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NEWS ALERT

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Long-lasting disinfectant promises to help fight pandemics

University of Central Florida researchers have developed a nanoparticle based disinfectant that can continuously kill viruses on a surface for up to seven days—a discovery that could be a powerful weapon against COVID-19 and other emerging pathogenic viruses. The researchers created a nanoparticle-engineered disinfectant with an active ingredient, an engineered nanostructure called cerium oxide, which is known for its regenerative antioxidant properties. The cerium oxide nanoparticles are modified with small amounts of silver to make them more potent against pathogens. The nanoparticles emit electrons that oxidize the virus, rendering it inactive. Mechanically, they also attach themselves to the virus and rupture the surface. The nanoparticle formulation maintains its ability to inactivate microbes and continues to disinfect a surface for up to seven days after a single application. It could have a major impact in health care settings and reduce the rate of hospital acquired infections, such as Methicillin-resistant Staphylococcus aureus (MRSA), Pseudomonas aeruginosa and Clostridium difficile. The formulation has no harmful chemicals, which indicates it will be safe to use on any surface.

Bionic arm restores natural behaviors in patients with amputations

Cleveland Clinic researchers have engineered a first-of-its-kind bionic arm for patients with upper-limb amputations that allow wearers to think, behave and function like a person without an amputation. The bionic system combines three important functions - intuitive motor control, touch and grip kinesthesia, the intuitive feeling of opening and closing the hand. The system is the first to test all three sensory and motor functions in a neural-machine interface all at once in a prosthetic arm. The neural-machine interface connects with the wearer's limb nerves. It enables patients to send nerve impulses from their brains to the prosthetic when they want to use or move it, and to receive physical information from the environment and relay it back to their brain through their nerves. The artificial arm's bi-directional feedback and control enabled study participants to perform tasks with a similar degree of accuracy as non-disabled people. The researchers tested their new bionic limb on two study participants with upper limb amputations who had previously undergone targeted sensory and motor reinnervation. Participants performed tasks reflective of basic, everyday behaviors that require hand and arm functionality.

Nitrogen-efficient wheats with fewer greenhouse gas emissions

An international collaboration has discovered and transferred to elite wheat varieties a wild-grass chromosome segment that causes roots to secrete natural inhibitors of nitrification, offering a way to cut down heavy fertilizer use for wheat and to reduce the crop's nitrogen leakage into waterways and air, while maintaining or raising its productivity and grain quality. Wheat varieties with the biological nitrification inhibition (BNI) trait could increase yields in both well-fertilized and nitrogen-poor soils. The team transferred the BNI chromosome sequence into several elite, high-yielding wheat varieties, leading to a near doubling of their BNI capacity, as measured through lab analyses of soil near their roots. The new wheat varieties from the International Maize and Wheat Improvement Center (CIMMYT) into which the BNI trait was cross-bred greatly reduced the action of soil microbes that usually convert fertilizer and organic nitrogen substances into ecologically-harmful compounds such as nitrous oxide gas. The BNI-converted wheats also showed greater overall biomass and grain yield, with no negative effects on grain protein levels or breadmaking quality. BNI-enabled wheat cultivars can play an important role to cut greenhouse gas emissions. A project to establish nitrogen-efficient wheat production systems in the Indo-Gangetic Plains using BNI has recently been approved by Japan and is under way, with the collaboration of JIRCAS, the Indian Council of Agricultural Research (ICAR), and the Borlaug Institute of South Asia (BISA).

Mini CRISPR for genome editing

Researchers at Stanford University have developed a compact and efficient CRISPR-Cas system, named CasMINI, which could be broadly useful for cell-engineering and gene-therapy applications because it is easier to deliver into cells. The development of CRISPR-Cas systems for human cells has revolutionized genome engineering, but their large sizes present problems. The team applied RNA and protein engineering to the Cas12f system to generate a class of Cas12f variants named CasMINI which could drive high levels of gene activation comparable to those associated with Cas12a and allows for robust base editing and gene editing. Moreover, it is highly specific and does not produce detectable off-target effects. The size of the engineered CasMINI molecule is only 529 amino acids. This small size makes it suitable for a wide range of therapeutic applications. For example, the CasMINI fusion proteins are well suited for AAV packaging. In addition, CasMINI mRNA can be easily packaged into lipid nanoparticles or other RNA-delivery modalities, potentially enhancing its entry into cells. Its small size and non-human pathogen source might make it less likely to produce immune responses than large protein payloads. The researchers plan to test the system for in vivo gene-therapy applications.

Self healing Ceramics materials

Researchers at Texas A&M University have discovered a self-healing mechanism within a type of ceramics, called MAX phases. These ceramics form natural faults or kink-bands during loading that can not only effectively stop cracks from growing, but can also close and heal them, thereby preventing catastrophic failure. This behaviour of MAX phases results from their atomically layered structures. The researchers studied single crystal samples of chromium aluminium carbide MAX phase and while applying loading, they observed that there were kink-band like defects that formed in the material, resembling those formed in natural rocks. More interestingly, they discovered that the material within kink-bands rotate during loading which not only form a barrier against crack propagation but also eventually close and heal the cracks. As a consequence, the sample was no longer vulnerable to catastrophic failure. The self-healing ability could result in next-generation technologies and materials, for applications like efficient jet engines, hypersonic flights, and safer nuclear reactors. The kink-band induced self-healing of cracks may also be found in other materials with atomically layered structures.

