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NEWS ALERT

Forum for Indian Science Diplomacy

RIS Science Diplomacy News Alert is your fortnightly update on Indian and global developments in science research, technological advancements, science diplomacy, policy and governance. The archives of this news alert are available at http://fisd.in. Please email your valuable feedback and comments to science.diplomacy@ris.org.in

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Self-folding natural plant material for 'intelligent' green products

Combining sunflower pollen with printer toner, scientists from Nanyang Technological University, Singapore (NTU Singapore) have developed a paper like material that is able to fold itself into new shapes in response to environmental humidity. The team demonstrated their method, by creating several geometrical configurations, from straws and boxes to more complex forms like a 3D paper orchid. The printed pollen paper's ability to fold into 3D configurations demonstrates its potential for use in 'intelligent' green products such as self-folding envelopes, boxes, and food containers. The material also has the potential to be used in 'origami robots' – flat sheets that can fold autonomously into 3D shapes – for electronic and biomedical applications with special shape requirements, shape-dependent tissue engineering, and stimuli triggered drug delivery. The NTU research team has filed a patent application for potential commercialization of the technology.

Ferritin-based nanomedicine for targeted leukemia therapy

Researchers from the Institute of Process Engineering (IPE) of the Chinese Academy of Sciences, Peking University and Zhujiang Hospital of Southern Medical University have developed a ferritin (Fn)-based nanomedicine for targeted delivery of arsenic (As) and efficient therapy against diverse leukemia types. Through screening large numbers of clinical samples, researchers confirmed that patients with different forms of leukemia featured stable and strong expression of CD71.Fn can bind to CD 71 and has a unique interior cavity, which are favorable for drug accommodation. The medicinal form of the chemotherapeutic drug arsenic trioxide (ATO), was efficiently loaded inside the Fn. In terms of therapeutic efficacy, As @Fn outperformed the gold standard in diverse cell line-derived xenograft models, as well as in a patient-derived xenograft model.

'Virus-killing' air filtration system

A new carbon-based air filtration nanomaterial capable of capturing and destroying various viruses, including animal coronavirus, a close relative of SARS-CoV-2—the virus that causes COVID-19—has been developed by Cambridge scientists and engineers. The prototype, has been developed and tested by a multidisciplinary team. It is equipped with ultra-thin carbon nanotube electrically conductive membranes. This new conductive filtration membrane enables simultaneous virus filtration and sanitization by thermal flashes via resistive heating to temperatures above 100°C, deactivating viruses, including beta coronavirus, in seconds. The researchers say the multifunctional filter could be especially useful at fighting the viral spread of airborne diseases in confined environments such as emergency vehicles, hospitals, leisure and education centers, whether it is used as a standalone unit or in conjunction with heating, ventilation, and air conditioning (HVAC) filtration systems.

Method to boost energy generation from microalgae

Scientists from Nanyang Technological University, Singapore have found that encasing algae protein in liquid droplets can dramatically enhance the algae's light-harvesting and energy-conversion properties by up to three times. This energy is produced as the algae undergoes photosynthesis which captures sunlight and turns it into chemical energy.

Artificial photosynthesis may be a sustainable way of generating electricity that does not rely on fossil fuels or natural gas. Boosting the overall electricity produced could make artificial photosynthesis commercially viable. New bio-inspired technology based on phycobili proteins could be used to make more efficient solar cells and paves the way for greater efficiency within artificial photosynthesis.

Researchers make hardened wooden knives

Researchers have developed a potentially more sustainable way to make sharp knives: using hardened wood. The method makes wood 23 times harder, and a knife made from the material is nearly three times sharper than a stainless-steel dinner table knife. The hardened wood knife can be washed and reused, making it a promising alternative to steel, ceramic, and disposable plastic knives. The method can be used to produce wooden nails as sharp as conventional steel nails which are resistant to rusting. The team used a two-step process. In the first step, the wood is partially delignified by boiling the wood at 100° Celsius in a bath of chemicals, which could potentially be reused from batch to batch. In the second step pressure and heat is applied to the chemically processed wood to densify and remove the water. After the material is processed and carved into the desired shape, it is coated in mineral oil to extend its lifetime.

