VATIS UPDATE

Waste Management

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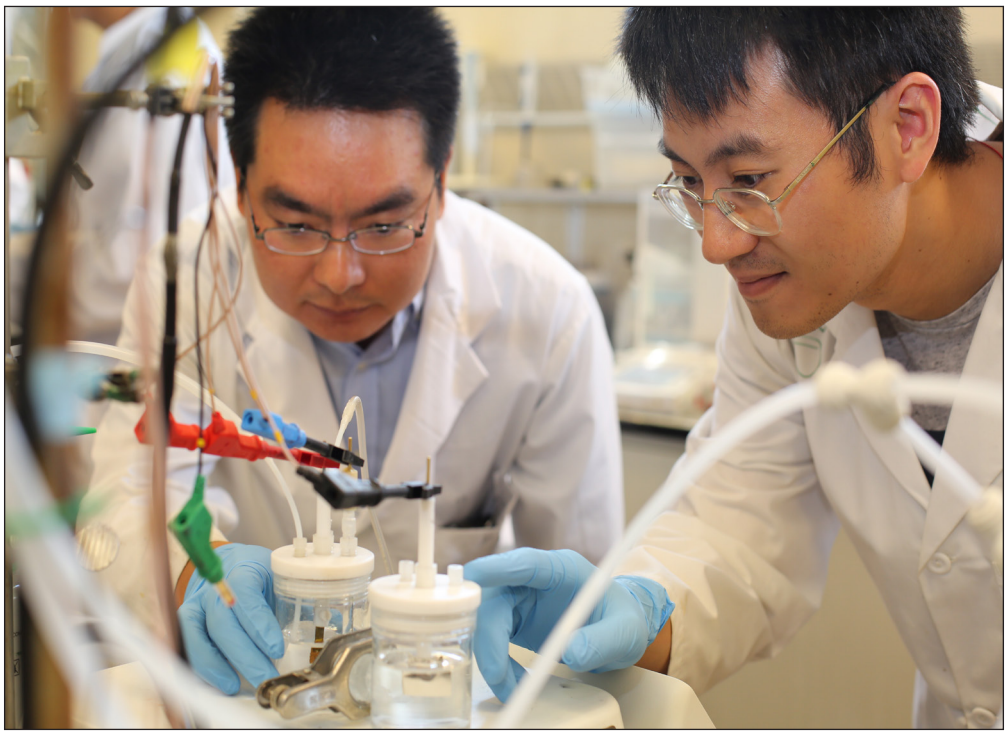
Highlights

- Indian start-up turns food waste into fuel
- Diesel fuel made from recycled plastic
- Bacteria used to extract precious metals
- New method to clean contaminated water
- Bacteria to clean up oil spill
- Novel electrochemical process



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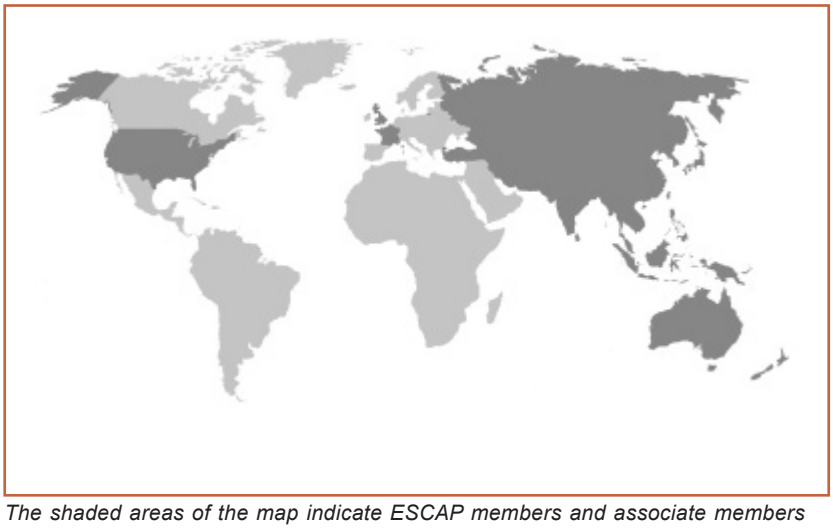
Asian and Pacific Centre for Transfer of Technology

UNITED NATIONS ESCAP
Economic and Social Commission for Asia and the Pacific

The **Asian and Pacific Centre for Transfer of Technology (APCTT)**, a subsidiary body of ESCAP, was established on 16 July 1977 with the objectives: to assist the members and associate members of ESCAP through strengthening their capabilities to develop and manage national innovation systems; develop, transfer, adapt and apply technology; improve the terms of transfer of technology; and identify and promote the development and transfer of technologies relevant to the region.

The Centre will achieve the above objectives by undertaking such functions as:

- Research and analysis of trends, conditions and opportunities;
- Advisory services;
- Dissemination of information and good practices;
- Networking and partnership with international organizations and key stakeholders; and
- Training of national personnel, particularly national scientists and policy analysts.



The shaded areas of the map indicate ESCAP members and associate members

Cover Photo

University of Toronto Engineering researchers Min Liu (left), Yuanjie Pang and their team designed a way to efficiently reduce climate-warming carbon dioxide into carbon monoxide, a useful chemical building block for fuels such as methanol, ethanol and diesel.

(Credit: Marit Mitchell, University of Toronto, Canada)

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Indian start-up turns food waste into fuel

GPS Renewables, India, has set up biogas units on their premises in Karnataka. The biogas company converts over 20 tonnes of food waste in 30 biogas generating plants across 11 states which generate 1400kg LPG. In April 2015, Indian Institute of Management Bengaluru (IIMB) graduates Sreekrishna Sankar and Mainak Chakraborty set up the company which has set up units in Bangladesh, Japan, and Malaysia. GPS Renewables uses the Biourja system, a high-rate dry anaerobic digestion system that digests biowaste and produces biogas.

Source: http://www.timesofindia.indiatimes.com

e-Waste in India

The government of India has announced that around 17 lakh tonne of e-waste was generated in the country in 2014 and it has notified rules in March this year to ensure better management of such wastes. Based on a survey carried out by the Central Pollution Control Board in 2005, the generation of e-waste in the country was assessed at 1.46 lakh tonne and was estimated to exceed 8 lakh tonne by 2012. "As per the United Nations University report, 17 lakh tonnes of e-waste was generated in the country in 2014," said Environment Minister Anil Madhav Dave.

Source: http://www.timesofindia.indiatimes.com

Sri Lanka gets ADB loan for wastewater management

The Asian Development Bank (ADB) has granted a 128 million US dollar loan for a greater Colombo water and wastewater management improvement investment program to assist achieve providing safe water and full sanitation coverage in Sri Lanka. The water system upgrade is expected to bring 24/7 water supply to Colombo city by reducing non-revenue water to less than 20 percent.

