digital health. The centre would facilitate the training of other healthcare professionals, paramedical staff, technicians, engineers and researchers. Training will be offered at multiple levels (basic/advanced) in urology, neurology, laparoscopy and other domains.

'Spongy' liquid to clean up industrial carbon dioxide

Researchers from IIT Bombay have designed a porous liquid to capture/store carbon dioxide, and subsequently convert it to calcium carbonate—an industrially valuable chemical. The novelty lies in combining porosity, and catalytic activity within a liquid to convert carbon dioxide into calcium carbonate which can be removed from the porous liquid, for the latter to be reused. This porous liquid with honey-like viscosity is simple to manufacture and easy to integrate with continuous flow industrial processes. It is stable at industrial working temperatures. The porous liquid can also store the trapped carbon dioxide at low temperatures.

Molecular mechanisms for desalination techniques

Researchers at the Indian Institute of Technology-Madras together with Swinburne University of Technology, Australia and the Netherlands-based Delft University of Technology have identified the possible molecular mechanisms in water flow through a new nanopore geometry for desalination techniques to convert seawater to drinking water. The results of the study will be useful in the design of novel RO (reverse osmosis) systems that utilize carbon nanotubes-based membranes.

New low cost semiconductor manufacturing process

Indian scientist has indigenously developed a low-cost semiconductor manufacturing process and used it to design integrated circuits (ICs) that can handle voltages up to 20 V. These developed high voltage devices along with the processes were integrated into the CMOS (Complementary Metal Oxide Semiconductor) process flow of Semiconductor Laboratory (SCL), Mohali in a cost-effective manner. The technology is in the 4th stage of the Technology Readiness Level and could be used to design clock drivers, high voltage switches, power management ICs (PMICs), and battery management ICs. The testing of the developed devices has been carried out at IIT Gandhinagar and Semiconductor Laboratory, Mohali and Space Application Centre, Ahmedabad. Once qualified, this technology will be an asset for space and defense applications. The indigenous development of the CMOS-DMOS technology and the availability of low-cost semiconductor processes in India will open up more design activities and encourage technical start-ups in PMICs.

DBT-NBRC develops project SWADESH

DBT-National Brain Research Centre (DBT-NBRC), Haryana has recently developed project SWADESH, a unique brain initiative focusing on certified neuroimaging, neurochemical, neuropsychological data and analytics that are made accessible to researchers for managing brain disorders. SWADESH is the first large-scale multimodal neuroimaging database designed specifically for the Indian population with big-data architecture and analytics for various disease categories under one platform. To strengthen Alzheimer's disease (AD) research and help the scientific community come up with promising treatments. SWADESH proposes a big-data architecture that manages and analyzes six modules, namely neurodegenerative [AD, mild cognitive impairment (MCI), and Parkinson's disease (PD)], neuropsychiatric (schizophrenia and bipolar disorder), neurodevelopmental (autism and epilepsy), COVID-19-related

disorders, other disorders, and healthy subjects. SWADESH is supported by JAVA-based workflow environment and Python. Backed by a dedicated storage system, it provides quality control, data analysis reports, and data backups. Its development will facilitate the integration of multi-site data and collaborative research worldwide.

[Indian Bio-Jet Fuel technology receives formal military certification](#)

CSIR-IIP Dehradun's homegrown technology to produce bio-jet fuel has been formally approved for use on military aircraft of the Indian Air Force (IAF). The technology, developed by the Indian Institute of Petroleum (CSIR-IIP), has undergone evaluation tests and trials over the last three years with military and civil aircraft under a variety of conditions. Indian bio-jet fuel can be produced from used cooking oil, tree-borne oils, short gestation oilseed crops grown off-season by farmers, and waste extracts from edible oil processing units. It will reduce air pollution by virtue of its ultra-low sulphur content compared with conventional jet fuel and contribute to India's Net-Zero greenhouse gas emissions targets. It will also enhance the livelihoods of farmers and tribals engaged in producing, collecting, and extracting non-edible oils.

[Smart device to protect power-grids from short-circuits](#)

Researchers from IIT Kanpur have developed a prototype device that could limit a current surge by developing high resistance in the current path. The indigenously developed Smart Superconducting Fault Current Limiter (SCFLsm) works on a similar principle as superconductors offer zero resistance to currents up to a threshold current value. At currents beyond the critical current, the resistance of the superconductor becomes high. Thus, the SCFL's operating principle is that when the fault current exceeds the critical current of the superconductor, its resistance becomes high. This reduces the fault current. In the SCFLsm system, the circuit is connected in parallel to a low resistance shunt through a switch. An array of hall sensors allows continuous monitoring of current flowing through different regions of the superconductor used in the SCFLsm.