Metal-organic frameworks stabilize perovskite LEDs

Researchers from Los Alamos National Laboratory have now succeeded in stabilizing Perovskite nanocrystals in porous structures known as metal-organic frameworks (MOFs). The resulting films, which can be fabricated at room temperature, could have applications in consumer electronics and medical imaging as well as photovoltaic devices. The method is based on a solution-coating approach that is far less expensive than conventional vacuum processing techniques. The MOF-stabilized LEDs can be fabricated to create bright red, blue and green light, as well as varying shades in between. The devices also display an improved colour purity and a higher photoluminescence (PL) quantum yield. Preventing them from recombining and thus making it so they can't emit light. As well as LEDs, the new PeMOF structures might be useful as radiation scintillators for medical X-ray imaging.

New method for extracting lithium

A team from the University of Texas at Austin has developed a novel polymer membrane containing crown ethers – chemically functionalized ligands that can bind certain ions. These ligands hinder the permeation of sodium but allow lithium to pass through the membrane, preferring lithium over sodium by a factor of roughly 2.3. Lithium is currently extracted from brines through the use of evaporation ponds, which is a slow and laborious process. The new membranes are energy efficient, scalable and can have a much higher throughput than evaporation ponds. As well as lithium extraction, the researchers say the new membranes might also be useful for removing toxic solutes from water. The team plan to study various polymer structures and new ligands for making the membrane more selective to lithium and for other applications.

Machine learning predicts antibiotic resistance spread

Bacteria have the ability to pass genes to each other, or pick them up from their environment, through a process called horizontal gene transfer, which can cause the spread of antibiotic resistance. Cornell researchers used machine learning to predict with near-perfect accuracy how genes are transferred between them, an approach that could potentially be used to stop the spread of antibiotic resistance. The team used several machine-learning models, each of which teased out different phenomena embedded in the data. This enabled them to identify multiple networks of different antibiotic resistance genes, and across strains of the same organism. For the study, the researchers focused on organisms associated with soil, plants and oceans, but their model is also

well-suited to look at human-associated organisms and pathogens, such as Acinetobacter baumannii and E. coli, and within localized environments, such as an individual's gut microbiome. They found the machine-learning models were particularly effective when applied to antibiotic resistance genes.

New tool can identify harmful blue-green algae

A team led by the University of Birmingham has designed a new approach which uses mass spectrometry to identify key protein features within algae that are unique to each species, enabling them to be rapidly identified. Blue-green algae, or cyanobacteria, present huge environmental problems. As algae are a vital part of many water systems, it is only those species which become harmful that may need preventive measures. The technique is also successful in identifying combinations of different cyanobacteria at low pre-bloom concentrations. The technique can also be used to check the authenticity of cyanobacterial products, such as spirulina extracts, that are consumed as health and food supplements.

COVID-19

COVID-19 (WORLD)

AY.4.2. Delta sub variant spreads in Europe

In April 2021 two samples connected via travel history to India were sequenced in the UK and classified as B.1.617.2, one of three main sub-lineages of B.1.617, and which was later named Delta by the World Health Organization. There are now 75 AY lineages of Delta identified, each with different additional defining mutations in their genome. One of these – AY.4 – has been steadily growing in proportion in the UK accounting for 63 percent of new UK cases in the last 28 days. The defining change in AY.4 is the mutation A1711V, which affects the virus's Nsp3 protein, which plays a number of roles in viral replication. AY.4.2 is a sub-lineage of AY.4 – which was first noted at the end of September 2021 with two additional genetic mutations, Y145H and A222V, that affect the spike protein. AY.4.2 has grown steadily in volume to the point where it now accounts for about 9 percent of UK cases in the last 28 days. It has also been observed in a few European nations: Denmark, Germany and Ireland. The Y145H mutation is within an "antigenic supersite" of the spike protein – a part of the protein that antibodies (including from some vaccines) frequently recognize and target. It is possible the Y145H mutation could give the virus an even greater ability to escape immunity by making this supersite less recognizable to antibodies.

