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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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GLOBAL

[Use of 3-D printed components for nuclear waste separation](#)

Scientists of Argonne National Lab have printed 3-D parts that pave the way to recycling even more nuclear waste using the Actinide Lanthanide Separation Process (ALSEP). The team redesigned the ALSEP process around devices that separate chemicals, called centrifugal contactors. They have printed several contactors and linked them together, turning a small (and slow) process into one in which scientists can continuously separate actinides from lanthanides. By following a 36-step separation blueprint, scientists removed 99.9 percent of the highly radioactive actinides from the chemically very similar lanthanides. There are some additional benefits of using 3D-printed parts, the contactors offered inherent safeguards against nuclear proliferation. The tubes that connect the 20 contactors run inside each device, making it more difficult to divert plutonium or other radioactive material from the process. Moreover, the 3D-printed parts are flexible; an incorrect part can be easily reprinted and replaced. This technology could be of great help in addressing problems of radioactive waste.

[Electrolyte to enhance performance of next-generation lithium-ion battery](#)

Researchers at the U.S. Department of Energy's (DOE), Argonne National Laboratory have developed a new electrolyte mixture and a simple additive that could be used with silicon anode material in the next generation of lithium-ion batteries. Lithium-ion battery electrolytes currently contain a solvent mixture, with a dissolved lithium salt and at least one, often more than three organic additives. Scientists have developed a unique electrolyte additive strategy - a small amount of a second salt containing any one of several doubly or triply charged metal cations. These enhanced electrolyte mixtures, collectively named "MESA" (Mixed-salt Electrolytes for Silicon Anodes), giving silicon anodes increased surface and bulk stabilities, improving long-term cycling and calendar life, and making possible the use of silicon as anode material in place of graphite. The energy densities obtained with these cells surpassed those for comparable cells having graphite chemistry by up to 50%. It is simple, scalable and fully compatible with existing battery technology. The new technology has proven to be sustainable and can work best over hundreds of charge-discharge cycles. The research opens up the way for silicon anodes ever replace graphite and could have far reaching impact.

[Affordable catalyst to generate hydrogen in commercial devices](#)

Researchers at the SLAC National Accelerator Laboratory, Department of Energy and Stanford University have shown that a cheap catalyst can split water and generate hydrogen gas for hours, through a commercial device. The electrolyzer technology, which is based on a polymer electrolyte membrane (PEM), was not fully utilized due to the high cost of precious metal catalysts, like platinum and iridium, which are required to boost the efficiency of chemical reactions. The team replaced the platinum catalyst on with a catalyst consisting of cobalt phosphide nanoparticles, deposited on carbon to form a fine black powder. The cobalt phosphide catalyst operated extremely well for the entire duration of the test, more than 1,700 hours - suggesting that it may be sufficient for everyday use in reactions that can take place at elevated temperatures, pressures, current densities and in extremely acidic conditions over extended time duration.

[Artificial intelligence to support small farm holders](#)

Colombia's National Cereals and Legumes Federation (FENALCE), and big-data scientists at the International Center for Tropical Agriculture (CIAT) have used machine learning to analyse data from multiple sources, to make farming more efficient and productive, despite climate change impacts. During a four-year study, researchers analyzed and verified the data and developed guidelines for increased maize production; implementation of this system led to increase in their yields from an average of 3.5 tons per hectare to more than 6 tons per hectare. The technology uses a web-based platform to collect and maintain data from individual farms. Local experts uploaded information on soils after visiting farms at various stages of the crop development, while Colombia's weather agency, supplied weather information from six stations in the region. The researchers used

machine learning algorithms and expert analysis to measure the impact of different weather, soil conditions and farming practices on yields. It has positive implications for farmers in terms of its cost effectiveness, leading to food security and improved livelihoods.