Water-repellent nanomaterial

Researchers at the University of Central Florida have created a new nanomaterial that repels water and can stay dry even when submerged underwater. The discovery could open the door to the development of more efficient water-repellent surfaces, fuel cells and electronic sensors to detect toxins. They created the material by placing a drop of a gel created from fullerites on any surface, triggering a super water-repellent state. The unique cage-like structure of the gel doesn't interfere with the original material being treated, which means they preserve their unique functional properties. That means the new super surface can potentially be used for splitting water, bacterial disinfection, hydrogen generation or electrocatalysis, all of which can be generated in fluid environments. The fullerite films display extreme water repellence regardless of direction of water flow and even under continuous flow of water over them. Even when they are submerged at 2 feet of water for several hours, the films remain dry. The team found that they can also capture and store gases underwater in the form of plastrons -- a form of trapped bubbles.

Films with tunable elongation and fracture

Researchers from Nagoya Institute of Technology, Japan have successfully synthesized an elastomer film whose elastic properties can be controlled by post-preparation photo

reaction to suit desired applications, thus, saving time, cost and human resources. They added to a polyester (polymer having ester group) thermoreactive and photoreactive groups, which react to heat and light, respectively. They then followed a two-step process in which the thermoreactive groups first underwent thermal cross-linking and then the photoreactive group formed cross-links in presence of UV light. The team found that the material obtained after thermal cross-linking was soft and flexible, but when further treated with UV light, the material increased in stiffness depending on the time of exposure. In fact, when exposed for 30 minutes, the material's Young's Modulus increased by two orders of magnitude. This shows that post-preparation tuning of tensile strength in materials is possible. The team designed elastomer films with inhomogeneous patterning of Young's modulus through selective UV illumination, using horizontal and vertical photo-masking slits, creating patterns of soft and rigid sections. On testing the horizontal patterned films under stress, the rigid sections hardly showed any deformation, whereas the soft sections showed 5 times elongation. Surprisingly, however, the vertically patterned films showed excellent toughness and resistance to the propagation of cracks. This technique could have diverse applications.

COVID-19

COVID-19 (WORLD)

WHO Monitoring New Coronavirus Variant Named 'Mu'

The World Health Organization (WHO) has said that it has identified a new coronavirus “variant of interest” (VOI) known as “Mu” and the global health body is now monitoring it. Also known by its scientific name B.1.621, the new coronavirus variant was classified as a VOI on 30 August 2021 and given the WHO label ‘Mu’. This includes the descendent Pango lineage B.1.621.1. This variant is known as 21H in Nextstrain nomenclature. The Mu variant has a constellation of mutations that indicate potential properties of immune escape. Preliminary data presented to the Virus Evolution Working Group show a reduction in neutralization capacity of convalescent and vaccines sera similar to that seen for the Beta variant, but this needs to be confirmed by further studies. ‘Mu’ was first identified in Colombia in January 2021 and since then there have been a few reports of cases of the Mu variant from other countries in South America and in Europe.

Rapid measurement of antibodies against SARS-CoV-2

Research team from Japan has developed a diagnostic system that can rapidly and sensitively measure the amount of antibodies in the blood that protect from SARS-CoV-2. The team developed diagnostic tools for use in a system that immobilizes several key SARS-CoV-2 proteins, allowing the presence of antibodies against SARS-CoV-2 to be detected automatically. The technique is based on the use of light. A substance that reacts to light is first coated on a plastic microchip, and a sample liquid containing the protein of interest is dropped onto the microchip in the form of a spot. Then the chip is exposed to ultraviolet light, which immobilizes the proteins. Using this method, the researchers developed a?chip called a microarray upon which key SARS-CoV-2 proteins are fixed. When antibodies in blood serum bind to the viral proteins on the chip they emit light, and the amount of emitted light can be measured precisely with a CCD camera. This value can therefore be used to quantify the number of antibodies in a way that is not possible with immune-chromatography. This test requires only a small drop of blood from the fingertip, and the sensitivity of the system is 500 times higher than that of conventional immune-chromatography. Its operation is quite simple and antibody detection is performed automatically in about 30 minutes. This system will enable precision testing at any medical facility, and can also be used to conduct epidemiological surveys in preparation for future pandemics.

Optical techniques offer fast, efficient COVID-19 detection

Researchers from the University of Texas investigated the opportunities for accurate rapid testing by using optical biosensors. They found that when a virion is present on the surface of an optical sensor, its interaction with a light beam on the sensor affects the light's properties, causing a measurable shift in the light signal. The system can reliably detect the coronavirus in real time even with a very small viral dosage. According to the team, there are a number of different ways in which this interaction can be utilized and improved upon, such as integrating it with measurements of plasma oscillations or incorporating graphene into its fabrication process.

