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SCIENCE & TECHNOLOGY

GLOBAL

Catalyst Transforms CO2 from Industrial Emissions into Useful Chemicals

In a collaborative project involving the U.S. Department of Energy's (DOE) Argonne National Laboratory, Northern Illinois University and Valparaiso University, scientists report a family of catalysts that efficiently converts CO_2 into ethanol, acetic acid or formic acid. These chemicals are among the most produced in the U.S. and are found in many commercial products. The catalysts are based on tin metal deposited over a carbon support. The method used by the team is called electrocatalytic conversion, meaning that CO_2 conversion over a catalyst is driven by electricity. By varying the size of tin used from single atoms to ultrasmall clusters and also to larger nano-crystallites, the team could control the CO_2 conversion into acetic acid, ethanol and formic acid.

NUS Scientists Discover Novel Way for Cancer Defence

A team of researchers from the NUS has unveiled a novel approach to stimulate muscle, by way of using brief and mild pulsed electromagnetic field exposure, to produce and release proteins possessing anticancer properties. These soluble chemical molecules can then be carried in the blood stream to all regions of the body for system-wide protection against cancer. Exercise is known to have protective effects against cancer, including reducing the risk of developing breast, prostate, and colon cancers, as well as improving the survival rate of patients with cancer. However, given the debilitating effects of cancer progression and treatment-related side effects, patients with cancer may not be able to exercise and benefit from muscle's anticancer effects. The BICEPS lab's method of stimulating muscle cells uses a form of magnetic therapy that exhibits key commonalities with exercise. The study demonstrated that non-invasive method of muscle stimulation mobilises a similar anticancer defence as exercise, bringing us a step closer towards the development of drug-free therapeutics and the discovery of cancer-related biomarkers to help patients with cancer benefit from exercise-stimulated anticancer agents while not being able to exercise.

New Method for Making Steel Developed

MIT spin out Boston Metal used an electrochemical process called molten oxide electrolysis (MOE) to recover high-value metals from mining waste, to clean up the steelmaking industry. This company is commercializing a new method for making steel and other metals, to help clean up the

emissions-intensive industry. It has also built a prototype MOE reactor to produce green steel at its headquarters in Woburn, Massachusetts. Steel produces around 10 percent of global emissions. This new method can be a viable technology solution to ensure carbon reductions, emissions reductions and making net zero goals.

Innovative Material for Sustainable Building

Researchers at the Karlsruher Institut für Technologie (KIT) developed a novel polymer-based metamaterial that combines various properties and could replace glass components in construction in the future. This Polymer-based Micro-Photonic Multi-Functional Metamaterial (PMMM) consists of microscopic pyramids made of silicone. These micro-pyramids measure about ten micrometers, which is about one-tenth the diameter of a hair. This design gives the PMMM film several functions: light diffusion, self-cleaning, and radiative cooling while maintaining a high level of transparency. The researchers tested the material's properties and measured its light transmittance, light scattering, reflection properties, self-cleaning ability, and cooling performance using modern spectrophotometry. The tests achieved cooling of 6 °C compared to the ambient temperature. Additionally, the material showed a high spectral transmittance, or transparency, of 95 percent. The material has the potential to be used in various areas and makes a significant contribution to sustainable and energy-efficient architecture. The material can simultaneously optimize the use of sunlight indoors, provide passive cooling, and reduce reliance on air conditioning. The solution is scalable and can be seamlessly integrated into plans for environmentally friendly building construction and urban development.

INDIA

BHISHM: IAF Conducts Airdrop Test of Portable Hospital Cubes

In a first test of its kind, the Indian Air Force has successfully tested an innovative portable hospital concept. Enabled by Artificial Intelligence, the BHISHM portable hospital cubes could be quickly deployed in emergency situations either via airdrop or ground transport. The test was conducted as a part of "Project BHISHM" - Bharat Health Initiative for Sahyog, Hita and Maitri. It focuses on providing “immediate and all-encompassing medical care” to address over 200 injuries ranging from basic first aid to advanced medical procedures. During the test conducted in Agra, the hospital cube was airdropped from an IAF aircraft and was intended to verify its rapid deployment capability. The hospital can reportedly provide emergency full scope medical attention to about 200 injuries. Consisting of over 72 portable components, the cubes are waterproof, durable and lightweight. The hospital further employs AI and big data analytics to facilitate accurate coordination and monitoring. It can be configured to suit a particular emergency situation or disaster and can be assembled merely in 12 minutes.

Flood Forecasting: IISc Researchers Develop New Model

A team at the Indian Institute of Sciences (IISc), Bengaluru have developed a novel flood forecasting model which can be applied at the ward level. The model has been put by creating a digital twin of Bengaluru using two types of data. It firstly entails a data drawn from dynamic high-resolution maps of Bengaluru which includes crucial details including the city’s drainage system, road networks, land terrain and buildings. The model also draws data from hydrological models

and a Numerical Weather Prediction (NWP) model. Prof Pradeep P Mujumdar who led the study at the Interdisciplinary Centre for Water Research (ICWAR) noted that the model could be employed by researchers as well as civic agencies explore future 'what if' scenarios. The team is currently working with the KSNDMC which sends reports to the Bruhat Bengaluru Mahanagara Palike (BBMP) to explore the potential for the system to be adopted.