Removal of Carbon Dioxide from air stream

Researchers in the Department of Chemical Engineering, MIT, demonstrated the experiment based on passing air through a stack of charged electrochemical plates. It captures carbon dioxide from streams of any concentration, even down to 400 parts per million currently found in the atmosphere, and allows its release into any carrier stream, including 100% carbon dioxide. In operation, the device would alternate between charging and discharging, with fresh air or feed gas being blown through the system during the charging cycle, and then the pure, concentrated carbon dioxide being blown out during the discharging. As the battery charges, an electrochemical reaction takes place at the surface of each of a stack of electrodes. These are coated with a compound called polyanthraquinone, which is composited with carbon nanotubes. The electrodes have a natural affinity for carbon dioxide and readily react with its molecules in the airstream or feed gas, even when it is present at very low concentrations. The reverse reaction takes place when the battery is discharged — during which the device can provide part of the power needed for the whole system — and in the process ejects a stream of pure carbon dioxide. The system can withstand at least 7,000 charging-discharging cycles, with a 30% loss in efficiency over that time.

INDIA

India's persisting commitment to nuclear disarmament

At the Conference on Disarmament, it was reaffirmed that India remains committed to the goal of universal, non-discriminatory and verifiable nuclear disarmament and has called for complete elimination of nuclear weapons through a systematic process. India will be tabling four draft resolutions; namely 'Convention on the Prohibition of the Use of Nuclear Weapons', 'Reducing Nuclear Danger', 'Measures to Prevent Terrorists from Acquiring Weapons of Mass Destruction' and 'Role of Science and Technology in the context of International Security and Disarmament'. It was stated that India's nuclear doctrine continues to stress a policy of credible minimum deterrence with a posture of no-first use and non-use against non-nuclear weapon States. The country acknowledges importance to the Biological Weapons Convention (BWC) and remains committed to improve the effectiveness of the BWC and strengthening its implementation and universalization.

IIT Madras- ExxonMobil to collaborate in Energy and Biofuels Research

ExxonMobil Research and Engineering Company (EMRE) for research on energy and biofuels, the research and engineering arm of ExxonMobil Corporation has signed a Master Research Agreement with the Industrial Consultancy and Sponsored Research, IIT Madras. This agreement positions Indian academia at the forefront of R&D in Energy related technology. The objectives of this programme are aimed to deconstruct rice straw effectively, bagasse and other biomass varieties of Indian origin used to produce sugar. It will be a part of ExxonMobil's bioconversion platform, which aims to convert the lignin present in biomass to valuable phenols using novel catalysts, and evaluate the environmental and economic implications of performing such conversions at scale. India is the third highest producer of agro-residues globally with the surplus potential of over 230 million tonnes per year after China and Brazil. India's huge biofuel potential is expected to get realized shortly with the 'new biofuel policy', which targets to convert the country's biofuel industry into a \$15.6 billion economy.

Qualcomm to support India's NavIC Satellite Navigation System

American chipmaker Qualcomm Technologies in collaboration with the Indian Space Research Organization (ISRO) will be working together on India's Regional Navigation Satellite System (IRNSS), Navigation with Indian Constellation (NavIC), in select chipset platforms across the Company's upcoming portfolio. The initiative will help accelerate the adoption of NavIC and enhance the geolocation capabilities of mobile, automotive and the Internet of Things (IoT) solutions, by harnessing the engineering expertise in India. Support for NavIC will be available in select Qualcomm Technologies' chipset platforms starting in late 2019 and commercial devices with NavIC support are expected to be available during the first half of 2020.

Centre for research in natural products to be established in JNU

A National Centre for Screening of Natural Products for Parasitic Diseases will be established shortly at Jawaharlal Nehru University (JNU). The main objective of the centre is to screen natural products and identifying potential candidates for further optimization, preclinical and clinical development for new drugs against parasitic diseases such as leishmaniasis, amoebiasis and malaria. The centre will facilitate discovery of new lead molecules against tropical parasitic diseases that are the second leading cause of deaths globally. The centre is being funded by the Department of Science and Technology (DST), under its Technology Development and Transfer Division. It will get a grant of Rs 50 million over three years. The centre will build alliance with academia and pharmaceutical industries to integrate research, development and commercialization of potentially useful natural products. Moreover, the natural products library will be obtained from CSIR-IICT, Hyderabad. The center will be collaborating with Pune-based Emcure Pharmaceuticals for developing and commercializing lead compounds. It will collaborate with the Post Graduate Institute of Medical Education and Research, Chandigarh; National Institute of Pharmaceutical Education and Research, Guwahati; and Khalsa College, Mumbai. The programme is designed to harness knowledge of traditional medicinal system and biodiversity of the country, to support the Indian medicine industry.