Nanofiber face masks need replacing more often

Researchers from Southern University of Science and Technology in China studied the effects of micro water droplets on the integrity of nanofibers face masks. They used high-speed microscopic videos to systematically visualize the evolution of nanofibers made of polymers with different contact angles, diameters, and mesh sizes under water aerosol exposure. The images revealed nanofibers coalesced irreversibly during the "droplet capture stage" as well as the subsequent liquid evaporation stage, significantly reducing the effective fiber length for capturing aerosols. They provide direct visual evidence for the need to replace face masks frequently, especially in cold environments. The study's findings are expected to help improve design, fabrication, and use of face masks made with nanofibers.

Thermostable COVID-19 vaccines

Engineers at the University of California San Diego have developed two thermally stable COVID-19 vaccine candidates from a plant virus and a bacteriophage. The researchers used cowpea plants and E. coli bacteria to grow millions of copies of the plant virus (cowpea mosaic virus) and bacteriophage (Q beta), respectively, in the form of ball-shaped nanoparticles. These nanoparticles were then attached to a small piece of the SARS-CoV-2 spike protein on the surface. In mice, the vaccine candidates triggered high production of neutralizing antibodies against SARS-CoV-2. Since, the plant virus and bacteriophage nanoparticles are extremely stable at high temperatures; the vaccines can be stored and shipped without needing to be kept cold.

Microscopy plus AI for rapid COVID-19 detection

Researchers at Beckman Institute paired microscopy with artificial intelligence to develop a COVID-19 test that is fast, accurate, and cost-effective. They used an optical method for directly imaging unlabeled viral particles and used deep learning for detection and classification. An ultrasensitive interferometric method was used to image four virus types with nanoscale optical path-length sensitivity. Pairing these data with fluorescence images for ground truth, semantic segmentation models were trained. Remarkably, due to the nanoscale sensitivity in the input data, the neural network was able to identify SARS-CoV-2 vs. the other viruses with 96% accuracy. This method can potentially test patient breath condensates. The necessary high throughput can be achieved by translating concepts from digital pathology, where a microscope can scan hundreds of slides automatically.

COVID-19 (INDIA)

COVID-19 Vaccine candidate receives DCGI approval for two Clinical Trials

Biological E. has received Drugs Controller General of India (DCGI) approval for conducting the Phase III Comparator Safety and Immunogenicity trial in adults after the Subject Expert Committee's (SEC) review of Phase I and II clinical trials data. Additionally, Biological E also received approval on 01.09.2021 to initiate the Phase II/III Study to evaluate Safety, Reactogenicity, Tolerability and Immunogenicity of CORBEVAX™ vaccine in Children and Adolescents. The vaccine candidate is a protein subunit vaccine.

CoWIN launches new API: KYC-VS

Co-WIN has developed a new Application Programming Interface (API) called 'Know Your Customer's/Client's Vaccination Status' or KYC-VS to check the status of vaccination of an individual. To use this API, an individual requires entering a mobile number and name along with the OTP generated. In return, Co-WIN will send a response to the verifying entity on the individual's status of vaccination. This response will be digitally signed and can be shared instantly with the verifying entity. KYC-VS is consent-based, privacy preserving and can be seamlessly integrated with any system. It will facilitate instances where an entity does not need to see the certificate in full and would just need to know whether an individual has been vaccinated or not.

Vaccination effective in preventing COVID mortality

COVID-19 vaccines administered in India are around 97 percent effective in preventing mortality, whereas vaccination also significantly reduces hospitalization, the assessment of real time vaccination data captured under COVID-19 Vaccine tracker shows. India's COVID-19 vaccine tracker has data synergies between CoWIN, COVID-19 India Portal, and COVID-19 testing portal of the ministry of health and family welfare, and the Indian Council of Medical Research (ICMR). The data has been collected on the basis of ICMR identification number and mobile numbers of beneficiaries. The key message that came from the vaccine tracker was that breakthrough infections after the first or both the doses do not result in mortality, and result in extremely low, almost insignificant percentage of hospitalisation. Vaccine effectiveness in preventing death after the first dose is 96.6 percent; and after two doses is 97.5 percent. The effect has been demonstrated in all age groups.

India's first needle-free COVID-19 vaccine, likely to be launched in early October

Zydus Cadila's needle-free coronavirus vaccine - ZyCoV-D is likely to be available in India by early October. The three dose vaccine is the world's first plasmid DNA vaccine for COVID-19. The vaccine, when injected, produces the spike protein of the SARS-CoV-2 virus and elicits an immune response, which plays a vital role in protection from disease as well as viral clearance. The plug-and-play technology on which the plasmid DNA platform is based can be easily adapted to deal with mutations in the virus. The vaccine has been approved by Indian regulators to be administered to adolescents between ages 12 and 18.

MSME Ministry to help commercialise COVID-19 testing kits

The standard operating procedure and know-how of the indigenously developed saline gargle-based technique for testing of COVID samples has been transferred to the MSME Ministry to help commercialise and license it to all capable parties, including private, government, and various rural development schemes and departments. Under this arrangement, the licensees of the new technique are expected to set up manufacturing facilities for commercial production in the form of easily usable compact kits. The technology has been developed by scientists at CSIR-National Environmental Engineering Research Institute (NEERI) for RT-PCR testing. It is a non-invasive technology where a patient has to gargle the solution and rinse it inside the tube instead of using a nasopharyngeal and oropharyngeal swab.