ADB, totaling 300 million US dollars, will fund 20 percent of the 1.5 billion US dollar investment plan for water and sanitation in Greater Colombo. The first loan of 84 million US dollars was made in 2012 and the second loan of 88 million US dollars in 2013. This is the third and last phase. This third phase will construct a new sewer system in un-served areas of Kirillopone.

The proposed wastewater treatment plant will improve effluent water quality of the Wellawatta sea outfall. These works will be undertaken by the Colombo Municipal Council. The third phase will also support the National Water Supply and Drainage Board to complete non-revenue water reduction program commenced under the previous phases.

Source: http://www.lankabusinessonline.com

China moves to tackle e-waste pollution

Chinese authorities have imposed stringent regulations on workshops whose activities damage the ecosystem. Guiyu, a township in Guangdong province, has developed a cleaner, healthier atmosphere since strict restrictions on the disposal of electronic waste – including televisions, air conditioners, washing machines, cellphones and computers – came into force in 2013.

Known as the e-waste capital of the world since the 1990s, Guiyu has grown into a major hub for its disposal. "In its heyday, more than 100,000 people, about 50 percent of the permanent residents, made a living dismantling electronic equipment to harvest the expensive metals inside," said Lin Qiurong, head of the township government.

It seemed that on every street, people could be seen heating circuit boards over coal fires to recover lead, while others used acid to burn out copper or bits of gold. Before the restrictions were imposed three years ago, Guiyu's e-waste industry recovered about 20 metric tons of gold and 450,000 tons of copper every year.

Source: http://www.china.org.cn

App to report uncollected garbage in Malaysia

The Selangor state government in Malaysia has launched a new smartphone application to allow users to report uncollected garbage in the state with a maximum turnaround time of four days. iClean Selangor, available on Android's Play Store, is currently available for use in Klang and will be made available statewide before 2017. After a registration process, the application requires its users to take photographs of uncollected garbage in Klang and the complaint will be forwarded to the command centre handled by KDEB Waste Management Sdn Bhd.

The photos will be automatically geotagged and forwarded to ground KDEB Waste Management team, who will further send the complaints to contractors to resolve them. According to the Selangor state agency, in the first month of its trial in Klang starting

July 1, KDEB Waste Management received 817 complaints via the application and resolved all of them. The data regarding the complaints and the completion turnaround will be sent to the state government for evaluation. The application also allows users to track status of their complaints.

Source: http://www.themalaymailonline.com

Waste discharging projects in Viet Nam

The Vietnamese Minister of Natural Resources and Environment Tran Hong Ha has approved a plan to inspect all projects with large waste discharging volumes in the country. The purpose is to assess the state administration in the field of environmental protection and water resources in Viet Nam. Based on the results, the relevant agencies will propose amendments and perfect the legal institutions to strengthen the State management of environmental protection in the process of evaluation, approval and implementation of investment projects.

The inspection team will also propose appropriate solutions to overcome the existing problems in order to ensure that businesses strictly observe the law associated with sustainable development. The subjects of inspection are organizations and businesses that discharge waste into the environment. Inspections will focus on industrial production enterprises with wastewater discharge volume of 200m3/day or more, which are likely to cause pollution of the marine environment, watersheds in major provinces and cities.

The Ministry will establish three inspection groups to check the enterprises with wastewater discharge volume of 500m^3/day or more in 23 provinces. Minister Tran Hong Ha also asked the Departments of Natural Resources and Environment of all 63 provinces and cities to make the list of enterprises that discharge 200m^3 of wastewater or more per day for the inspection in 2017. This is considered one of the largest inspections of this kind so far.

Source: http://www.english.vietnamnet.vn

e-Waste and hazardous waste centres in India

The New Delhi Municipal Council (NDMC) has proposed to set up 7 new collection centres for e-waste and hazardous domestic waste. The NDMC has adopted the Union Ministry of Environment's Solid Waste Management Rules, 2016, which paved the way for the new collection centres. The collection centres would be set up at Kautilya Marg, Chanakyapuri, Jai Singh Road, Ashoka Road, Barakhamba Road, Netaji Nagar and Lodhi Colony.

The NDMC has recently inaugurated an eco-friendly waste collection centre at Kautilya Marg. The centre, set up in collaboration with the environmental NGO Chintan, is also a e-waste collection point. "The e-waste collection bins were still being designed, though solid waste was being collected at the Kautilya Marg centre," said Chitra Mukherjee, the head of programmes at Chintan.

E-waste recycling has gained importance in the last few years, with Delhi coming in second after Mumbai in terms of e-waste generation. With thousands of tonnes of e-waste being generated in the Capital every year, the need for more recycling centres is growing. Meanwhile, the NDMC also decided to start charging a user-fee for its domestic solid waste collection facility.

Source: http://www.thehindu.com

e-Waste recycling in China

According to a report released by the Ministry of Commerce, e-waste items recycled in China in 2015 alone amounted to 152.74 million pieces. Baidu Recycle App has been an extremely viable measure towards reduction of e-waste and to help spread the message participants from over 13 countries came together to learn from China's experience in managing the mounting e-waste recycling challenge and be inspired by China's e-waste management systems, disposal and treatment technologies and how these can be applied and replicated throughout the world.

The pioneering Baidu Recycle App, uses an innovative model of connecting consumers, dismantlers and manufactures together using an efficient and user friendly smartphone app. The user can find out a price and recycle their electronic products using a nearby legitimate e-waste pick-up services, helping to simplify the recycling process and cut down on informal recycling stations. The Baidu Recycle App can be downloaded for free in English from the Apple store.

Source: http://www.techtree.com

Global Cleantech Innovation Programme for SMEs

For more information, access:

http://www2.cleantechopen.org/

Diesel fuel made from recycled plastic

A new research led by associate professor Farid Dailami, at Bristol Robotics Laboratory (BRL), the United Kingdom, in partnership with Recycling Technologies, the United Kingdom, developers of 'Plaxx', will determine if Plaxx, made from residual mixed plastic waste, can be used efficiently in diesel engines which currently use HFO (Heavy Fuel Oil), without increasing engine wear. These engines are in marine vessels such as tankers, ferries, as well as other nautical machinery. The research will be funded by Innovate UK and ESPRC.

The waste source is the plastic entering the commercial, industrial and municipal waste streams that is mixed, laminated, contaminated and otherwise not processable by conventional plastics recycling techniques. Plaxx is the product of the polymerization of plastic and is made up of a mixture of hydrocarbon monomers similar to crude oil. It is reportedly very low in sulphur and other organic and inorganic contaminants. Currently it is a soft wax at room temperature but a low viscosity liquid at 70°C. The researchers say that it can be further refined and could be used as an input to plastics manufacturing.