IN BRIEF

[Synthetic biology yields easy-to-use underwater adhesives](#)

Researchers at Washington University in St. Louis have developed a method that uses engineered microbes to produce the necessary ingredients for a biocompatible adhesive hydrogel that is as strong as spider silk and as adhesive as mussel foot protein (Mfp), which means it can stick to a myriad of surfaces underwater. Using synthetic biology, they produced a silk-amyloid hybrid protein that was stronger than steel and tougher than Kevlar. The team integrated the silk-amyloid protein with Mfp and, using a synthetic biology approach, synthesized a tri-hybrid protein that has the benefits of both the strong adhesion of Mfp and the high strength of spider silk. Using the tri-hybrid protein, they prepared adhesive hydrogels. Because the protein-based adhesive can be biocompatible and biodegradable, it could have applications in tissue repair, especially for tendon-bone repair, which suffers from a high failure rate from current suture-based strategies. By controlling bacteria to modify each motif of the protein, including parts from spider silk and mussel foot proteins, they can control the adhesion and strength of the hydrogel, tailoring it to meet the specific requirements for tendon-bone repair and other tissue repair needs.

[Salvaging rare earth elements from electronic waste](#)

Researchers at Penn State University have found a method to separate and recycle rare earth elements using plant cellulose, an inexpensive renewable resource. In the process, hairy cellulose nanocrystals, nanoparticles derived from cellulose fibrils, bind selectively to neodymium ions, separating them from other ions, such as iron, calcium and sodium. The nanoparticles are known as "hairy" due to cellulose chains attached to

their two ends, which perform critical chemical functions. The researchers negatively charged the hairy layers of the nanoparticles in order to attract and bind with the positively charged neodymium ions, resulting in particle aggregation into larger pieces that can then be effectively recycled and reused.

[New lignin based material to replace fossil plastics and adhesives](#)

Researchers at Stockholm University have developed a resource-efficient method to produce new lignin-based materials that can be thermally reprocessed and used to substitute thermosetting resins and adhesives. The team used lignin (a by-product from the pulp and paper industry) as the renewable raw material in a catalyst-free reaction with a non-toxic chemical derived from ethylene glycol. The product is a black and plastic-like material that could be cast to various shapes using conventional technology such as injection molding. The new lignin-based materials can be used several times, which is central to a circular material economy. The researchers measured mechanical strength of the pristine material and again from the same material that was reprocessed from the fractured sample. The mechanical strength was comparable to that of engineered plastics and remained unchanged after the reprocessing. The scientists also discovered that the material performance could be tailored from hard and brittle to soft and tough simply by changing the amount of lignin used in the formulation. The ability to tune the material properties opens many opportunities to commercial applications.

[NASA tests next-generation indoor farming](#)

NASA has launched a new generation indoor farming technique based on controlled environment agriculture. NASA's pilot two-acre farm produces similar yields to a 720-acre outdoor farm with the use of just 1 per cent water used in traditional farming. The method optimizes plant growth and maximizes efficiency by combining plant science and environmental control along with frequent incorporation of vertical growth structures. Filtering of contaminants from crop water, delivering precise nutrient balances, and artificial controlled lighting and environmental controls to maintain ideal temperature and humidity are part of the process. The development of indoor farming technology is also essential during long-term space exploration, by growing plants using less water, energy and without soil. It is estimated that the industry of vertical farming and indoor farming in general, which currently stands at \$2.9 billion, will skyrocket to \$7.3 billion by 2025.

['Super jelly' can survive being run over by a car](#)

Researchers at the University of Cambridge have developed a jelly-like material that can withstand the equivalent of an elephant standing on it, and completely recover to its original shape, even though it's 80 per cent water. The soft-yet-strong material looks and feels like a jelly, but acts like an ultra-hard, shatterproof glass when compressed, despite its high-water content. The non-water portion of the material is a network of polymers held together by reversible on/off interactions that control the material's mechanical properties. The 'super jelly' could be used for a wide range of potential applications, including soft robotics, bioelectronics or even as a cartilage replacement for biomedical use. The researchers used molecules called cucurbiturils, a crosslinking molecule which holds two guest molecules in its cavity. The compressive strength could be easily controlled through simply changing the chemical structure of the guest molecule, with the mechanical performance of the final hydrogel ranging from rubber-like to glass-like states. Team is working to further develop these glass-like materials towards biomedical and bioelectronic applications.