New carbon nanotube-based sensor can detect pathogens

Using specialized carbon nanotubes, MIT engineers have designed a novel sensor that can detect SARS-CoV-2 without any antibodies, giving a result within minutes. Their new sensor can quickly generate rapid and accurate diagnostics, not just for Covid-19 but for future pandemics. It is based on a modified carbon nanotube capable of selectively detecting the viral proteins. This approach eliminates the need for antibodies or other reagents. The technique relies on carbon nanotubes with wrapping of different amphiphilic polymers, called Corona Phase Molecular Recognition (CoPhMoRe). Loops are formed by the amphiphilic polymers attached to carbon nanotubes. Different types of target molecules can get bound to the loops, and this binding of the target alters the intensity or peak wavelength of fluorescence produced by the carbon nanotube. A prototype device can produce a result within about five minutes, and can detect concentrations as low as 2.4 picograms of viral protein per milliliter of sample. The researchers also showed that the device could detect the SARS-CoV-2 nucleocapsid protein (but not the spike protein) when it was dissolved in saliva. The researchers have filed for a patent on the technology.

COVID-19 (INDIA)

India administers over one billion COVID vaccine doses

India has administered more than 1 billion doses of Covid-19 vaccines since starting its ambitious vaccination program on 15 January. Government data showed around 708 million people, or 75% of the eligible population, received at least one dose of vaccine while 30% are now fully inoculated against the disease. To fully vaccinate nearly 950 million people, India would need more than 1.8 billion doses of vaccines. Vaccine manufacturers in India have stepped up their output in recent months.

INDIA – SCIENCE & TECHNOLOGY

Material to make carbon-free hydrogen economy

Researchers at the Indian Institute of Technology Guwahati (IIT-G) are developing novel materials that can use sunlight to split water into hydrogen and oxygen. The materials are much cheaper than the currently used 'noble metals', leading to cost-effective solar-powered hydrogen generators as well as also pave the way to a carbon-free hydrogen economy. They have developed Photo Electro Chemical (PEC) cells to use solar energy to split compounds such as water into hydrogen and oxygen, hydrogen being a high-energy fuel that can be stored and used as needed. The team has developed a ternary catalyst that comprises cobalt-tin layered-double hydroxides (LDH) and bismuth vanadate, which forms a p-n junction semiconductor with graphene bridges, and have shown that the catalyst, when used as a photoanode, is able to split water easily to produce hydrogen and oxygen.

Toxic-free method to convert carbon dioxide to methane

The scientists from Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bengaluru have devised a toxic-free method that converts the most common greenhouse gas (GHG) carbon dioxide (CO_2) to methane (CH_4) - known to be the cleanest fossil fuel. The team achieved this using non-metal catalysts, unlike procedures that are in use, which are found to release toxic gases in the process. They used a stable conjugated microporous organic polymer as a heterogeneous catalyst. The keto group present in the polymer performed as a catalytic site. This is a cost-effective metal-free catalyst to achieve the conversion by absorption of visible light.

India successfully tests nuclear-capable Agni-V ballistic missile

India conducted the first user-trial of the Intercontinental-range Ballistic Missile (ICBM) Agni-V. The test paves the way for early induction of the system into the armed forces, with Multiple Independently Targetable Reentry Vehicles (MIRV). The Agni-V ICBM has been developed by the Defence Research & Development Organisation (DRDO) and Bharat Dynamics Limited. It weighs close to 50,000 kilograms. The missile is 1.75 meters tall with a diameter of two metres. The 1,500-kilogram warhead will be placed on top of the three-stage rocket boosters powered by solid fuel. The missile is equipped with a ring laser gyroscope inertial navigation system (NavIC) that works with satellite guidance. The missile can be launched from mobile launchers.