The research will develop the use of Plaxx by testing engine performance, exhaust emissions and engine wear on different engines over a broad range of test conditions. The research will also develop software tools that will monitor these three aspects to enable engine users to achieve optimum performance from Plaxx. "This new fuel could have huge environmental benefits as an alternative to HFO currently used in marine diesel engines and industrial engines," said Farid Dailami.

Source: http://www.ptonline.com

Plastic waste into fuel

Farai Musendo, a final year Chemical Engineering student of the National University of Science and Technology (NUST), Zimbabwe, has tapped into Zimbabwe's waste problem, by designing a machinery that turns plastic to diesel. The innovative student has revealed that his innovation, if tried and tested, can be used to fuel millions of vehicles in Zimbabwe, and will also go a long way in ridding the country of its plastic waste problem. He said he will require an investment of $100,000 to complete research on his petrochemical innovation.

"This is value addition through litter. We collect used plastics and clean them before processing them into diesel. What I've are just samples and my passion of waste management drove me to do this. As a country we're far from properly managing our waste. So this is part of waste management project and improving our energy sector. This could also create employment if it succeeds. We can create employment for people who would be collecting the waste on our behalf. 100 kilograms of plastic litter is equivalent to 55,2 liters of fuel," said Musendo.

"The university encourages young and innovative students to come up with technological breakthroughs that can transform Zimbabwe to a science and technology driven economy. Innovation projects improve people's lives as well as the nation at large. We've managed to top the education sector through the sincerity of our projects. Our innovations are things that are implementable. STEM is really not about academic subjects but the subjects should be practical to transform people's lives and the economy as well as the country," said Felix Moyo, at NUST.

Source: http://www.atlantablackstar.com

Plant-based biodegradable water bottle

A group of Japanese researchers from the Kyoto Institute of Technology and Keio University, have discovered a species of bacteria that degrades and assimilates poly ethylene terephthalate (PET) commonly used for water bottles. The team gathered 250 samples of PET contaminated by sediment, soil and wastewater from a plastic bottle recycling site. The researchers screened the microbes living on the samples to identify whether any were using the PET as a growth source.

While they found a number of microbes broke down the PET film, one newly discovered bacteria species, Ideonella sakaiensis 201-F6, was responsible for converting 75% of the PET carbon into carbon dioxide (CO_2). The scientists explained, "By screening natural microbial communities exposed to PET in the environment, we isolated a novel bacterium, Ideonella sakaiensis 201-F6, which is able to use PET as its major energy and carbon source." The bacterium was able to almost completely degrade a thin film of PET after six weeks at 30°C.

When grown on PET, the bacterium produces two enzymes capable of hydrolysing PET and the reaction intermediate, mono(2-hydroxyethyl) terephthalic acid. The bacteria then digest both substances. The two enzymes – PETase and MHETase – efficiently break down PET into its

two environmentally benign monomers, terephthalic acid and ethylene glycol, which are then broken down further to produce CO_2 and water. The researchers hope "these results will bring us closer to achieving an ideal model for PET recycling."

Source: http://www.iom3.org

New method to recycle carbon fiber

Researchers at Georgia Tech, the United States, have developed a method to recycle nearly 100 percent of the materials in certain types of thermoset carbon fiber composites. During the new process, the carbon fiber composites are soaked in alcohol, which slowly dissolves the epoxy that binds and gives shape to the carbon fibers. Once dissolved, the researchers can separate the carbon fibers and the epoxy and use them for new applications.

"This method we think could have a lot of immediate industrial applications, with lots of economical and environment benefits," said Kai Yu, at Georgia Tech. "Traditional carbon fiber has historically presented a number of challenges for recycling. The polymer matrix is usually crosslinked, just like the rubber, and it can't be simply melted; it's very hard to strip away the polymer to reclaim the embedded carbon fibers, which are more valuable to recycle," said Jerry Qi, at Georgia Tech.

The research team focused on carbon fiber that uses a special type of epoxy called "vitrimer epoxy" to give the composite component its shape. "Vitrimers contain dynamic bonds that can alternate their structure without losing network integrity under certain conditions. We let alcohol, which has small molecules, to participate in the network of alternating reactions, which effectively dissolved the vitrimer," Yu said. The new recycling process has the potential to reduce the thousands of tons of carbon fiber waste generated each year in the US and Europe.

Source: http://www.compositesmanufacturingmagazine.com

Biodegradable plastic

Researchers at Michigan Technological University (Michigan Tech), the United States, have been developing solar-powered 3D printers, and lately seem to be directing their overall attention towards making 3D printing technology more environmentally friendly. The proof that Michigan Tech has been looking to develop more sustainable additive manufacturing processes certainly exists outside of their research on solar-powered 3D printing. In fact, one group of students have recently launched a business to manufacture and sell recycled and biodegradable filaments.

The company, which is called Superior Filament, was started by a group of four Michigan Tech students who have been producing plastic filaments since 2015. Their main objective is to promote environmental sustainability in 3D printing, aiming to reuse discarded plastic pollutants instead of creating more. The method that they're developing will transform our everyday plastic waste, such as soda bottles, water bottles, milk jugs and many others, into high-quality 3D printing filament.

Though not all of their available filaments are 100% environmentally friendly, the ultimate goal of offering recycled filament for a fraction of the average price seems near in sight. Superior Filament is already offering rPET (available for pre-sale at $24.95), which is made from household items such as soda bottles and water bottles, and rABS ($29.95), a spin on the commonly used material made from the same plastic as car battery cases and Legos.

Both of these filaments can be purchased on the Superior Filament website.

Source: https://www.3dprint.com

Innovative bottle waste recycling project

A team of young engineers from Birzeit University, Palestine, has developed a machine that separates and reduces the volume of beverage containers, reducing the effects of waste on the environment and decreasing the amounts of solid waste caused by lack of awareness. Antranik Emerezian and Nicola Shaer, and information technology student Mu'tasem Hidmi have developed the Canbot project under the supervision of professor Simon Araj and the mechanical engineering department.

This machine allows the user to easily reduce the volume of aluminum cans, plastic, glass and paper bottles and containers instead of adding them to other waste. Canbot not only grabs these beverage containers from the user, but also uses a smart control system linked to an efficient pneumatic system to separate different types of materials and reduce their volume by crushing them.

The students expressed their excitement about the environmentally-friendly project. "We aim to kick-start the market of sustainable waste management. We seek to encourage Palestinian businesses and the community to develop waste minimization projects that are socially and environmentally responsible," said Emerezian. *Contact: Birzeit University, PO Box 14,*

Birzeit, West Bank, Palestine, Tel: +972-2-298-2000, Fax: +972-2-281-0656, E-mail: pr@birzeit.edu.