INDIA – SCIENCE & TECHNOLOGY

New online platform to promote reuse, repair, recycle e-waste

The Indian Institute of Technology (IIT)-Madras is developing a new model to tackle electronic wastes (e-waste). It will be an exchange platform that will serve as an online marketplace for waste electrical and electronic equipment and facilitate a formal supply chain between various stakeholders. IIT-Madras researchers are working to develop the model which, they estimate, can potentially open doors to a $50 billion economy. E-

source is an open-source platform that will evolve towards using machine learning for better traceability of e-waste in compliance with guidelines and help increase the opportunities for repair and re-use of e-waste. This will potentially improve livelihoods for youth and women in peri-urban settings by upgrading their skills and improving occupational health and safety, reduce the flow of toxic materials in waste streams, and broaden the market for affordable, second-hand e-devices.

Latest technology for aquifer mapping in arid regions of India

The Council of Scientific & Industrial Research (CSIR) and the National Geophysical Research Institute NGRI have undertaken High-Resolution Aquifer Mapping and Management in arid regions of north western India to augment groundwater resources. The heliborne geophysical mapping technique of the CSIR-NGRI provides a high-resolution 3D image of the sub-surface up to a depth of 500 meters below the ground. Nearly 12% of India's total geographical area with 80 million people faces acute water shortages throughout the year. It is proposed to exploit the benefits of high-resolution aquifer mapping and management to augment the groundwater resources. The ultimate aim of this project is to map the potential sites for groundwater withdrawal and conservation, and results will be used to meet the broader objectives of aquifer mapping, rejuvenation, and management of groundwater resources in the arid areas.

IIT Ropar's startup develops plant based smart air-purifier

Scientists from the Indian Institutes of Technology (IIT) Ropar and Kanpur have developed a living-plant-based air-purifier for indoor spaces called 'Ubreathe Life'. The technology works through amplifying the phytoremediation process of the plants. It effectively improves indoor air quality by removing particulate, gaseous and biological contaminants while increasing the oxygen levels in the indoor space through specific plants, UV disinfection and a stack of pre-filter, charcoal filter and HEPA (high-efficiency particulate air) filter fitted in a specially designed wooden box. The specific plants tested for air-purification include Peace Lily, Snake Plant, Spider plant etc. and all have given good results in purifying indoor-air. The results of testing, conducted by National Accreditation Board for Testing and Calibration Laboratories and the Laboratory of IIT Ropar show that using Ubreathe Life the AQI (Air Quality Index) for a room size of 150sq.ft. drops from 311 to 39 in 15 minutes.

Bio-methanation technology for integrated treatment of sewage and organic solid waste

Scientists at CSIR- Indian Institute of Chemical Technology (IICT) have developed high rate biomethanation technology based on Anaerobic Gas lift Reactor (AGR) Technology for the treatment of organic solid waste and concomitant generation of biogas and bio manure along with Nanofiltration (NF) setup. This integrated and sustainable sewage and organic solid waste treatment system can be used for treating groundwater and wastewater and generating potable and reusable water, respectively. An integrated model plant comprising of AGR and NF technologies has been established at CSIR-IICT, Hyderabad, for the simultaneous treatment of sewage (100 liters/day) and organic solid waste (250 kg/day) for the generation of value-added products such as biogas, bio manure, and reusable water. The integrated technology is field-tested and working continuously for the past two years. This integrated approach of sewage and organic solid waste treatment could be exploited anywhere in India.

Improved water management system developed to treat wastewater

Researchers from the Indian Institute of Technology, Kanpur have developed a modified Advanced Oxidation Process (AOP) technology that can completely re-use industrial dye wastewater from the textile industry, eliminating its toxicity and making it suitable for domestic and industrial usage. This modified treatment process consists of the primary dosing step followed by the sand filtration step, another AOP and subsequent

carbon filtration step. This technology is being utilized for the complete re-use of industrial dye wastewater for domestic and industrial usage at a rate of 10 Kilo litres /day. The technology has resulted in the reduction of 50 percent of the treatment cost incurred from conventional processes for water treatment in the water-scarce regions of Rajasthan. Further, scaling up of this plant to 100 Kilo litres /day capacity is underway to meet the current industrial requirement with automated plant operations.

India's first indigenously designed High Ash Coal Gasification based methanol production plant

BHEL R&D centre at Hyderabad has successfully demonstrated a facility to create methanol from high ash Indian coal. The facility can create 0.25 tonnes per day (TPD) of methanol from high ash Indian coal using a 1.2 TPD Fluidized bed gasifier. The methanol purity of the crude methanol produced is between 98 and 99.5 per cent. The in-house design expertise in BHEL for designing greater capacity coal gasification facilities can assist India's coal gasification mission and coal-to-hydrogen production for the Hydrogen Mission. Further, BHEL is developing in house critical processes such as catalytic conversion of syngas to methanol.

