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**FORUM FOR INDIAN  
SCIENCE DIPLOMACY**

SCIENCE DIPLOMACY NEWS ALERTS | 01-15 MARCH 2022 | ISSUE 81

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## NEWS ALERT

*Forum for Indian Science Diplomacy*

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### CONTENTS

#### GLOBAL

[Energy storage system using lignin based organic flow battery](#)

[Cleaning solar panels without water](#)

[Re-engineered red blood cells to trigger the immune system](#)

[Edible, biodegradable, anti-microbial plastic has higher tensile strength](#)

[Leap forward towards improved personalized medicine](#)

[Solution to biggest hurdle for solar cell technology](#)

#### COVID-19 (WORLD)

[Microbial enzyme helps to speed Molnupiravir production](#)

[New antimicrobial air filters rapidly kill SARS-CoV-2 and other viruses](#)

#### COVID-19 (INDIA)

[India's Cumulative COVID-19 Vaccination Coverage exceeds 1.8 billion](#)

[Neem tree bark extract may be useful for COVID-19 treatments](#)

#### INDIA – SCIENCE & TECHNOLOGY

[Energy-efficient hydrogen production by urea electrolysis](#)

[Novel solid adsorbents for CO2 capture and utilization](#)

[Paper-based sensor to detect hydrogen peroxide](#)

[Reactor to remove pollutants from textile effluents](#)

[Technology for touchless touchscreen to prevent virus spread](#)

## **IN BRIEF**

[Solar brick for building facades](#)

[CAR-T cell therapies show early promise in solid cancers](#)

## **RESOURCES AND EVENTS**

[Supercomputer 'PARAM Ganga' installed at IIT Roorkee](#)

[UN Environment Assembly takes landmark decisions](#)

[UN Conference on Marine Biodiversity kicks off](#)

## **SCIENCE POLICY AND DIPLOMACY**

[India and Singapore sign MoU on STI cooperation](#)

[India and Finland to partner in carbon-neutral technologies and innovations](#)

[India-Canada Bilateral Center for S&T](#)

[Science cooperation with Russia affected by Ukraine conflict](#)

## **GLOBAL**

[Energy storage system using lignin based organic flow battery](#)

An international consortium led by MSE international (UK) is developing a storage technology for applications in commercial ports, capable of meeting the intermittent nature of the electricity demand. The organic redox flow battery is currently under development by Swanbarton Ltd (UK), which will be responsible for battery engineering and construction as well as associated controls and interfaces. The electrochemistry for the batteries will be supplied by CMBlu (Germany), based on entirely organic electrolytes, derived from lignin, a by-product from pulp mills. The material is organic, non-flammable, non-explosive, recyclable, and can work over more than 10,000 charging cycles. The flow battery system has a multi-cell stack design, scalable and suitable for stationary storage applications. Similar technology is described in the

### **Cleaning solar panels without water**

Researchers at MIT have devised a way of automatically cleaning solar panels, or the mirrors of solar thermal plants, in a waterless, no-contact system that could significantly reduce the dust problem. The new system uses electrostatic repulsion to cause dust particles to detach and virtually leap off the panel's surface, without the need for water or brushes. To activate the system, a simple electrode passes just above the solar panel's surface, imparting an electrical charge to the dust particles, which are then repelled by a charge applied to the panel itself. The system can be operated automatically using a simple electric motor and guide rails along the side of the panel. Dust accumulation can easily reduce solar panel power output by 30 percent after just one month without cleaning. Many solar power plants are located in desert regions where water is scarce. Water cleaning makes up about 10 percent of the operating costs of solar installations. The new system could potentially reduce these costs while improving the overall power output by allowing for more frequent automated cleanings.

### **Re-engineered red blood cells to trigger the immune system**

McMaster University researchers have modified red blood cells to transport viral agents which can safely trigger the immune system, creating a promising new vehicle for vaccine delivery. The new method modifies red blood-cell membranes embedding them with SARS-CoV-2 spike proteins, which then form virus-like particles. The red blood cells insides are removed and spike proteins are attached to the outside to mimic a coronavirus. The particles, shown to activate the immune system and produce antibodies in mice, are completely harmless. The researchers found that the cells can be loaded with a large dose of viral proteins, yet likely produce few side effects, making the new method more tolerable and effective than other vaccine options. The technology can be quickly adapted to develop vaccines for variants or new viruses that may emerge in future. This technique had earlier used modified red blood cells to deliver drugs throughout the body, which could then target infections or treat catastrophic diseases such as cancer or Alzheimer's. This platform is versatile and can have many uses.