Source: http://www.birzeit.edu

Method to recycle polycarbonates

IBM has developed a process to recycle polycarbonates into a new form of plastic that does not leach Bisphenol A into the environment. The new discovery, provides a way to both recycle a key plastic used in CDs and smartphones, as well as transform it into a non-toxic material. As a consequence of (international) concerns about the safety of the material, and to find a way to re-use the current stock of waste polycarbonates, IBM researchers have discovered a new recycling process to turn the polycarbonates waste from old smartphones and CDs into a non-toxic high-strength plastic.

Through the process of adding a secondary compound and heat to the plastic waste it is converted into a precursor for reuse as a plastic, with properties of the new plastic exhibiting "temperature and chemical resistance [properties] superior to the original substance". The new plastic, according to the firm, no longer decomposes in the way that leaches BPA into the environment. The firm, in part, attributes the discovery to the use of cognitive computing power within the research process.

"Polycarbonates are common plastics in our society – especially in consumer electronics in the form of LED screens, smartphones and Blu-rays, as well as everyday eyeglass lenses, kitchen utensils and household storage gear," said Gavin O. Jones, at IBM. "We now have a new way of recycling to improve how this prominent substance impacts the world's health and environment. We simultaneously recycle the substance into a new type of plastic – safe and strong enough for purifying our water and producing medical equipment," says Jeanette Garcia, at IBM.

Source: http://www.consultancy.uk

Scientists turn old plastic bottles into fuel

A team of scientists from the University of California, Irvine (UCI), the United States, and the Shanghai Institute of Organic Chemistry (SIOC), China, has developed a technique which involves breaking down the plastic to a molecular level to turn it into a readily usable fuel similar to diesel. The source material is the most common type of plastic, polyethylene, which is predicted to reach a global annual demand of nearly 100 million metric tons by 2018.

"The process does not involve any harmful chemicals and does not create waste products," explained Zhibin Guan, at UCI. Devised "in light of the huge plastic pollution as well as the critical energy needs in China," the process basically melts the old plastic into liquid fuels and waxes. The technique has been published in the journal *Science Advances*.

Source: http://www.edition.cnn.com

Waste plastic converted into oil

Students of the petrochemicals department of KBN Engineering College, Kalaburagi city, India, have made a remarkable breakthrough in converting waste plastics into oil that is widely used in industrial production, including electricity generators and diesel pumps. The innovative methodology adopted by them for the apparatus that is used in converting the plastics – including polypropylene, polyethylene, and polystyrene – has been successfully configured and tested by Fateh Mohammad, Mohammad Amanathulla Khan, Tafseer Furqan Sharieff, and Waseem Ahmed Shariff and they now propose to patent the product.

The students, under the guidance of the Head of the Department Chetana Alimany of the college, used the principal of 'pyrolysis', a process that breaks down complex products in plastics to simple products like gas and oil. The students spent more than two months to configure the machine that has a capacity of 12 kg. The oil produced has diesel-grade calorific value. With further processing, the oil can be used as an automotive fuel and can be converted it into a second generation transport fuel, which requires a further purification process.

Mr Mohammad said that the oil in its present form can be directly used in power plants for the generation of electricity, heat and stream. It can also be used in heating oil-fired burners, furnaces and turbines, hot water generators, hot air generators, thermal fluid heaters and electricity generators, by mixing the oil with 50 per cent diesel, in diesel pumps by mixing it with 50 per cent of diesel and can be used as substitute to industrial diesel.

Mr. Mohammad said that this process would be an effective solution to overcome the environmental problems caused by the indiscriminate use and unscientific discarding of plastic. At present, only around 9605 tonnes of total plastic waste is collected and recycled and another 6,137 tonnes of plastic waste remains uncollected.

http://www.thehindu.com

GPS tracking devices for toxic e-waste

A two-year investigation of electronics recycling using GPS tracking devices, done by the Basel Action Network (BAN), the United States, has revealed that policies aimed at curtailing the trade in toxic e-waste have been unsuccessful, with nearly one-third of the devices being exported to developing countries, where equipment is often dismantled in low-tech workshops – often by children – endangering workers, their families, and contaminating the surrounding environment. BAN devoted to ending the trade in toxic waste, decided to physically track devices sent for recycling.

"In our view those reports underestimated the export flows. So we decided if the government is not going to use tracking devices, we will," said BAN's executive director, Jim Puckett. BAN installed 200 GPS tracking devices into "used, non-functional computer equipment that its research team delivered to publicly accessible e-waste recycling drop-off sites around the U.S." This equipment was left for recycling in more than a dozen states across the country between July 1, 2014, and December 31, 2015; 149 devices went to recyclers, 49 to thrift stores (mainly Goodwill) and two to retailers.

BAN has found that 65 of those devices (or 32.5 percent of the equipment tracked) have been exported. Of that equipment, BAN estimates that 62 devices (or 31 percent of the tracked equipment) were likely to be illegal shipments based on the laws in the countries or regions where the electronics ended up. Of the equipment left with commercial recyclers, 39 percent of the tracked equipment was exported. Of the 46 tracked devices sent to Goodwill stores, seven (or 15 percent) were exported. This includes six (or 21 percent) of the 28 delivered to Dell Reconnect stores.

Source: https://www.theintercept.com

Bacteria used to extract precious metals

Scientists from the National University of Singapore (NUS) have re-engineered the Chromobacterium violaceum bacterium to give it the ability to create enzymes that can recycle metals such as gold, platinum and palladium from e-waste. This means barrels of poisonous chemicals such as cyanide or concentrated acids – now often used to dissolve metals in e-waste before they are recovered through electrolysis – could one day be replaced with pools of this common soil bacterium. When immersed in the bacteria, the metals are dissolved and then converted into solids without the need for electrolysis.

"This method is safer and more environmentally sustainable," said Yew Wen Shan, at NUS. Using the example of cyanide, which is often also used in gold mines to extract the precious metal, he said that, as it is highly poisonous, extra safety infrastructure is needed to prevent its fumes from escaping the facility. It is also harder to scale up operations using such harmful chemicals as there are regulations that limit how much can be used. They can also stay effective for at least three months, compared to chemicals which lose their effectiveness after a few uses.

Source: http://www.straitstimes.com

Non-toxic leaching formula for e-scrap

Mineworx, Canada, has revealed that its HM X leach formula removes gold, palladium, platinum, silver and other metals from circuit boards and is safer than cyanide or other leaching formulas. This method can effectively extract precious metals from e-scrap without using toxic chemicals "You could essentially drink this," said Duane Nelson, at Mineworx. The company has filed for a patent from the U.S. Patent and Trademark Office for the technology. The formula can also be applied to extracting metals from ores, concentrates and tailings.