Low-cost synthesis method for silver nanowires

A team of Indian scientists have developed a process for large-scale manufacturing of nano-materials (silver nanowires) that can bring down the costs to less than one-tenth of the market price. Synthesis of one-dimensional nanomaterials such as nanowires, nanotubes, and so on, in large quantities is technologically challenging and hence, makes it an expensive material. Secondly, it is necessary to get a uniform nanowire diameter range with a narrow variation in the length as it helps achieve uniform coating for touch screens or other conducting coating applications. A process developed by CSIR-National Chemical Laboratory, Pune, can produce silver nanowires at the scale of

500 grams per day at the cost of $20/ gm when compared to $250/gm to $400/gm market price. The process is a simple, cost-effective, and scalable through synthesis route when compared to existing batch manufacturing protocols that even generate large amounts of nanoparticles in suspension, which is not easy to separate from nanowires. The developed process has been tested at the CSIR-NCL's characterisation facility and is in stage eight of the Technology Readiness Level. The CSIR-NCL has licensed the process technology to Nanorbital Advanced Materials LLP (Ahmedabad) in November 2020 and has signed a material transfer agreement with three more industries in 2021.

IN BRIEF

Plant-based jet fuel could reduce emissions by 68 per cent

A team from the University of Georgia has estimated that oil obtained from Brassica carinata, a non-edible oilseed crop could help reduce the carbon footprint of the aviation sector while creating economic opportunities. The price for producing sustainable aviation fuel (SAF) from carinata ranged from $0.12 per litre on the low end to $1.28 per litre, based on existing economic and market incentives. The price for petroleum-based aviation fuel was $0.50 per litre - higher than carinata-based SAF when current economic incentives were included in the analysis. The infrastructure for crushing the seed and processing the oil into SAF needs to be built. Carinata has the potential to be a win-win situation for rural areas, the aviation industry, and climate change.

New gene-editing technique offer more control

A team from the University of Pennsylvania has found a way to introduce targeted mutations to the genome by splitting specific mutator enzymes and then triggering them to reconstitute, opening up a novel gene editing technique that offers superior control compared to other existing techniques and has the potential to be used in-vivo. The technique has been patented. The Penn researchers found that DNA deaminases can be divided into two inactive pieces, which can then be put back together using a small cell-permeable molecule called rapamycin. The new split-engineered base editors (seBEs) system can be introduced and lie dormant within a cell until the small molecule is added, at which point the base editing complex can be rapidly "turned on" to alter the genome. This method offers new potential for both research and therapeutics.

AI enables rapid diagnosis of genetic causes of rare disorders

Scientists from University of Utah have found that an artificial intelligence (AI)-based technology can rapidly diagnose rare disorders in critically ill children with high accuracy and enable earlier treatment. The new Fabric GEM algorithm incorporates AI to find DNA errors that lead to disease. In tests, GEM identified the causative gene as one of its top two candidates 92% of the time and outperformed existing tools. GEM can also find "structural variants" as causes of disease, which are behind 10 to 20% of genetic disease. The Fabric team is working to further optimize GEM's accuracy and interface for use in the clinic.

Stretchable and flexible LEDs

A team from Washington University has developed a new Perovskite LED (PeLED) that is flexible and stretchable using an inkjet printer. They used a particular type of crystalline material called an organometal halide perovskite, and an inkjet printer in place of spin coating. The process is much faster as well, cutting fabrication time from more than five hours to less than 25 minutes and can be printed onto a variety of unconventional substrates, such as rubber. By embedding the inorganic perovskite crystals into an organic, polymer matrix made of polymer binders the PeLEDs became elastic and stretchable. A patent has been filed on the technology and fabrication method. These PeLEDs may be lead to an electronics revolution: Walls could provide lighting or even display the day's newspaper. They can be used to make wearable

devices, even smart wearables, like a pulse oximeter to measure blood oxygen. Being able to print stretchy, flexible PeLEDs cheaply and quickly may lead to new applications.