Noise control sheet absorber developed by mimicking bee hives

Researchers at IIT Hyderabad have fabricated paper honeycomb and stronger polymer honeycomb structure as sound-absorbing panels. They fabricated low thickness and strong acoustic panels using design methodology which involves understanding the physics of bee hive sample acoustic energy dissipation and then mimicking its design. The team developed a mathematical model and calculated optimized parameters, and then fabricated the test samples using systematic, controlled parameters. The developed technology provides a mechanism of acoustic energy dissipation with lower thickness and higher specific strength of acoustic panels. A test facility to measure the absorption coefficient of large samples has also been established as part of this work. This technology may create an opportunity to capture 15 percent of the traditional sound-absorbing acoustic material market based on the low-frequency applications.

IN BRIEF

New catalyst to generate hydrogen from ammonia at low temperatures

Scientists from Tokyo Institute of Technology (Tokyo Tech) have developed a highly efficient calcium imide (CaNH)-supported Ni catalyst that can decompose ammonia at temperatures 100°C lower than what conventional Ni catalysts require. This promising new catalyst can help to sustainably produce hydrogen fuel. The team discovered that the presence of CaNH resulted in the formation of NH_2- vacancies (VNH) on the surface of the catalyst. The highly active and durable Ni/CaNH catalyst can be successfully deployed for the generation of hydrogen gas from ammonia. Also, the insight into the mechanism of catalysis provided by this study can be utilized to develop a new generation of catalysts.

Molecular memristor has exceptional memory reconfigurability

Researchers at the National University of Singapore have developed a new memristor that can be reconfigured using voltage to embed different computational tasks and the potential to contribute to designing next generation processing chips with enhanced computational power and speed. They created a tiny electrical circuit consisting of a 40-nm layer of molecular film sandwiched between a top layer of gold, and a bottom layer of gold-infused nanodisc and indium tin oxide. They observed an unprecedented current-voltage profile upon applying a negative voltage to the device. These organic molecular devices could switch between on-off states at several discrete sequential voltages. The team used the molecular memory devices to run programs for different real-world computational tasks and perform complex computations in a single step, and could be reprogrammed to perform another task in the next instant.

Carbon capture grows more affordable

Researchers at the Pacific Northwest National Laboratory (PNNL) have developed a method to convert captured carbon dioxide (CO_2) into methane, the primary component of natural gas. The method uses a chemical EEMPA, a PNNL-developed solvent that captures CO_2 from power plant flue gas. The new process requires an initial investment that costs 32 percent less. Operation and maintenance costs are 35 percent cheaper, bringing the selling price of synthetic natural gas down by 12 percent. The savings stem partly from EEMPA's ability to make CO_2 dissolve more easily, which means less pressure is needed to run the conversion. Under the new method, captured CO_2 can be mixed with renewable hydrogen and a catalyst in a simple chamber, and then heated to half the pressure used in conventional methods to make methane. The reaction is efficient, converting over 90 percent of captured CO_2 to methane, while EEMPA captures over 95 percent of CO_2 emitted in flue gas. The new process gives off excess heat, too, providing steam for power generation.

Actuator using organic semiconductor nanotubes

University of Houston researchers are reporting a breakthrough in the field of materials science and engineering with the development of an electrochemical actuator that uses specialized organic semiconductor nanotubes (OSNTs). This device demonstrates an excellent performance, including low power consumption/strain, a large deformation, fast response and excellent actuation stability. This outstanding performance stems from the enormous effective surface area of the nanotubular structure. The larger area facilitates the ion transport and accumulation, which results in high electroactivity and durability. The device uses organic semiconductors called conjugated polymers. These new OSNT-based electrochemical devices could help advance the next generation of soft robotics, artificial muscles, bioelectronics and biomedical devices.

Nano 'camera' allows real-time monitoring of chemical reactions

A team from the University of Cambridge has made a tiny camera, which allows real time monitoring of chemical reactions. The device combines tiny semiconductor nanocrystals called quantum dots and gold nanoparticles using molecular glue called cucurbituril (CB). When added to water with the molecule to be studied, the components self-assemble in seconds into a stable, powerful tool that allows the real-time monitoring of chemical reactions. They were able to use the camera to observe chemical species which had been previously theorised but not directly observed. The simplicity of the device opens up a lot of new possibilities for imaging chemical reactions and sensing through taking snapshots of monitored chemical systems.

New filtering method promises safer drinking water, improved industrial production

A team of scientists at the Tufts University School of Engineering has developed a new filtering technology that is capable of separating ions that differ by only a fraction of their atomic diameter. The filtration membranes were designed by coating a zwitterionic polymer onto a porous support, creating membranes with channels narrower than a nanometer surrounded by both water repelling and plus and minus-charged chemical groups. The very small size of the pores forces the ions to interact with the charged and water-repelling groups in the pores, allowing some ions to pass much faster than others. This novel polymer membrane can separate fluoride from chloride and other ions with twice the selectivity reported by other methods. The application of the technology could prevent fluoride toxicity in water supplies where the element occurs naturally at levels too high for human consumption and could have wide applications to improving agricultural water supplies, cleaning up chemical waste, and improving chemical production.