"The Mineworx formula, made of food-grade, organic ingredients, was recently tested on e-scrap samples. HM X-leach accumulated 2,600 parts per million of gold in the solution in less than an hour of soaking. It matches cyanide's recovery rate of 97 percent over the course of about four hours. While some of the formula is consumed in the process, the liquid is reusable. Because the ingredients in HM X-leach are more expensive than cyanide, the formula's recyclability is key," said Nelson.

Source: http://www.resource-recycling.com

Self-destructing battery dissolves in water

Researchers at the Iowa State University (ISU), the United States, have developed a battery that self-destructs and dissolves in just 30 minutes when submerged in water. This dissolvable battery could help save the planet by reducing waste caused by discarded electronics. According to the researchers,

unlike conventional electronics that are designed to last for extensive periods of time, a key and unique attribute of transient electronics is to operate over a well-defined period, undergo fast, complete self-deconstruction and vanish when transiency is triggered.

The battery measures 5 mm long, 6 mm wide and 1 mm thick, and is similar to commercial batteries in terms of components, structure and electrochemical reactions. It is composed of eight layers, which include the anode, cathode and electrode, and is wrapped in a polyvinyl alcohol-based polymer. Once dropped into the water, the battery's polymer casing swells and the electrodes break apart, thus causing it to dissolve. However, the batteries contain nanoparticles, which dissolves but does not completely disappear. The dissolving process could take about half an hour.

Scientists are exploring dissolvable batteries in an effort to reduce electronics waste. A team of researchers from the University of Illinois, the United States, is also developing electronic circuit boards that could be dissolved in water. According to the scientists, the circuit boards will break down within three to six months at the landfill site. The research has been published in the Journal of *Polymer Science*.

Source: http://www.natureworldnews.com

Green way to recycle batteries

A team of researchers at University of South Florida (USF), the United States, is working to use naturally-occurring fungi for an environment-friendly recycling process to extract cobalt and lithium from waste batteries. "The idea first came from a student who had experience extracting some metals from waste slag left over from smelting operations," said Jeffrey A. Cunningham, at USF. Cunningham's team is developing the environmentally-safe way to do this with organisms found in nature – fungi in this case – and putting them in an environment where they can do their work.

To drive the process, Cunningham and Valerie Harwood, both at USF, are used three strains of fungi – Aspergillus niger, Penicillium simplicissimum and Penicillium chrysogenum. The team first dismantled the batteries and pulverised the cathodes. Then, they exposed the remaining pulp to the fungus. "Fungi naturally generate organic acids, and the acids work to leach out the metals" added Cunningham. According to the results, using oxalic acid and citric acid, two of the organic acids generated by the fungi – up to 85 per cent of the lithium and up to 48 per cent of the cobalt – from the cathodes of spent batteries were extracted.

Source: http://www.thehindu.com

Converting mobile phones into valuable metals

The University of New South Wales (UNSW), Australia, has unveiled a pilot micro-factory that safely transforms toxic electronic waste (e-waste) into high value metal alloys. This project will offer a unique low-cost solution to one of the world's fastest-growing waste burdens. Although e-waste contains a range of valuable metals, it is especially challenging to recycle, due to the presence of toxins and the complex mix of materials. Currently, large volumes of e-waste are exported from industrial economies like Australia to developing nations, where hand processing to recover metals exposes poor communities to dangerous contaminants.

The process, developed by Veena Sahajwalla, at UNSW, recovers the considerable wealth of resources embedded in e-waste, while overcoming the challenges of toxicity and the often prohibitively high costs of conventional industrial-scale recycling. "A ton of mobile phones (about 6,000 handsets), for example, contains about 130 kg of copper, 3.5 kg of silver, 340 grams of gold and 140 grams of palladium, worth tens of thousands of dollars," Sahajwalla said. Sahajwalla used precisely controlled high-temperature reactions to produce copper and tin-based alloys from waste printed circuit boards (PCBs) while simultaneously destroying toxins.

A programmed drone identifies PCBs from within crushed e-waste, and a simple robot extracts them, overcoming the risks of contamination, before the PCBs are fed into the furnace. The new micro-factories are suitable for mobile use: they can be set up in containers and transported to waste sites, avoiding the huge costs and emissions of trucking or shipping e-waste over long distances. Sahajwalla's solution also offers a safe way for poor communities in developing nations to generate an income from the production of metal alloys.

Source: http://www.asianscientist.com

Step Initiative

Solving the e-waste problem

http://www.step-initiative.org

Tiny bubbles to reduce industrial wastewater

US-based Mikroflot Technologies founder Jose Ramirez, has developed a wastewater treatment system for manufacturing plants. Ramirez is aiming to fix the problem using microscopic bubbles. "Our technology is based on a new way of generating these microscopic bubbles that is very simple and easy," said Ramirez. The idea of using bubbles to push contaminants to the top of a tank that needs cleaning is nothing new. There are big, expensive systems for that, all with the goal of minimizing the repeated rinsing needed to clean equipment to the right standards.

Ramirez's solution, is called acoustic resonance air dispersion microflotation technology. It uses compressed air that has an acoustic wave pulsating in it to generate tiny air bubbles that float contaminants out of the water. The contaminant sludge is then skimmed from the water's surface and stored in a tank until Mikroflot's hauling service comes to collect it. "What's unique about Mikroflot is its combination of an innovative technology and a business model that doesn't require customers to make a big capital outlay, said George Arida, at 30Ventures, the United States.

"That makes the company "pretty disruptive" to current solutions on the market. I haven't seen their patent applications, but if their claims are solid and they can protect this technology and it's robust enough to work well across a lot of variable waste streams, then I think they have something really interesting," said Arida. Mikroflot will dramatically reduce or eliminate sewer surcharges using little or no chemicals, providing cost savings from 40% to 70% and delivering a reduced environmental footprint.

Source: http://www.jsonline.com

New method to clean contaminated water

Dais Analytic Corporation, the United States, a commercial nanotechnology materials company selling its Aqualyte™ membrane nanomaterial with engineered processes addressing needs in the worldwide air, energy and water markets, today announced it is accepting orders for delivery of its first NanoClear™ product targeted to be used in the estimated $65 billion industrial wastewater cleanup market. NanoClear™ is a revolutionary water cleaning architecture enabled by the features in Dais's nanomaterial – Aqualyte™.

NanoClear's benefits include simpler plant engineering, lower initial and operating costs, safe separation of numerous contaminants from the dirty wastewater stream, and high quality product water (nearly 1000x clearer than today's drinking water standard). Unlike most of today's water cleaning operations using the Reverse Osmosis ("RO") water cleaning method, NanoClear does not employ high pressure. This combined with another feature of the Aqualyte material offers the industry a true 'low fouling' membrane material. Fouling is a source of many RO system failures.