Space debris from Russian anti-satellite test will be a safety threat for years

Space debris created by a Russian anti-satellite missile test will pose a threat to satellites in low Earth orbit as well as astronauts aboard the International Space Station for years to come. The anti-satellite (ASAT) test targeted the 2 ton defunct Soviet surveillance satellite Cosmos 1408, at an altitude of about 650 kilometers, creating over 1,500 trackable fragments immediately upon the strike, and hundreds of thousands of smaller pieces that are invisible to Earth-based observers. The space debris has forced the astronauts and Russian cosmonauts aboard the International Space Station (ISS) to repeatedly take refuge in their transport vehicles. Experts now warn that this space debris will remain a danger for years to come, threatening satellites in low Earth orbit (LEO), the heavily used region of space closest to Earth, as well as space station crews. Preliminary calculations suggest that the cloud of debris will increase the number of avoidance maneuvers performed by satellite operators all over the world by more than 100 per cent in the next few years. In 2019, India conducted an anti-satellite missile test, which, however, targeted a satellite much closer to Earth, at about 282 kms. Most of the debris created by that strike therefore entered Earth's atmosphere within weeks or months. The impact of the Russian ASAT test is more serious due to the higher altitude of the target satellite. Debris from an ASAT test conducted by China in 2007, which targeted a satellite at an even higher altitude of 865 kms, is still a major source of collision hazard in low Earth orbit today.

US imposes ban on 27 technology entities

The US Commerce Department's Bureau of Industry and Security (BIS) has added twenty-seven foreign entities and individuals to the Entity List for engaging in activities that are contrary to the national security or foreign policy interests of the United States. The twenty-seven entities and individuals are located in the People's Republic of China (PRC), Japan, Pakistan and Singapore. One entity based in Russia was added to the Military End-User (MEU) list. The move is to help prevent the diversion of U.S. technologies to the PRC's and Russia's military advancement and activities of non-proliferation concerns like Pakistan's unsafeguarded nuclear activities or ballistic missile program. The list includes 8 technology entities based in the PRC are being added to the list while 16 sixteen entities and individuals operating in PRC and Pakistan were added to the Entity List based on their contributions to Pakistan's unsafeguarded nuclear activities or ballistic missile program.

SCIENCE POLICY AND DIPLOMACY

First global agreement on the Ethics of Artificial Intelligence

All the member states of the UN Educational, Scientific and Cultural Organization (UNESCO) adopted on 25 November a historical text that defines the common values and principles needed to ensure the healthy development of Artificial intelligence (AI). AI is present in everyday life, and is also supporting the decision-making of governments and the private sector, as well as helping combat global problems such as climate change and world hunger. Challenges such as increased gender and ethnic bias, significant threats to privacy, dignity and agency, dangers of mass surveillance, and increased use of unreliable AI technologies in law enforcement, etc., arise. The adopted text aims to guide the construction of the necessary legal infrastructure to ensure the ethical development of this technology. The text aims to highlight the advantages of AI, while reducing the risks it also entails and to ensure that digital transformations promote human rights and contribute to the achievement of the Sustainable Development Goals, addressing issues around transparency, accountability and privacy.

Science Ministers from India and UK discuss Green Energy collaboration

Science Ministers of India and the United Kingdom, Dr Jitendra Singh and George

Freeman discussed Green Energy collaboration between the two countries as well as host of other issues of mutual interest during an online meeting. The UK has emerged as India's second largest international research and innovation partner. The India-UK Science & Technology (S&T) collaboration has been growing at a rapid pace and the joint research programme has gone from an almost zero base to close to £300-400 million. India-UK S&T partnership covers all aspects of Research and Innovation from discovery to development to translation.

WISER launched by Indo-German Science & Technology Centre

To promote women in the field of research and development, the programme called Women's Involvement in Science and Engineering Research (WISER) was launched by Indo-German Science & Technology Centre (IGSTC) for encouraging women researchers in joint R&D projects. This program by IGSTC, a joint initiative of the Department of Science and Technology (DST), Government of India and the Federal Ministry of Education and Research (BMBF), Government of Germany, will support women scientists holding regular/long term research positions in academia or research institutes/industry. The involvement in the program will be possible through lateral entry. There is neither requirement of break-in-career nor any age limit, and it will enable easy participation.

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