### **Edible, biodegradable, anti-microbial plastic has higher tensile strength**

Scientists at São Paulo State University have made a bioplastic (or "green plastic") from type B bovine gelatin easily available in the form of a colorless powder. Gelatin is abundant, low cost and has excellent film-forming properties. The team added cloisite Na<sup>+</sup> nanoclay to the gelatin. This made the film more homogeneous and increased its tensile strength to 70 megapascals (MPa). Conventional polyethylene packaging has less than half this tensile strength (in the range of 20 MPa-30 MPa). Besides nanoclay, they also added a nanoemulsion made from black pepper essential oil to give the packaging a more attractive flavor and odour. The mixture also extends the shelf life of food products packaged with the material, due to the inclusion of anti-microbial and anti-oxidant components in the polymeric matrix. This kind of packaging could significantly reduce the use of plastic made from non-biodegradable polymers and hence the amount of solid waste. In addition, the bioplastic will better protect packaged food against contamination by pathogens and help reduce losses.

### **Leap forward towards improved personalized medicine**

A study by researchers at University of California, Irvine has revealed new details about a key enzyme that makes DNA sequencing possible. The finding is a leap forward into the era of personalized medicine. The molecule the UCI-led team studied is an enzyme called Taq, a name derived from the microorganism it was first discovered in, *Thermos aquaticus*. Taq replicates DNA. Polymerase chain reaction, the technique with thousands of uses from forensics to PCR tests to detect COVID-19, takes advantage of

Taq. The UCI-led team found that Taq, as it helps make new copies of DNA, behaves completely unlike what scientists previously thought. Instead of continuously churning out DNA copies, the enzyme instead carefully selects each piece to add to the DNA chain, but grabs dozens of misfits for each piece added successfully. The research is a leap toward revolutionizing medical care and could be used to develop improved versions of Taq that will take less time while making copies of DNA.

### [Solution to biggest hurdle for solar cell technology](#)

Materials scientists at the UCLA Samueli together with colleagues from other universities have discovered the major reason why perovskite solar cells degrade in sunlight, causing their performance to suffer over time. The team found a way to address the cells' long-term degradation by pairing the positively charged ions with negatively charged ones for surface treatments. The switch enables the surface to be more electron-neutral and stable, while preserving the integrity of the defect-prevention surface treatments. The team tested the endurance of their solar cells in a lab under accelerated aging conditions and 24/7 illumination designed to mimic sunlight. The cells managed to retain 87 percent of their original sunlight-to-electricity conversion performance for more than 2,000 hours. These perovskite solar cells are among the most stable in efficiency reported till date. The study has laid new foundational knowledge, on which the community can further develop and refine the versatile technique to design even more stable perovskite solar cells.

## COVID-19

### COVID-19 (WORLD)

#### [Microbial enzyme helps to speed Molnupiravir production](#)

Molnupiravir is one of the few approved drugs that can prevent severe COVID-19. A promising route for production involves a precursor molecule called N-hydroxy-cytidine. Researchers at the University of Manchester, UK have found that, under certain conditions, an enzyme from the bacterium *Escherichia coli* could generate small amounts of the precursor from the common biomolecule cytidine. The team mutated the DNA encoding the enzyme, improving the enzyme's efficiency, and used *E. coli* cells to make the upgraded enzyme. Finally, the researchers optimized the synthetic process by lowering the reaction's temperature. It prompted N-hydroxy-cytidine to crystallize in high purity from solution as soon as it formed. In a scaled-up demonstration, the researchers prepared 137 grams of N-hydroxy-cytidine, converting 71 percent of reactants to the precursor molecule in under three hours. During that time, each enzyme molecule facilitated more than 85,000 chemical transformations.