Super multi-element catalyst containing 14 elements

Researchers from Japan have developed a “nanoporous super multi-element catalyst” that contains 14 elements which are mixed uniformly at the atomic level and used as a catalyst. They prepared an aluminum alloy containing 14 elements, and the nanoporous super multi-element catalyst is manufactured by preferential dissolution of aluminum using an alkaline solution. The nanoporous structure has a large specific surface area with a pore size of about 5 nanometers, and elements other than aluminum that do not dissolve in the alkaline solution are accumulated to be aggregated in the form of a solid solution alloy in which the 14 elements are uniformly distributed at the atomic level. The nanoporous super multi-element catalyst was found to show excellent properties as an electrode material for water electrolysis due to the multi-element synergy effect. This catalyst could be developed into an omnipotent and versatile catalyst in the future.

High-energy shape memory polymers

Stanford University researchers have developed a shape memory polymer that stores almost six times more energy than previous versions, and can release large amounts of energy when returning to its original state. They incorporated 4-, 4'-methylene bisphenylurea units into a poly(propylene glycol) polymer backbone. In the polymer's original state, polymer chains were tangled and disordered. Stretching caused the chains to align and form hydrogen bonds between urea groups, creating super molecular structures that stabilized the highly elongated state. Heating caused the bonds to break and the polymer to contract to its initial, disordered state. In tests, the polymer could be stretched up to five times its original length and store up to 17.9 J/g energy. The team demonstrated that the stretched material could use this energy to lift objects 5,000 times its own weight upon heating. The shape memory polymer is also inexpensive (raw materials cost about $22 per kg) and easy to make.

Combining sunlight and wastewater nitrate

Researchers at the University of Illinois Chicago have created a solar-powered electrochemical reaction that not only uses wastewater to make ammonia, but also achieves a solar-to-fuel efficiency that is 10 times better than any other comparable technology. The new method uses nitrate, one of the most common groundwater contaminants, to supply nitrogen and sunlight to electrify the reaction. The system produces nearly 100 percent ammonia with nearly zero hydrogen gas side reactions. The reaction needs no fossil fuels and produces no carbon dioxide or other greenhouse gases, and its use of solar power yields an unprecedented solar-to-fuel efficiency, or STF, of 11percent, which is 10 times better than any other state-of-the-art system to produce ammonia (about 1percent STF).The method uses a catalyst with a rough cobalt surface derived from oxidation, A patent has been filed for the new process.

Transforming ‘sewer gas’ into clean hydrogen fuel

Scientists at the Ohio State University have found a new chemical process to turn toxic sewer gas into a clean-burning fuel. Their process uses relatively cheap material – the chemical iron sulfide with a trace amount of molybdenum as an additive. The team invented the SULGEN process, which converts hydrogen sulfide into hydrogen. The researchers found that introducing a trace amount of molybdenum into iron sulfide improves the breakdown of hydrogen sulfide, splitting it into two parts – hydrogen fuel and sulphur. This method might be an attractive option for larger-scale operations.

Nanocrystals in metal oxide frameworks improve LEDs

Researchers from the U.S. and Taiwan have prepared stable perovskite nanocrystals for

LEDs. They stabilized perovskite nanocrystals by encapsulating them in MOF structures, to enhance the brightness and stability of the light-emitting nanocrystals substantially. The team used lead nodes in the framework as the metal precursor and halide salts as the organic material. The solution coating approach used is far less expensive than the vacuum processing used to create the inorganic LEDs in wide use today. The MOF-stabilized LEDs can be fabricated to create bright red, blue, and green light, along with varying shades of each. In durability tests, the material performed well under ultraviolet radiation, in heat and in an electrical field without degrading and losing its light-detecting and light-emitting efficiency.

Composite catalyst helps transform excess CO2 into ethanol

An international team of scientists led by Brookhaven National Laboratory has developed a catalyst composed of cesium, copper, and zinc oxide in a special configuration that transforms carbon dioxide (CO2) into ethanol (C2H6O). This could lead to technologies that are able to recycle CO2 emitted from combustion and convert it into usable chemicals or fuels. The catalyst is formed by depositing tiny amounts of copper and cesium onto a surface of zinc oxide. Another goal of this area of research is to find an ideal catalyst for CO2 conversion to "higher" alcohols for industrial applications. This approach opens up a research area of use of composite catalysts for various reactions.

RESOURCES AND EVENTS

New WHO center for Pandemic and Epidemic Intelligence

Germany and the World Health Organization (WHO) have teamed up to launch a new hub that aims to accelerate efforts to detect and respond to new disease outbreaks. The German government pledged $100 million to set up the WHO Hub for Pandemic and Epidemic Intelligence led by Dr. Chikwe Ihekweazu, a leading Nigerian public health specialist. WHO currently identifies about 4500 potential public health risks a month which need a wide range of information and analysis. Between 100 and 120 people would be working at the hub by the end of the first year. The hub will become the foundation of new global surveillance architecture for COVID-19 and other pathogens.