New hydrogen storage material has improved properties

Researchers from Lawrence Livermore National Laboratory (LLNL) and Sandia National Laboratories developed a nanoconfined material which improved the properties of alane (Aluminium Hydride). They found that alane situated within the nanopores of a highly porous bipyridine-functionalized covalent triazine framework can be regenerated at a H2 pressure of only 700 bar which is tenfold lower than that required for its bulk counterpart. This pressure is readily achievable in commercial hydrogen fueling stations, although further improvements are necessary to achieve rapid fueling. The work paves the way for developing composite materials suitable for real-world hydrogen storage applications, including onboard vehicular hydrogen storage. Nanoconfinement is a really interesting approach for stabilizing metastable hydrogen-storage materials in various host materials. This work also could have implications for tuning properties of other energy-generation and storage materials, including batteries and catalysts.

Making plastic durable and degradable

A team from the University of Konstanz has now incorporated polar groups in the molecular chains of polyethylene in order to expand its properties and simultaneously reduce the problematic persistence of plastic in the environment. The desired favorable properties of polyethylene remain unchanged afterwards. They incorporated keto groups in the molecular chains by using a catalyst which is compatible with the carbon monoxide utilized as a reagent for producing keto groups. The limited amount of keto groups can also improve the new plastic's degradability. This material provides a new approach for developing non-persistent polyethylene. The new material has the same favorable properties as conventional polyethylene, as far as mechanics and processability are concerned.

RESOURCES AND EVENTS

EU's artificial intelligence law could serve as model

EU Telecommunications ministers held their first debate on the proposed AI Act in Brussels on 14 October to decide the guidelines for the coming years. They supported a single comprehensive law on artificial intelligence, which would serve as a model across the globe, similar to the general data protection regulation, GDPR, in the area of protection of personal data. The Artificial Intelligence Act seeks to ensure safety and respect for fundamental rights and stimulate the development and uptake of AI-based technology in all sectors. While there are clear benefits from research in medicine, there are other uses that carry risks. An example is law enforcement without any oversight which could lead to the violation of civil rights.

Greenhouse gas levels hit a new record

The World Meteorological Organization released its annual report on greenhouse gases in the atmosphere on 25 October. It said greenhouse gas concentrations hit a new record high last year of 413.2 parts per million and increased at a faster rate (of 2.5 ppmv/year) than the annual average for the last decade despite a temporary reduction during pandemic lockdowns. This is 149% of the pre-industrial level, while Methane (CH4) is 262% and nitrous oxide (N2O) is 123% of the levels in 1750. At the current rate of increase in greenhouse gas concentrations, a temperature increase by the end of this century will be far in excess of the Paris agreement targets of 1.5 to 2 degrees Celsius above pre-industrial levels. Atmospheric concentrations of the major greenhouse gases, carbon dioxide, methane and nitrous oxide, are at record levels.

UK sets out economy-wide strategy for 2050 net zero goal

The UK government has revealed a strategy to meet its 2050 net zero emissions goal. The 368-page document was published on 19 October alongside a Treasury review of how to pay for the transition. The policy package includes investment in carbon capture and storage, hydrogen technologies and nuclear energy, an end to sales of gas boilers by 2035 and targets for manufacturers to deliver net zero vehicles. The UK was the first major economy to set a 2050 net zero goal in law. To achieve 2050 carbon neutrality, the UK said it will decarbonise its power sector fully by 2035. It promised to roll out renewables, including 40GW of offshore wind, and spend £120m ($166m) on nuclear projects.

Fourth General Assembly of the International Solar Alliance

The fourth general assembly of the International Solar Alliance (ISA), was held virtually between October 18th and October 21st, 2021. It was presided over by the Union Minister Shri R.K. Singh, Minister for Power, New and Renewable Energy, Government of India and the President of the ISA Assembly. A total of 108 countries participated in the Assembly, including 74 Member Countries and 34 Observer & Prospective Countries, 23 Partner Organizations and 33 Special Invitee Organisations also participated. The ISA Assembly gave a green signal to the "One Sun" political declaration for the launch of Green Grids Initiative- One Sun One World One Grid (GGI-OSOWOG) at COP26. It approved a solid action agenda to mobilize USD one trillion dollars in solar investments by 2030, including a blended finance risk mitigation facility. ISA has also forged partnerships with Bloomberg Philanthropies and Global Energy Alliance for People and Planet. New ISA programmes were launched on management of solar PV panels & battery usage, waste and solar hydrogen programme.