#### [New antimicrobial air filters rapidly kill SARS-CoV-2 and other viruses](#)

Researchers at the University of Birmingham working in partnership with two firms have developed new antimicrobial technology for air filters which can kill bacteria, fungi and viruses including SARS-CoV-2 in seconds, providing a potential solution to prevent the spread of airborne infections. The antimicrobial treatment for air filters coated with a chemical biocide called chlorhexidine digluconate (CHDG) were rigorously tested including in a trial on-board trains operating on the UK's railways. Both the control and treated filters were installed in heating, ventilation and air conditioning systems on train carriages. The trial found no pathogens survived on the treated filter, even after three months on-board the train. The treated filters are durable, and are able to maintain their structure and filtration function over the lifetime of their use. This opens up possibilities for improved control of the spread of airborne respiratory pathogens in crowded spaces, from offices to large indoor venues, shopping malls, and on public transport. The technology can be applied to existing filters and can be used in existing heating, ventilation and air conditioning systems with no need for

any modifications. NitroPep Ltd is now further developing the filters to deliver them as a product on the market.

## **COVID-19 (INDIA)**

### **India's Cumulative COVID-19 Vaccination Coverage exceeds 1.8 billion**

India's COVID-19 vaccination coverage has exceeded 1.8 billion as on 13 March. This includes 89 million (age 15-18), 1 billion (age 18-44), 385 million (age 45-59), and 240 million (age over 60), and 20 million (third or precaution dose). The level of daily new cases has dropped to 3116 on 13 March compared to 250,000 on 28 January.

### **Neem tree bark extract may be useful for COVID-19 treatments**

Scientists at the University of Colorado and the Indian Institutes of Science Education and Research believe that *Azadirachta indica*, more commonly called neem tree, may be instrumental in the future of the pandemic. The tree is native to India, and practitioners use it within Eastern-based Ayurvedic medicine. A preclinical study examines how the extract from the bark of *Azadirachta indica* affects human lung cells and mice with a SARS-CoV-2 infection. In different experiments, the researchers tested NTB extract on human lung cells and mice with SARS-CoV-2. After testing the NTB extract on human lung cells, they found it restricted the pathological effects of multiple coronaviruses. In the testing with the mice, they found that the NTB extract inhibited inflammation in the lungs. Additionally, NTB extract prevented the virus from replicating as much. It also stopped the virus from causing inflammation of the brain, spinal cord, and liver. While these results seem promising, more research is necessary before health experts can use NTB as a virus preventive or therapy.

## **INDIA – SCIENCE & TECHNOLOGY**

### **Energy-efficient hydrogen production by urea electrolysis**

Indian Scientists have designed an electrocatalyst system for energy-efficient hydrogen production with the help of electrolysis of urea. The urea electrolysis is helpful towards urea-based waste treatment with low-cost hydrogen production. The energy requirement for production of hydrogen through water electrolysis can be reduced by 70 percent through urea electrolysis. The energy-intensive counterpart of water splitting, oxygen evolution, can be replaced with urea oxidation in urea electrolysis. The low-cost, earth-abundant Ni-based catalysts are widely applied for this process. The main challenge associated with urea oxidation is retaining the prolonged activity of the catalyst as the strong adsorption of the reactive intermediate (COx) on the active site, referred to as catalyst poisoning, causes activity loss. The urea electrolysis is helpful towards urea-based waste treatment with low-cost hydrogen production. India is one of the top countries by urea production, and it produced 24.5 million tonnes of urea during 2019-20. The nitrogenous fertilizer industries generate a high concentration of ammonia and urea as effluents. This can be utilized for hydrogen production.

### **Novel solid adsorbents for CO2 capture and utilization**

Research group at IISER Kolkata has discovered a strategy to synthesize novel solid adsorbents for CO<sub>2</sub> capture and utilization. The novel materials have distinct physical properties on its surfaces that have include porous Covalent organic frameworks like COF-graphene Janus thin films prepared through the interactions (non-covalent) between the COF and graphene, rendering flexible porous Janus films at the DCM-water interface. The newly designed COF-coated zeolites could be an excellent candidate for CO<sub>2</sub> storage in the industry due to their high surface area and increased chemical stability. The high CO<sub>2</sub> uptake for the COF coated zeolites, even after treatment with weak acids makes it appropriate for industrial purposes.