India-Netherlands launched phase II-LOTUS-HR for sewage treatment

India and the Netherlands launched second phase of the Local Treatment of Urban Sewage streams for Healthy Reuse (LOTUS-HR) program. In the second phase, ten thousand litres of sewage water will be treated per day. Dutch and Indian companies are contributing to the project by sharing their existing technologies and will showcase how one can treat urban waste water into clean water for various purposes. It is envisaged to emulate this process in other projects, across the country. LOTUS-HR was initiated in July 2017 and aims to demonstrate a novel and holistic waste water management approach, which will produce clean water which can be reused for various purposes. The innovative pilot scale modular plant upon commissioning will treat 10,000 L sewage water per day and will showcase a self-sustaining model for the end users. This pilot scale facility will employ multiple technologies so that the data generated at the pilot scale becomes a tool-box of treatment technologies for replication at other sites in Delhi as well as other parts of India. The LOTUS-HR project is jointly supported by Department of Biotechnology, Ministry of Science and Technology and Netherlands Organization for Scientific Research and Severn Trent Water (STW).

India's CO2 emissions reduced in 2019

India's CO2 emissions growth has slowed down sharply in the initial months of 2019, putting the country on track to its lowest annual increase of 2 % in nearly 20 years. The main reason led to this decrease is the slowdown in the expansion of coal-fired electricity generation, with renewable output surging and demand growth slowing. Oil demand growth has also slowed this year, helping keep the increase in India's emissions to just 2%, against

an average of 5% per year over the past decade. India's CO₂ emissions have doubled since 2005, driven by a rapid expansion in coal use. The growth is poised to slow down in 2019, due to a surge in renewable power generation and a slowdown in demand growth, which means the share of fossil fuels in meeting power demand growth, will be the lowest in the past 30 years. Around 75% of India's electricity is still generated from fossil fuels, signifying that the country has one of the world's unsustainable electricity systems. The power sector is also responsible for half of India's CO₂ emissions. In the first six months of 2019, wind, solar and hydro met a record 70% increase in electricity generation. Pulling back from building new coal plants is logical in light of India's renewable energy ambitions. A target of 450GW of non-fossil energy recently announced. This compares with current solar, wind and biomass capacity of around 74GW and a previous target of 175GW by 2022.

IN BRIEF

[Safer pain-relief alternative to opioids](#)

A team of Australian researchers has discovered a unique fungus in Tasmania that produces novel molecules with similar activity to opioids. The research suggests that this molecule could have similar analgesic properties to morphine but without its dangerous side-effects. Discovered around 16 years ago, the previously unknown genus of *Penicillium* was found to produce several molecules that were novel. These compounds are known as tetrapeptides with entirely novel molecular structures very similar to the kinds of molecules that influence opioid receptors in the human body. Based on this unique molecular structure, the researchers produced a novel molecule called bilactorphin, which was found to be nearly equipotent with morphine in mouse tests. If further tests prove successful and lead to a new medication, it will significantly reduce the risk of death by overdose from opioid medications such as codeine.

[New CRISPR offers a wide range of versatility in human cells](#)

Scientists from Broad Institute, MIT and Harvard University have developed a new CRISPR genome-editing approach by combining two of the most important proteins in molecular biology -- CRISPR-Cas9 and a reverse transcriptase -- into a single machine. The system, called "prime editing," is capable of directly editing human cells in a precise, efficient, and highly versatile fashion. The approach expands the scope of gene editing for biological and therapeutics research, and has the potential to correct up to 89 percent of known disease-causing genetic variations. Prime editing differs from previous genome-editing systems in that it uses RNA to direct the insertion of new DNA sequences in human cells. The research demonstrates prime editing's ability to precisely correct gene variants that cause sickle-cell anemia, requiring the conversion of a specific T to an A, and Tay Sachs disease, requiring the removal of four DNA letters at a precise location in the genome. The researchers and the Broad Institute are making this technology freely available to the academic and non-profit communities.