Malaria Vaccine: JNU Researchers Pioneer Key Breakthrough

Researchers from the Jawaharlal Nehru University (JNU), New Delhi have found a crucial genetic detail that can potentially pave the way for a new malaria vaccine. According to the details of the research published in the iScience journal, the vaccine focuses on targeting a protein called Prohibitin found in the malaria parasite. The unique contribution of the study in effect is in identifying the "novel PHB2-Hsp70A1A receptor ligand pair that helps the parasite gain infection inside the human host". The receptor can therefore serve as a basis for developing a new vaccine. The research was led by Professor Shailja Singh and Professor Anand Ranganathan at the Special Centre for Molecular Medicine, JNU. The discovery is expected to help develop an effective vaccine against the malaria parasite which easily develops resistance against drugs.

TCS, IIT Bombay Sign Agreement to Develop Quantum Diamond Microchip Imager

IIT Bombay and Tata Consultancy Services have entered into a strategic partnership to develop India's first quantum diamond microchip imager. Under this arrangement, experts from TCS would build the imager at the IIT Bombay PQuest Lab. The quantum diamond microchip imager is an advanced sensing tool intended to test the quality of semiconductor chips. It can can purportedly help improve the reliability and safety of electronic products, while also boosting their energy efficiency. The technology can also be employed in a wide range of areas including biological and geological imaging and fine scale imaging of magnetic fields. The imager works by integrating quantum diamond microscopy with an imaging software powered by artificial intelligence and machine learning. The partnership is expected to take forward the goals outlined under India's National Quantum Mission while allowing India to favourably position itself in the quantum revolution.

GLOBAL CHALLENGES

Climate Change Satellite Launched

NASA launched a satellite from New Zealand with the mission to improve climate change prediction by measuring heat escaping from Earth's poles. The information will improve our ability to model what's happening in the poles and the climate in general. The tiny satellite was launched by an Electron rocket, from Mahia in the north of New Zealand. It will serve to take infrared measurements from above the Arctic and Antarctic to measure the heat that the poles release into space. The overall mission is known as PREFIRE through which NASA also aims to understand how clouds, humidity or the melting of the ice affects this heat loss from the poles.

Researchers Develop a Model to Predict Impact on Ocean Microplastics

Researchers at Imperial College London and GNS Science, in a joint study have concluded that reducing plastic pollution by 5 per cent per year would stabilize the level of microplastics – plastics less than 5 mm in length – in the surface oceans. However, the modelling shows that even reducing pollution by 20 per cent per year would not significantly reduce existing microplastics levels, meaning they will persist in our oceans beyond 2100. The researchers developed a model to predict the impact on ocean microplastics of eight different scenarios of plastic pollution reduction over the next century, starting from 2026 up to 2100. The results show that if countries reduce plastic pollution by more than 5 per cent each year, the amount of microplastics in the ocean could stabilise, rather than continue to increase.

EarthCARE Launched by SpaceX

The European Space Agency has launched its latest earth sciences satellite from American soil aboard SpaceX's Falcon-9 rocket. The EarthCARE (Earth Cloud Aerosol and Radiation Explorer) is a joint collaboration between the ESA and the Japan Aerospace Exploration Agency (JAXA). The mission seeks to study how cloud density and aerosol concentration in the upper atmosphere impact the earth's temperature. The satellite is fitted with four instruments including JAXA's Cloud Profiling Radar. The instruments shall simultaneously operate to collect data that can help gain crucial insights into addressing global warming. The data collected by EarthCARE is meant to provide key inputs to the ESA's Copernicus programme, the earth observation component of the European Union's space programme.

RESOURCES & EVENTS

World Health Assembly Held

The 77th session of the World Health Assembly was held between 27 May-1 June 2024 at Geneva, Switzerland. The theme for the year has been identified as "All for Health, Health for All". The session included several strategic roundtables which brought together various stakeholders including WHA delegates, civil society representatives, WHO experts and several partner agencies. Discussions were held on current and future priorities pertaining to public health issues of global

importance, including combating malaria, reducing maternal, newborn and child mortality and the eradication of polio and smallpox.

UN Conference on Small Island Developing States Adopts Declaration on Sustainable Development

The fourth international conference on Sustainable Development of Small Island Developing States (SIDS) was held at St. John's, Antigua and Barbuda during 27-30 May 2024. THe conference was attended by over 3000 participants including 22 heads of state. The conference attendees unanimously adopted the Antigua and Barbuda Agenda for SIDS (ABAS) a 10-year action plan seeking to deliver an ambitious pathway to facilitate the SIDS sustainable development. The declaration further underlines the support that the international community should provide the SIDS in aiding them to achieve sustainable development. Several pertinent issue-areas including climate and biodiversity finance, science, technology and innovation and monitoring and evaluation were discussed at the conference. The key outcomes of the conference are expected to be carried forward at the Summit of the Future which will be held at the UN headquarters, New York during 22-23 September 2024.