The NanoClear product shipped is the ME201 model, a modular device containing Aqualyte nanomaterial capable of separating approximately 26 gallons per hour of harmful contaminants found largely in industrial wastewater. The modules are available in sizes from 13-130 gallons per hour and can be grouped together as needed to clean millions of gallons of contaminated industrial wastewater per day. The clean wastewater can be reused by the industrial process lowering the processes' draw on the local water supply, lowering the environmental impact and potentially the demand on a local wastewater treatment plant.

Source: http://www.marketwired.com

Electrochemical treatment of wastewater

Element Six, South Africa, the world leader in synthetic diamond supermaterials and member of The De Beers Group of Companies, has announced the next generation of its Diamox electrochemical advanced oxidation cell technology. Diamox is a cost effective and highly efficient wastewater treatment electrochemical cell, designed using free-standing boron doped diamond electrodes. Diamox is effective in treating extremely contaminated industrial wastewater that cannot be treated by biological methods.

This packaged reactor is simple to implement in to on-site industrial wastewater treatment systems, providing an environmentally cleaner and versatile solution that can be used across various types of effluents, with no hazardous chemical additions. The latest design of Diamox has been successfully applied in a pilot project with an industry-leading wastewater treatment company, delivering unparalleled electrochemical oxidation capacity that can be scaled to meet industry requirements.

The latest Diamox technology has been significantly redesigned with increased capacity and improved efficiency for more

cost-effective treatment of waste streams. Through a combination of increasing the electrode area, and the power density that the cell operates at, the new 20 cell version has five-times the oxidation capacity of earlier generations. Diamox is a small footprint packaged product that can be scaled in size for incorporation into any existing or new industrial water treatment plant – enabling on-site treatment systems that are simple to operate and maintain.

Source: http://www.prnewswire.com

Dye removal and low-cost water purification

A team of researchers from Shandong University (SDU), China, have developed a novel dye absorbent called hybrid nano-particles of silver and silver sulfide (Ag2S@Ag hybrid nano-particles) using laser-induced fabrication technique and demonstrated the nanomaterial's superior adsorption performance for removing methyl blue and methyl orange from wastewater. The new adsorbents can be removed directly from solutions by filters without absorbent purification procedures, as the silver-based hybrid nano-particles will be agglomerated and deposited on the bottom after adsorbing dyes, providing a simple solution for water purification.

"Without using any expensive chemical reagents or facilities, the laser-induced fabrication method is a low-cost and versatile route for fabricating Ag2S@Ag hybrid nano-crystals. After adsorbing dyes such as methyl blue and methyl orange, the agglomerated and deposited adsorbents can be easily removed from solutions by filters, which are very beneficial to the practical wastewater treatment plants," said Ming Chen, at SDU.

Chen's team used a technique called laser ablation to fabricate silver-based hybrid nano-crystals in liquid, which is a process of removing materials from a solid or liquid surface by irradiating it with a laser beam.

The team's early study showed that the electron distribution of the highly excited silver species can be influenced by Ag2S@Ag nanoparticles, resulting in "polarized" silver species, or silver species with positive charges as dye adsorption sites. Since dye molecules such as methyl blue and methyl orange have negatively charged functional groups, due to strong electrostatic force between positive charges and negative charges, the enhanced adsorption sites on the hybrid material's surface will stick more dye molecules, leading to the material's enhanced capability of removing dyes.

Source: http://www.phys.org

Fertilizer from wastewater

Researchers at the Fraunhofer Institute for Interfacial Engineering and Biotechnology IGB, Germany, have developed the electrochemical process ePhos® that would recover phosphorus from wastewater without relying on chemicals or harming the environment. When installed at water treatment plants, it allows fertilizer to be obtained from wastewater, and in a form that is ready for use in food production. At the heart of this technology is an electrolysis cell that makes it possible to extract nitrogen and phosphorus using a magnesium electrode, resulting in either struvite (magnesium ammonium phosphate) or potassium struvite.

"Struvite is free of biomass and can be used directly in agriculture as a high-quality fertilizer that releases nutrients slowly," explained Dr. Iosif Mariakakis, at Fraunhofer IGB. What's really special about the process is that it is purely electrochemical: unlike traditional methods, there's no need to add salt or lye. "This is also good news for water treatment plant operators – the process is very straightforward and doesn't require them to stock chemicals," added Mariakakis. A licensing agreement has been signed with Ovivo, the United States, who is marketing the technology in the USA, Canada and Mexico.

Due to the stringent limit values associated with water treatment, there is considerable demand for efficient ways of extracting phosphorous. Moreover, many of the water treatment plant providers in the U.S. that will use this process are also looking to sell the struvite, considering it as an attractive source of income. But ePhos® could also quickly gain a foothold across Europe, where it will soon be mandatory to separate phosphorous from sewage sludge and where demand for cheap fertilizer is expected to grow. Given this situation, IGB is searching further licensees to introduce the technology on the European market as well.

Source: http://www.igb.fraunhofer.de

Warehouse of Persistent Organic Pollutants

This warehouse aims at harmonizing and/or developing monitoring land local/regional effects data to provide the tools for East Asian countries to establish scientifically sound priorities for future management of chemicals land POPs.

For more information, access:

http://www.pops-asia.org

Bacteria to clean up oil spill

Scientists at Heriot-Watt University (Heriot-Watt), the United Kingdom, have cracked the genetic code of the marine bacteria which helped 'eat' the oil spilled in the Deepwater Horizon disaster, information which could aid clean-up efforts for any future major spill. Dr. Tony Gutierrez, at Heriot-Watt, was in the US at the time of the disaster and was able to perform experiments with samples from oil-contaminated waters of the Gulf of Mexico shortly after the spill occurred, samples that contained key species of bacteria that fed on the oil.

Experiments with the samples revealed that certain bacteria had thrived on the oil that gushed into the Gulf, devouring the oil as a preferred food source. Dr. Gutierrez and his colleagues from the University of Texas, the United States, and University of North Carolina, the United States, reveal the genetic pathways these bacteria use to consume the oil, what conditions they thrive in, what oil hydrocarbons they can eat, and how they work in concert during an oil spill. "Oil is a very complex fluid that contains thousands of different types of hydrocarbon chemicals, many of which are toxic and difficult to break down. But some of these bacteria can," said Dr. Gutierrez.

The findings also revealed an ability of these bacteria to move towards oil droplets and to use scarce nutrients, suggesting that these microbes are like sentinels in the ocean that are well-adapted to respond quickly to the influx of oil in the event of a spill. The team also identified the bacteria that work best at different depths. Oceanospirillales, for example, degraded alkanes in the deepwater oil plume, whereas Rhodospiralles and Cycloclasticus were responsible for degrading polycyclic aromatic hydrocarbons (PAHs), which are recognised as some of the most toxic chemicals in oil.