'India-EU Connectivity: Partnership for Development, Demand and Democracy' launched

Launching the report by the Indian think tank, Research and Information System for Developing Countries (RIS) titled 'India-EU Connectivity: Partnership for Development, Demand and Democracy', the Ambassador of the European Union to India said that the India-European Union (EU) Connectivity Partnership will be a vital component of the EU's Global Gateway initiative that aims to connect goods, services, institutions, banks, businesses and people across the world. Leveraging the strengths of the European Investment Bank and the private sector will be key to effective implementation of the India-EU Connectivity Partnership. The representative of the Ministry of External Affairs said that India and the EU have ensured that their bilateral Connectivity Partnership was of a 'high standard' and focuses on people-to-people connectivity as well as mobility.

RIS report entitled 'AYUSH Sector in India: Prospects and Challenges' released

Research and Information System for Developing Countries (RIS) report titled 'AYUSH Sector in India: Prospects and Challenges' was released at the inauguration of 'AYUR-UDYAMAH' in New Delhi. As per the report, the industry is projected to reach US$ 20.6 billion in 2021 and US$ 23.3 billion in 2022. In terms of global share, India has grown faster in the AYUSH market as compared to the world and accounts for about 2.8 per cent of the market, which is likely to hold even though disruptions in production are not ruled out. During the same period, different product segments have grown at a much higher rate than the overall industry. Plant derivatives experienced 21 per cent growth in the period 2014-2020 followed by nutraceuticals (20.5 per cent), pharmaceuticals (15.8 per cent), plant extracts 14.7 per cent and herbal plants (14.3 per cent). On the occasion RIS-FITM Journal was also launched.

SCIENCE POLICY AND DIPLOMACY

Emerging economies opposed to 2050 net zero target for all countries

Ahead of the Cop26 climate talks, starting on 31 October, a group of 24 "like-minded" developing countries issued a strong criticism of the UK for calling on all countries to cut their emissions to net zero by the middle of the century. Ministers from the group of 24 nations, which includes China, India, Egypt, Indonesia, Pakistan, Saudi Arabia and Vietnam, accused rich nations of failing to address their historic responsibility for causing climate change and shifting the burden on developing economies. They said this new 'goal' which is being advanced runs counter to the Paris Agreement and is anti-equity and against climate justice. Instead, developed countries should "aim for their full decarbonisation within this decade" to allow developing countries more time to grow their economies and meet energy demands, the statement said. Scientific models show that the world should achieve global carbon neutrality by 2050 for a 50% chance of limiting global heating to 1.5C – the most ambitious goal of the Paris Agreement. The statement emphasizes that during their industrialisation phase, developed countries overused their share of the carbon budget.

Emphasis on 'Green' transition during India-Sweden Innovation Meet

Addressing the India-Sweden Innovation meet, the Union Minister of State Science & Technology, Dr Jitendra Singh said that India and Sweden cooperation in the Energy Sector will go a long way in achieving the ultimate goal of fossil fuel free economy. He said that cooperation in the energy sector was identified as an important area during the visit of Prime Minister Narendra Modi to Stockholm in April 2018, as India is looking for technology solutions for clean energy. The Minister noted with satisfaction that the Department of Science & Technology and the Swedish Energy Agency have worked out and launched a Call for Industrial R&D proposals in this sector.

Call for Papers on India Russia STI Cooperation

RIS and the Embassy of India, Moscow have issued a call for papers on India-Russia cooperation in STI. The call covers a wide range of topics and we hope to receive contributions from interested scholars and stakeholders. There is a system of awards and certificates for selected papers and opportunities for publishing the papers in RIS journals.
The link to the call is
http://fisd.in/sites/default/files/Call%20for%20Papers%20India%20Russia%20rev.3.pdf.
We look forward to your support and cooperation.

We welcome your comments and valuable suggestions. Please write to us for receiving publications, updates and notices regarding seminars, conferences etc.

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