### [Paper-based sensor to detect hydrogen peroxide](#)

Researchers at the Indian Institute of Science (IISc) have developed a paper-based sensor for detecting hydrogen peroxide. This chemical is used widely in household and healthcare products like hand sanitiser as a disinfectant, in rocket fuel as a propellant, and is also found in biological cells. This low-cost system could be adopted to quantify or detect hydrogen peroxide for quality-control purposes or other applications. The technique involved preparing a gel from a solution containing a specially designed molecule treated with a liquid that has hydrogen peroxide, and air-drying them on a thin paper disc of about 0.45 cm in diameter. The paper disc emits a green light when placed under an ultraviolet lamp only in the presence of hydrogen peroxide. The intensity of the light was found to be directly proportional to the concentration of hydrogen peroxide. The paper disc is low-cost, biodegradable and easy to use; and it could serve as a powerful tool in low-resource settings, even for testing biological fluids like blood. Detecting hydrogen peroxide efficiently is also crucial in other fields.

### [Reactor to remove pollutants from textile effluents](#)

Researchers at the National Institute of Technology, Andhra Pradesh have developed a continuous reactor for the treatment of textile industrial effluent and recycle water in Tirupur, Tamil Nadu. This is done using the nano coupled advanced oxidation process. A scaled-up version of this work can provide a sustainable solution for the removal of pollutants, particularly textile effluents, from water systems and provide clean water. The thermal activation of salts results in the generation of reactive hydroxyl and sulphate radicals which catalyses the removal of dye pollutants. The rate of removal was almost doubled by the addition of a heterogeneous catalyst. Based on the developed process, an integrated reactor was designed for the continuous removal of textile dyes.

### [Technology for touchless touchscreen to prevent virus spread](#)

The researchers at Jawaharlal Nehru Centre for Advanced and Scientific Research and Centre for Nano and Soft Matter Sciences have reported an affordable solution to develop a low-cost touch-cum-proximity sensor — popularly called touchless touch sensor — through a printing technique. The scientists in Bengaluru have set up a semi-automated production plant for the production of printing-aided patterns, with a resolution of around 300 microns. These electrodes have potential uses in advanced touchless screen technologies. They have fabricated a touch sensor which senses a proximal or hover touch even from a distance of 9 cm from the device. The novel low-cost patterned transparent electrodes have the potential to be used in advanced smart electronic devices like touch-free screens and sensors. This touchless touch sensor technology could assist in preventing the spread of viruses that spread through contact.

## IN BRIEF

### [Solar brick for building facades](#)

Mitrex, a Canadian solar technology manufacturer, is launching the Solar Brick. This solar-integrated surface looks just like a brick wall, but embedded lie modules of 330W solar panels, which are backed by an aluminum honeycomb sandwiched between layers of solid aluminum sheets, making it both lightweight and durable. The monocrystalline solar cell is topped with a glass façade in various designs, and the surface is coated with patented anti-reflective and anti-soiling coatings. The standard panel sizes range from 60-110 cm by 120-200 cm. and they can customize panel sizes up to a maximum of 190 cm. by 360 cm. The glass is customizable and other looks include granite, porcelain, brick, wood, or customized graphics. There's also a design that mimics roofing tiles. The Solar Brick is suitable for new construction projects or retrofits of older structures, including re-cladding or over-cladding. The facades are being tested in an installation on a building in Toronto on a wall of over 650 sq mtrs with capacity to generate 100 kW of energy, using three different colored facades with a combination of stone cladding.



### [CAR-T cell therapies show early promise in solid cancers](#)

Scientists at A2 Biotherapeutics have designed dual-signal CAR-T cells to treat solid cancers. The system incorporates two receptors in the CAR construct, which can shut down the T cells in healthy cells. The CAR-T cells designed based on this platform killed off colorectal cancer cells expressing the carcinoembryonic antigen (CEA) protein in lab dishes and in mice without affecting normal cells. A separate CAR T construct targeting mesothelin (MSLN) showed similar action against solid tumors in preclinical models. A2 Bio is advancing these two CAR-T programs into human clinical trials against multiple solid tumor types.