Source: http://www.marinetechnologynews.com

Bacteria that eats plastic pollution

Two students Miranda Wang and Jeanny Yao, from the University of Pennsylvania, the United States, have developed a prototype for breaking down polystyrene into carbon dioxide (CO_2) and water, and they see their technology being used in two ways – first, for landfill and beach cleanups, and, second, to create a secondary product to be used in textile manufacturing. The process first uses a solvent to dissolve the plastic, then enzymes catalyze depolymerization of its base chemicals, breaking it down into the more manageable compounds.

Wang envisages sending mobile clean-up stations – either a truck or a floating vessel – with a 150,000 liter bio-digester onboard. Workers could then load up the tanks with polystyrene and wait for the waste to degrade. The aim is to get the process down to as little as 24 hours. (Other processes, including these mealworms, take longer and don't break down the whole waste stream).

"The idea is there's no need to collect the plastic and ship it to some centralized location. This plastic is very lightweight, so transporting even one kilogram of it would take a huge amount of volume and be very unsustainable in terms of transportation," said Wang. Wang and Yao's company is called BioCellection. They aim to start field-testing this summer, hopefully in China, and to finalize a commercially viable process within two years. Wang hopes to remove about nine grams of plastic per liter of bacteria.

Source: http://www.fastcoexist.com

Earthworms to clean up wastewater

BioFiltro, Chile, offers an alternative: spraying the wastewater into giant bins filled with earthworms. Fetzer Vineyards, the United States, will use the process to treat 100% of its wastewater. The industrious worms are expected to clean the water just as well but in only four hours. They require almost no electricity, and the only byproduct is worm excrement – also known as castings – which can be returned to the vineyard as a nutritious fertilizer. "This system is using nature. It's using worms and microbes to treat all of our winery wastewater," said Josh Prigge, at Fetzer.

BioFiltro has begun to install its system at Fetzer, which expects to have it fully operational later this year, in time for the 2016 grape harvest. Fetzer and BioFiltro declined to disclose the system's cost. Fetzer has long been a sustainability leader in the wine industry, having converted its entire operation to use renewable energy sources such as solar, for example, back in 1999. It also recently became the largest winery certified as a B Corporation, a process requiring Fetzer to meet rigorous environmental and social standards.

BilFiltro designs different worm and bacteria recipes, which depend partly on the types of worms that can thrive in local conditions, to treat a particular type of wastewater.

Large solids in the wastewater collect on the wood shavings and are then consumed by the worms. Microscopic solids are consumed by the bacteria, both on the wood shavings and in the worms' digestive tracts. Fetzer will have three treatment boxes, each 36-feet wide, 200-feet long and 6-feet deep. An estimated 100m worms in total, mostly the common California red worms, will be on duty.

Source: http://www.theguardian.com

Researchers create 3D-printed sponge

Researchers at American University, the United States, led by Matthew Hartings, have created an ABS plastic filament with an active chemistry capable of neutralizing pollutants. To make the filament, they added chemically active titanium dioxide (TiO2) nanoparticles to the usual plastic filament and fed it into a 3D thermoplastic printer. The material was used to print a matrix design the size and appearance of a household sponge. The resulting structure was still active even after the printing process.

When natural light interacts with TiO_2, a reaction occurs that breaks down pollutants. To test if the printed sponge could clean polluted water, they placed it in water with an organic pollutant and it destroyed the pollutant. The researchers see this success as opening the door to other active 3D-printed objects that could serve a variety of purposes. "It's not just pollution, but there are all sorts of other chemical processes that people may be interested in. There are a variety of nanoparticles one could add to a polymer to print," Hartings said.

Right now, the material can only be successfully printed at a concentration of 10 percent nanoparticles. A higher concentration would probably be needed for serious pollution control, but with improvements, this material could have a lot of applications for keeping water, air and agricultural pollution under control. The team is working on printing the material into many different types of shapes to see if certain shapes affect the chemical reactivity and to see which shapes best perform against environmental pollutants.

Source: http://www.treehugger.com

Technology to treat sediment phosphorus

A research group led by Prof. WU Zhenbin from Institute of Hydrobiology (IHB) of Chinese Academy of Sciences, has developed new combined technology to treat sediment phosphorus in West Lake, China, which has been inscribed on the World Heritage List. Submerged vegetation recovery is the key technology for ecological restoration of the West Lake. However, serious problems such as sediment phosphorus stress and colonization difficulty still bedevil this lake.

To solve the issue, researches chose the red mud-based porous ceramic filter material (PCFM) and new modified bentonite particle screened through a variety of modified methods as absorbent material. They combined the treatment technology of PCFM and modified bentonite and remediation technology of submerged plants on sediment P, and developed combined technology of adsorption, bioremediation treating sediment P in the lake. They found that the effect of the combined technology on sediment P in all fractions in the lake was efficient.

The combination of PCFM or modified bentonite and macrophytes could achieve a synergetic sediment P removal because the removal rates of combinations were higher than the sum of that of PCFM or modified bentonite and macrophytes used separately. From the analysis of sediment microbial community and predicted function, researchers found that the combined PCFM and V. spiralis enhanced the function of P metabolism by increasing specific genus that belong to phylum Firmicutes and Nitrospirae.

Source: http://www.english.cas.cn

Field trials of oil-degrading bacteria

The Malabar Botanical Garden and Institute of Plant Sciences (MBGIPS), India, and Bharat Petroleum Corporation Limited (BPCL), India, has joined hands to launch field trials of oil-degrading bacteria in Kochi. The scientists will undertake the trail to establish the oil-degrading properties of three new strains of bacteria. The oil-degrading properties of these bacteria will pave the way for the development of bioremediation agents to clean up petroleum pollutants from the environment.

The three new strains including two species of Burkholderia and one species of Pseudomonas have been sequenced and submitted to the Genbank database on organisms. Scientists at MBGIPS have completed the sequencing of a new species of oil-degrading soil fungi belonging to the Paecilomyces genus. They have also isolated 110 dye-yielding and anti-microbial compounds from two species of bryophytes (lower group of plants like mosses and hornworts). Besides, 30 anti-bacterial compounds have also been isolated from two species of lichens.

Source: http://www.jagranjosh.com

Novel electrochemical process

Researchers at George Washington University (GWU), the United States, are working on a new method for taking carbon dioxide (CO_2) directly from the air and converting it to oxygen and nanoscale fibers made of carbon which could lead to an inexpensive way to make a valuable building material and may even serve as a weapon against climate change. Carbon fibers are increasingly being used as a structural material on the aerospace, automotive, and other industries, which value its strength and light weight. "The useful attributes of carbon fibers, which also include electrical conductivity, are enhanced at the nanoscale," said Stuart Licht, at GWU.