International Summit on green hydrogen mission

India hosted the International Climate Summit 2021 on 3 September with the focus on making India the new global hub of green hydrogen and its quest of becoming a leader in renewable energy. The summit witnessed various stakeholders putting forth their views and promising collective efforts to devise solutions pertaining to hydrogen and its applications as a green fuel. Prime Minister Modi had earlier announced a National Hydrogen Mission. The speakers in the summit called for forging partnerships in ramping up the transition towards net-zero carbon emissions through adopting clean energy. Minister of State for Earth Sciences & Science and Technology Jitendra Singh stressed the urgency to address climate challenges through a consolidated approach and timely interventions and called for shifting to cleaner options like green hydrogen as a potential energy source for a more sustainable future. Singh called for the creation of new hydrogen, carbon capture, use and storage technology hubs (CCUS) and launched the National Hydrogen Portal www.greenhydrogen-India.com. This platform will become a one-stop information source for research, production, storage, transportation, and application of hydrogen across the country and technology. Norway was the partner country for the summit. A keynote address was delivered by Reliance Industries Managing Director Mukesh Ambani.

EMA and FDA inputs for Live Biotherapeutic Product

YSOPIA Bioscience and the Pharmabiotic Research Institute have jointly published a regulatory review article detailing findings which highlight the shared mindset between the European Medicines Agency (EMA) and the US Food and Drug Administration (FDA) to evaluate the clinical and technical requirements for developing live biotherapeutic products (LBPs). The report clarifies and confirms the specific requirements needed to document and demonstrate the quality, safety and efficacy of LBPs, a novel class of biologic medicines which contain live microorganisms as an active substance(s). This regulatory feedback was in response to YSOPIA's lead drug candidate Xla1, which is a LBP developed to treat obesity and associated metabolic disorders. The regulatory concepts specific to LBPs that were raised by both EMA and FDA drug authorities would support strategic decisions that must be made when designing comprehensive preclinical and clinical development plans for LBPs.

Conservationists call for urgent ban on deep-sea mining

A motion calling for a ban on deep-sea mining has been adopted in the IUCN World Conservation Congress, Marseille. The motion calls on all state members to support a moratorium on deep-sea mining until rigorous and transparent impact assessments are carried out, the social, cultural and economic risks understood, and the protection of the marine environment ensured. It also called on states to promote the reform of the International Seabed Authority (ISA) to ensure transparent and environmentally responsible decision-making and regulation. Among governments and government agencies, 81 voted for the moratorium, 18 against and 28 abstained. For NGOs and civil society groups, the vote was even more in favour of the motion, with 577 for, 32 against and 35 abstentions.

UN Secretary General releases report on Our Common Agenda

The report "Our Common Agenda " presented to the UN General Assembly looks ahead to the next 25 years on global cooperation and reinvigorating multilateralism. The Common Agenda focuses on implementation of existing agreements, including the Sustainable Development Goals. The report calls for united action to meet the challenges of COVID-19, triple crisis of climate disruption, biodiversity loss and pollution destroying the planet. It also seeks a better governance system for global public goods and proposes a Summit of the Future.

SCIENCE POLICY AND DIPLOMACY

Leaked IPCC draft calls for lifestyle change

Lifestyle changes globally could cut emissions twice the size of Brazil's by 2030, compared to technological solutions alone, according to a leaked draft of an upcoming Intergovernmental Panel on Climate Change (IPCC) scientific report. Eating meat, air conditioning, flying and driving SUVs are among high carbon lifestyle choices on the rise, linked to disposable incomes. Those trends make consumer behaviour relevant to tackling climate change – particularly among the rich, who have the largest carbon footprints. For the first time, the IPCC is to include a major section on demand-side measures in the section of assessment report 6 on how to stop global warming due to be released in March 2022. A first draft of the summary for policymakers and the opening chapter has been leaked by Extinction Rebellion scientists. The report finds that better lifestyle options can deliver an additional annual 2 GtCo2eq (Gigatons CO2 equivalent) savings in 2030 and 3 GtCo2eq savings by 2050 beyond the savings achieved in conventional technology-centric mitigation scenarios. Total global greenhouse gas emissions per year were 59 GtCo2 in 2018 with 38Gt from fossil fuel and industry.

BRICS Energy Ministers meeting

BRICS Ministers of Energy met on 2 September under the chairmanship of India. The

BRICS Energy Report 2021, BRICS Energy Technology Report 2021 and BRICS Energy Research Directory 2021 were launched and a joint communique was adopted. The communique expressed the intent to step up Cooperation in Energy Access and Affordability, Energy Security and Clean Technology, Energy Efficiency, Energy Transitions, Renewable Energy and to strengthen the BRICS Energy Cooperation Framework. They also agreed to continue to work to implement the agreed Road Map for BRICS Energy Cooperation up to 2025 through strengthening the BRICS Energy Research Cooperation Platform (ERCP).