## RESOURCES AND EVENTS

### [Supercomputer 'PARAM Ganga' installed at IIT Roorkee](#)

The National Supercomputing Mission (NSM) has deployed PARAM Ganga-a High-Performance Computational (HPC) facility at IIT Roorkee, with a supercomputing capacity of 1.66 Petaflops. Supercomputer PARAM Ganga has been established by the Centre for Development of Advanced Computing (C-DAC) under the approach of NSM. The basic idea behind building a Petascale Supercomputer with manufactured in India components is to lead the path towards Aatmanirbhar Bharat and accelerate the problem-solving capacity in multidisciplinary domains simultaneously. The focus is to provide computational power to the user community of IIT Roorkee and neighboring academic institutions.

### [UN Environment Assembly takes landmark decisions](#)

The Fifth Resumed Session of the United Nations Environment Assembly was held in hybrid mode in Nairobi from 21 February – 4 March 2022. The session, with the theme “Strengthening Actions for Nature to Achieve the Sustainable Development Goals”, made important decisions. It adopted a resolution to “End plastic pollution: Towards an international legally binding instrument.” It decided to establish a science-policy panel to contribute further to the sound management of chemicals and waste and to prevent pollution. All in all, 14 resolutions, one decision, and a Ministerial Declaration were adopted, as well as a political declaration commemorating the 50th anniversary of the establishment of the United Nations Environment Programme. The resolution on plastic pollution starts the process for an international legally binding instrument on plastic pollution, to be drafted by a new Intergovernmental Negotiating Committee with the mandate to complete a draft legally binding agreement by 2024. The final agreement is expected to address the full lifecycle of plastics as well as the design of reusable and recyclable products and materials, signifying a shift from linear to circular economic models. UNEA also agreed to set up a new science-policy panel on chemicals and waste to fill the gap between science and policy and potentially allow UNEP to facilitate interlinkages between the IPCC, IPBES, and this new panel. The new panel on chemicals and waste will complement existing efforts on the science-policy interface for climate change and biodiversity. The details of the panel’s governance, scope, and mandate will be worked out during negotiations in an Ad Hoc Open-ended Working Group.

### [UN Conference on Marine Biodiversity kicks off](#)

After two years of postponements due to the COVID-19 pandemic, UN Member States are meeting in New York from 7 March to continue negotiations on an international legally binding instrument under the UN Convention on the Law of the Sea (UNCLOS) on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction (BBNJ). The conservation and sustainable use of BBNJ has increasingly attracted international attention, as scientific information, albeit insufficient, reveals the richness and vulnerability of such biodiversity, particularly

around seamounts, hydrothermal vents, sponges, and cold-water corals, while concerns grow about the increasing anthropogenic pressures posed by existing and emerging activities, such as fishing, mining, marine pollution, and bioprospecting in the deep sea. The United Nations General Assembly resolution 72/249 of 24 December 2017, decided to convene an Intergovernmental Conference (IGC) to elaborate the text of an international legally binding instrument under UNCLOS on the conservation and sustainable use of BBNJ. The fourth and final session of the IGC was supposed to convene in March 2020, but was delayed by two years due to COVID. The President Rena Lee (Singapore) held virtual intersessional sessions beginning in September 2020 over the Microsoft Teams platform and webinars to continue the dialogue on the four elements of the draft treaty: (1) marine genetic resources, including questions on the sharing of benefits; (2) measures such as area-based management tools, including marine protected areas; (3) environmental impact assessments; and (4) capacity-building and the transfer of marine technology, as well as cross cutting issues. At IGC-4, delegates are expected to conduct text-based negotiations on outstanding issues, such as: the scope of the instrument, including to what extent digital sequence information or derivatives will be addressed, as well as whether or not fish and fisheries will have a place in the agreement; whether mandatory or voluntary benefit-sharing measures would be carried out on a monetary and/or non-monetary basis; and the overarching principles governing the future international legally binding instrument, in particular the common heritage of humankind and the freedom of the high seas.