[India develops software for Thirty Meter Telescope \(TMT\)](#)

The Thirty Meter Telescope (TMT), the world's largest ground-based telescope operating at optical and infrared wavelengths, is an international Big Science project with participation from institutions from the United States, Canada, China, Japan and India. This week, a key milestone of software development for TMT was reached with pre-shipment review of the Telescope Common Software (CSW), which is ready for its future integration within TMT's software infrastructure. The software has been developed by ThoughtWorks Technologies based in Pune. The team is also developing another software component for the telescope -- Executive Software product. The CSW package will be the software communication backbone with necessary for the observatory-wide configuration, command, control, and status reporting. It will be layered on top of the IT infrastructure network provided by the future Communications and information sub-system. The package includes a number of services, each providing a single required function needed for integrating the subsystems. Its design made use of open-source resources and provided astronomy-oriented interfaces.

[AI System for faster Detection of Brain Hemorrhage](#)

A team of Indian origin researchers from UC San Francisco and UC Berkeley have developed an AI system which is able to reveal and identify, with utmost accuracy, a brain hemorrhage in a second. The research team has added that the reason for accuracy accounts to the fact that an ingenious training data was added to the algorithm. What's more is that this data was infused with a turning neural network that had over 4396 CT scans. The hemorrhage detecting system also gives minute details which have more refined information and insight. This system also shows if there are any abnormalities at a pixel level. Given the large number of people who suffer from traumatic brain injury every day and the extent of accuracy and precision required for the treatment, this innovation is of immense importance.

RESOURCES AND EVENTS

[The Budapest Water Summit 2019](#)

The third Budapest Water Summit (BWS 2019) was organised by the Government of Hungary, on 15-17 October 2019. It was thematised around 'Preventing Water Crises', providing a platform for high-level discussion on ten key global water issues. Nearly 2,500 participants from 118 countries, including two heads of state and 28 ministers participated in the event. The Summit recognized the crises triggered by water-related factors, in the context that sustainable development goal on water and sanitation (SDG 6), which is intrinsically linked to all other SDGs, towards the achievement of the 2030 Agenda for Sustainable Development. Discussions on various topics include prevention and management of emerging water crises and the identification of relevant gaps in relation to knowledge, governance, technology, finance, regulations and institutions. The Summit adopted a final document, "*Budapest Water Appeal*", four main areas for action were identified, which include (a) Recognizing the multi-faceted value of water in the fullest sense; (b) Creating a water-secure future for all; (c) Ensuring coordination across sectors and institutions; and (d) Building on innovative technologies, remote sensing and digital methods. In relation to implementation, the Appeal lists six main recommendations. The Indian representative, Shri Gajendra Singh Shekhawat, Ministry of Water Resources, River Development and Drinking Water and Sanitation and drew attention to the 17 countries facing high risks of water stress, which is creating shock waves across the globe. It was also elucidated that increased conflict and migration, threatened food supplies and vulnerability of water-dependent industries, has led to an unstable situation. The event was significant as water security is at the center of India's development agenda, underlining efforts to decentralize water governance.

[Online registration system for Indian Diaspora STEM professionals](#)

The Forum for Indian Science diplomacy (FISD) has set up an online system for registration of Diaspora Indian STEM professionals who wish to engage with India's developing STI ecosystem. The system provides for several modes of engagement - from delivering lectures during visits to India, engaging in R & D collaborations with Indian Institutions, short term assignments at Indian institutions, long term assignments including return to India, business start ups, etc. Diaspora STEM professionals are invited to participate. Nearly 100 registrations have been received since the system was put online.

To register, please visit <http://fisd.in> and select "for NRI-PIO-OCI STEM professionals" under the menu item [<http://fisd.in/node/488>], which would navigate to the registration web page

Note from the Editor

Science Diplomacy Alert No. 24 marks the completion of one year from the launch of this online publication. We have focused on news alerts covering science and technology developments and breakthroughs that could have a major impact on global economy and development. All the past issues of SD Alert can be accessed from FISD's website- <http://fisd.in>. We welcome feedback, suggestions, and comments from readers by Email at science.diplomacy@nis.org.in

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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