Convention on Biodiversity Scientific Body Holds Meeting

The 26th meeting of the Convention on Biodiversity (CBD) Subsidiary Body on Scientific, Technical and Technological Advice was held in Nairobi, Kenya during 13-29 May 2024. The discussions mostly pertained to the implementation and monitoring of the Kunming-Montreal Global Biodiversity Framework. The discussions also focused on major issue-areas including synthetic biology, conservation of marine and coastal biodiversity and biodiversity and health. According to David Cooper, Acting Executive Secretary of the CBD, "the meeting showed the willingness of Parties to the CBD to reach consensus on the important scientific foundations of our work to achieve The Biodiversity Plan". The meeting marks an important preparatory step ahead of the Conference of Parties scheduled to be held in Cali, Colombia during 21 October-1 November 2024.

iBRIC Organizes Course on Vaccinology

The Indian Institute of Biotechnology Research and Innovation Council (iBRIC) in association with the Coalition for Epidemic Preparedness Innovations organised the second Translational Health Science and Technology Institute (THSTI) advanced course in vaccinology during 27 May 2024 to 1 June 2024. The course which was held at the iBRIC-THSTI Faridabad campus sought to provide a comprehensive understanding on the theory and practical steps involved in "the design, development and commercialisation of vaccines". Along with Indians, about ten foreigners hailing from Nigeria, Egypt, Nepal, Kenya, Tanzania, Cameroon and Rwanda participated in the course.

SCIENCE POLICY AND DIPLOMACY

'QUAD Satellite' Proposed

US Ambassador to India Eric Garcetti visited ISRO headquarters and concluded a series of high-level meeting relating to deepening of collaboration across a range of domains fromEarth observation to human spaceflight and lunar exploration. In the meeting with ISRO Chairman, S

Somnath, the US delegation also proposed developing a "QUAD Sattelite" involving the partnership of India, the US, Japan and Australia. Other significant points of discussions covered potential joint missions including an advanced imaging spectrometer satellite building on the NASA-ISRO Synthetic Aperture Radar (Nisar) mission, India's proposal for a G-20 satellite dedicated to environmental monitoring and climate change, and the possibility of using India's Gaganyaan cargo module to transfer supplies to International Space Station. S Somnath highlighted potential for US-India university collaboration on advanced detectors and electronics packaging.

Joint Statement Signed by CERN and US

CERN and the US government have released a joint statement concerning future planning for large research infrastructures, advanced scientific computing and open science. The Joint Statement of Intent was signed in Washington DC in April by CERN Director-General, Fabiola Gianotti, and Principal Deputy US Chief Technology Officer, Deirdre Mulligan, of the White House Office of Science and Technology. Acknowledging their longstanding partnership in nuclear and particle physics, CERN and the US intend to enhance collaboration in planning activities for large-scale, resource-intensive facilities with the goal of providing a sustainable and responsible pathway for the peaceful use of future accelerator technologies. CERN and the US also intend to discuss potential collaboration on pilot projects to incorporate new analytics techniques and tools such as AI into particle physics research at scale and affirm their collective mission to take swift strategic action that leads to accelerating widespread adoption of equitable open research, science, and scholarship throughout the world.

Spain Joins International Solar Alliance

Spain has become the 99th member of the International Solar Alliance (ISA). Spain handed over the ISA Instrument of Ratification during the meeting between Spain's Ambassador to india, Jose Maria Ridao Domkinguez, and Head of Depository, Joint Secretary (ED & MER), Ministry of External Affairs (MEA), Abhishek Singh, New Delhi on 22 May. The ISA aims to contribute to the implementation of the Paris Climate Agreement through the rapid and massive deployment of solar energy.

WHO Member States Fail to Reach Agreement on Pandemic Accord

The WHO member states failed to finish negotiations on a pandemic accord, ahead of next week's World Health Assembly (WHA) – with key articles in the draft text still unresolved including the formula for global sharing of vaccines and medicines during international health emergencies. The member states of the Intergovernmental Negotiating Board, assembled in Geneva, stopped negotiating over the draft text, and were instead talking about the way forward. Despite the impasse, delegates from diverse countries and geopolitical alliances that had clashed repeatedly on the actual text, also sought to strike an optimistic note, that eventually agreement could be reached.

New Treaty on Intellectual Property, Genetic Resources and Associated Traditional Knowledge

World Intellectual Property Organization (WIPO) member states on 24 May approved a groundbreaking new Treaty related to intellectual property (IP), genetic resources and associated traditional knowledge, marking a historic breakthrough that capped decades of negotiations. This is the first WIPO Treaty to address the interface between intellectual property, genetic resources

and traditional knowledge and the first WIPO Treaty to include provisions specifically for Indigenous Peoples as well as local communities. It will establish in international law a new disclosure requirement for patent applicants whose inventions are based on genetic resources and/or associated traditional knowledge. Negotiations for this Treaty began at WIPO in 2001, initiated in 1999 with a proposal by Colombia, where discussions were notable for their inclusion of Indigenous Peoples as well as local communities.

We welcome your comments and valuable suggestions. Please write to us for receiving publications, updates and notices regarding seminars, conferences etc. Contact us at science.diplomacy@ris.org.in