## SCIENCE POLICY AND DIPLOMACY

### [India and Singapore sign MoU on STI cooperation](#)

An MoU on cooperation in the fields Science, Technology and Innovation was signed between the Department of Science & Technology, Government of India, and Ministry of Trade & Industry, Government of Singapore. The industry and research institutes from India and Singapore would jointly develop new products related to economic and societal challenges. The cooperative activities will include sharing experiences on the national research, development, and innovation policies and programmes of each country, exchanging and sharing of scientific and technological information, organising partnership development activities, workshops, scientific seminars, and conferences covering fields on issues of common interest, joint research and development (R&D) projects, including industrial R&D to advance technology development for commercial outcomes, exchange of scientists, researchers, technicians, and research students, training of scientists, researchers, technicians, and research students. It will encourage, develop and facilitate cooperation between India and Singapore in fields of common interest in science, technology, and innovation, including areas like agriculture and food science and technology, advanced manufacturing and engineering, Green economy, energy, water, climate, and natural resources, Data science, Emerging Technologies, Advanced Materials, and Health and biotechnology.

### [India and Finland to partner in carbon-neutral technologies and innovations](#)

India and Finland have worked out a detailed plan for establishment of the Indo-Finnish Virtual Network Centre on Quantum Computing. India has identified three premier institutes viz IIT Madras, IISER Pune and C-DAC Pune for working with Finnish counterpart institutions for the Virtual Network Centre. The progress of bilateral cooperation in areas like 5G, Artificial Intelligence and Sustainability was reviewed by involving Academia, Industries and Start-ups of the two countries. The establishment of the Indo-Finnish Virtual Network Centre on Quantum Computing is likely next month. Joint cooperation on Electric Vehicles, Cyber Physical System, Future Manufacturing, Green Hydrogen Fuel etc to address the societal challenges was forthcoming. Finland Ambassador Ms Ritva Koukku-Ronde added that Finnish companies will partner with India for Carbon-neutral technologies and innovations, and underlined that both sides should enhance cooperation for Sustainability in Climate Change. The possibilities of deeper cooperation in Finland's Biobank project to mediate high quality human samples



to medical research to promote development of new products and services that promote public health may also be explored. Finland reiterated its commitment for enhanced cooperation in the areas like renewable and bio-energy, sustainability, edu-tech, pharma and digitization.

### **India-Canada Bilateral Center for S&T**

India-Canada Bilateral Center will be set up for dedicated S&T activities between India and Canada. India has already established a few bilateral centres with other countries such as the US, Germany, France etc. which are working on various useful S & T schemes for India and the partner country. A delegation led by Canadian Minister of International Trade, Export Promotion, Small Business and Economic Development Ms Mary Ng met Dr Jitendra Singh, Union Minister of State (Independent Charge) Science & Technology and discussed the progress of bilateral cooperation in several key areas. Both sides identified the proposed areas of collaboration in areas like Green Technologies, Advanced Engineering and Manufacturing, Agriculture and Food Technologies, Digital Transformation, Energy Conservation and Healthcare. The Canadian Minister expressed desire to deepen cooperation in areas like bio-technology, renewal energy and Climate Change through applied research mode. Discussions are on to finalize possible terms and conditions for the cooperation.

### **Science cooperation with Russia affected by Ukraine conflict**

CERN's 23-nation governing council has decided to suspend Russia's status as an observer to the organisation. This means that Russia will no longer be able to attend open sessions of the CERN Council and will lose its "special right" to attend restricted sessions on the Large Hadron Collider, the world's largest and highest-energy particle collider. There will also be no new collaborations with Russian institutions, however, the 1100 scientists that have 'user status' at CERN and are affiliated with Russian academic and scientific institutes will be able to continue their work. CERN will comply with EU sanctions on Russia, which include a ban on technology exports. Another European mega-science project, the EU's X-ray Free-Electron Laser (XFEL) will not start new agreements with Russian institutions and will suspend existing ones. The US university MIT ended its 11-year partnership with Russia's tech hub, Skolkovo. However, the Russian Academy of Sciences called for peace and continued scientific cooperation between Russia and other parts of the world. The statement urged the scientific community to refrain from positions and actions dictated not by the interests of science, but by the political environment and the acuteness of the situation. The European Molecular Biology Organization (EMBO), the CERN equivalent in biology, condemned the war but has not frozen ties with Russia.

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