Global biodiversity issues discussed

The open-ended Working Group (WG) on the Post-2020 Global Biodiversity Framework (GBF) held its 3 rd meeting in virtual mode from 23 August to 3 September 2021. It was attended by 1680 participants including 141 parties, one non-party, and more than 200 observer organizations. The meeting revealed important divergences that prevented agreement on an ambitious framework. Agreement on Specific, Measurable, Achievable, Realistic, and Time-bound (SMART) targets for different components proved difficult to achieve. Major divergences were also noted on digital sequence information (DSI), especially when discussing "open" access and benefit sharing. During the WG, no formal changes to the first draft was made, but suggestions were collated into alternative texts and compiled in reports of five contact groups on: Goals, Milestones and Overall Structure; Reducing Threats for Biodiversity; Tools and Solutions for Implementation and Biodiversity Mainstreaming; Nature's Contributions to People; and Digital Sequence Information on genetic resources. Delegates agreed that these reports would form a basis for discussions at the resumed session of the Working Group, which is expected to reconvene as an in-person meeting in January 2022, in Geneva, Switzerland. The second part of CBD COP15 is scheduled to reconvene in a face-to face meeting in Kunming, China in 2022 to take a final decision on the post-2020 global biodiversity framework, including the successor to the Convention on Biological Diversity's Strategic Plan 2011-2020, and its 20 Aichi Biodiversity Targets (expired in 2020) and related topics.

Integrated spatial planning for Biodiversity, Climate, and Water objectives

A paper by the Nature Map consortium led by IIASA, presents an approach for spatial planning to truly integrate biodiversity, carbon, and water conservation within a common approach and a single global priority map. The new global priority maps developed show that quality (location and management effectiveness) of areas is more important than quantity (global extent). The study provides guidance on setting objectives and indicators for conserving species, healthy ecosystems and their services to people, and identifying areas to conserve accordingly. The researchers note that conserving a strategically located 30% of land could safeguard more than 62% of the world's above and below ground vulnerable carbon and 68% of all freshwater, while ensuring that over 70% of all terrestrial vertebrate and plant species are not threatened with extinction. The study assumes importance in view of UNFCCC-COP26 in Glasgow and the COP of the UN CBD in China in 2022 on a new Global Biodiversity Framework. The study demonstrates that optimizing jointly for biodiversity, carbon, and water maximizes synergies that can be gained from conservation compared to placing emphasis on any individual asset alone.

UNECE releases 44 recommended climate indicators for national reporting

The UN Economic Commission for Europe (UNECE) has released a set of 44 recommended indicators for measuring climate change in an internationally comparable way. The indicators aim to help European countries track and report their progress towards nationally determined contributions (NDCs) under the Paris Agreement. The set of suggested climate change indicators was developed by an expert task force of the Conference of European Statisticians (CES).The CES Indicator Set covers: drivers of

climate change; emissions; impacts; mitigation; and adaptation. The indicators were selected based on policy relevance, methodological soundness, and data availability.

XIII BRICS Summit- New Delhi Declaration

Leaders of BRICS member states meeting at the virtual 13th BRICS Summit on 9 September adopted the Delhi Declaration. The Declaration addressed key issues in science and technology. These were Covid-19 and boosting human health, biological weapons, cybersecurity, outer space, and technology for the SDGs, climate change, disaster management, food security and agriculture. Increase in joint research was also stressed and also leveraging digital solutions for ensuring inclusive and equitable quality education and enhancing research and academic collaboration. They called for strengthening energy security. China will take on the BRICS Chairship in 2022 and host the next BRICS Summit.

WHO Director-General addresses G20 Health Ministers Meeting

WHO Director General addresses the G20 Health Ministers meeting in Rome on 5 September. He noted that while more than 5 billion Covid-19 vaccines have now been administered worldwide, almost 75 percent of those doses have been administered in just 10 countries. Africa has the lowest vaccination coverage at 2%. This situation needed urgent correction. He outlined four critical areas for action for WHO's future. First, better global governance through an international agreement on pandemic preparedness and response, which will provide a much-needed foundation for global cooperation and for a more coherent and coordinated response to future epidemics and pandemics. This is to be discussed at a Special Session of the World Health Assembly in November 2021. Second, more and better financing for national and global preparedness and response. Third, better systems and tools, across the One Health spectrum. And fourth, a strengthened, empowered and sustainably financed WHO at the centre of the global health architecture, and better balance between assessed and voluntary, earmarked contributions to the budget.

Meeting of the U.S.-India Strategic Clean Energy Partnership (SCEP)

Minister of Petroleum and Natural Gas and Minister of Housing and Urban Affairs Hardeep Singh Puri today co-chaired a virtual Ministerial meeting with U.S. Secretary of Energy Ms. Jennifer Granholm to launch the revamped U.S.-India Strategic Clean Energy Partnership (SCEP).The SCEP organizes inter-governmental engagement across five pillars of cooperation. The meeting decided to add a fifth Pillar on Emerging Fuels, which signals joint resolve to promote cleaner energy fuels. A new India-US Task Force on Biofuels was also announced. Both sides will strengthen the electric grid in India and also renamed the Gas Task Force to India-US Low Emissions Gas Task Force. It was agreed to work on smart grid and grid storage under the Partnership to Advance Clean Energy (PACE)-R initiative. They also reviewed the progress on the India-US Civil Nuclear Energy cooperation.

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