The problem is that it's very expensive to make carbon fibers, much less nanofibers. Licht said that his group's newly demonstrated technology, which captures the CO_2 from the air and employs an electrochemical process to convert it to carbon nanofibers and oxygen, is more efficient and a lot cheaper than existing methods. But it's more than just a simpler, less expensive way of making a high-value product. It's also a "means of storing and sequestering CO_2 in a useful manner, a stable manner, and in a compact manner," said Licht. The process requires molten lithium carbonate, with another compound, lithium oxide, dissolved in it.

The lithium oxide combines with CO_2 in the air, forming more lithium carbonate. When voltage is applied across two electrodes immersed in the molten carbonate, the resulting reaction produces oxygen, carbon, and lithium oxide, which can be used to capture more CO_2 and start the process again. The researchers demonstrated the ability to make a variety of different nanofiber shapes and diameters by adjusting specific growth conditions, such as the amount of current applied at specific points of time and the composition of the various ingredients used in the process.

Source: https://www.technologyreview.com

Method to convert carbon dioxide into fuels

A team of researchers led by Professor Ted Sargent of the University of Toronto (U of T), Canada, have found an efficient way of turning carbon dioxide (CO_2) into stored energy – through the wonders of nanoengineering. Researchers Min Liu and Yuanjie Pang, along with a team of U of T, have developed a technique powered by renewable energies such as solar or wind. The catalyst takes climate-warming carbon dioxide (CO_2) and converts it to carbon monoxide (CO), a useful building block for carbon-based chemical fuels, such as methanol, ethanol and diesel.

The team's solution started by fabricating extremely small gold "nanoneedles" – the tip of each needle is 10,000 times smaller than a human hair. "The nanoneedles act like lightning rods for catalyzing the reaction," said Liu. When they applied a small electrical bias to the array of nanoneedles, they produced a high electric field at the sharp tips of the needles. This helps attract CO_2, speeding up the reduction to CO, with a rate faster than any catalyst previously reported. This represents a breakthrough in selectivity and efficiency which brings CO_2 reduction closer to the realm of commercial electrolysers.

The team is now working on the next step: skipping the CO and producing more conventional fuels directly. Sargent's research has been supported with the help of SOSCIP's Blue Gene/Q, Canada's fastest supercomputer, responsible for large scale parallel processing and grand challenge computational science. SOSCIP is a research and development consortium which pairs academic and industry researchers with advanced computing tools to fuel innovation leadership in Canada. The work has been published in the journal *Nature*.

Source: https://www.utoronto.ca

Scientists convert CO_2 to create electricity

Scientists at Cornell University (Cornell), the United States, have developed an oxygen-assisted aluminum/carbon dioxide (CO_2) power cell that uses electrochemical reactions to both sequester the CO_2 and produce electricity. In a recent study, Cornell researchers disclosed a novel method for capturing the greenhouse gas and converting it to a useful product – while producing electrical energy. The group's proposed cell would use aluminum as the anode and mixed streams of CO_2 and oxygen as the active ingredients of the cathode.

The electrochemical reactions between the anode and the cathode would sequester the CO_2 into carbon-rich compounds while also producing electricity and a valuable oxalate as a byproduct. In most current carbon-capture models, the carbon is captured in fluids or solids, which are then heated or depressurized to release the CO_2. The concentrated gas must then be

compressed and transported to industries able to reuse it, or sequestered underground. "The fact that we've designed a carbon capture technology that also generates electricity is, in and of itself, important," said Lynden Archer, at Cornell.

Scientists reported that their electrochemical cell generated 13 ampere hours per gram of porous carbon (as the cathode) at a discharge potential of around 1.4 volts. The energy produced by the cell is comparable to that produced by the highest energy-density battery systems. Another key aspect is in the generation of superoxide intermediates, which are formed when the dioxide is reduced at the cathode. The superoxide reacts with the normally inert CO_2, forming a carbon-carbon oxalate that is widely used in many industries, including pharmaceutical, fiber and metal smelting.

Source: https://www.sciencedaily.com

Breakthrough solar cell captures CO_2

Researchers at the University of Illinois (U of I), the United States, have engineered a potentially game-changing solar cell that cheaply and efficiently converts atmospheric CO_2 directly into usable hydrocarbon fuel, using only sunlight for energy. Unlike conventional solar cells, that convert sunlight into electricity which must be stored in heavy batteries, the new device essentially does the work of plants, converting atmospheric CO_2 into fuel, solving two crucial problems at once. A solar farm of such "artificial leaves" could remove significant amounts of carbon from the atmosphere and produce energy-dense fuel efficiently.

"The new solar cell is not photovoltaic – it's photosynthetic. Instead of producing energy in an unsustainable one-way route from fossil fuels to greenhouse gas, we can now reverse the process and recycle atmospheric carbon into fuel using sunlight," said Amin Salehi-Khojin, at U of I. Salehi-Khojin and his coworkers focused on a family of nano-structured compounds called transition metal dichalcogenides – or TMDCs – as catalysts, pairing them with an unconventional ionic liquid as the electrolyte inside a two-compartment, three-electrode electrochemical cell.

The new catalyst is 1,000 times faster than noble-metal catalysts and about 20 times cheaper. The artificial leaf consists of two silicon triple-junction photovoltaic cells of 18 square centimeters to harvest light; the tungsten diselenide and ionic liquid co-catalyst system on the cathode side; and cobalt oxide in potassium phosphate electrolyte on the anode side. When light of 100 watts per square meter – about the average intensity reaching the Earth's surface – energizes the cell, hydrogen and carbon monoxide gas bubble up from the cathode, while free oxygen and hydrogen ions are produced at the anode.

Source: https://www.news.uic.edu

N-doped biochar captures carbon dioxide

Engineers at the University of Ulsan (UOU), Republic of Korea, have found that nitrogen-doped biochar beads made from chicken manure could be an effective, sustainable way to capture carbon dioxide (CO_2) from waste gas streams. The most common capture method for CO_2 uses amine liquids, but these have a high regeneration cost and can react with other gases in flue gas. Other solid adsorption methods require high pressures or temperatures or are expensive.

Minh-Viet Nguyen and Byeong-Kyu Lee at UOU investigated the use of biochar, which has a very high internal surface area, but usually will only achieve good adsorption capacities at a high CO_2 partial pressure. The researchers used nitrogen-doping, also known as amine modification, to improve the adsorption capacity. NH3 groups have been shown to interact with the CO_2, increasing selectivity towards it.

Nguyen and Lee used chicken manure, a cheap and commonly-available waste product, as a source of carbon. They first dried the manure then pyrolysed it at 450˚C for one hour to produce biochar. The biochar was mixed with a solution of HNO_3, then NaOH, before being placed in a reactor at 450˚C with ammonia for one hour, producing amine-modified biochar (AMBC). The researchers then mixed this with a natural polymer called α-L-gulopyranuronate, and dropped the mixture into a calcium chloride solution to produce the beads.

Source: http://www.thechemicalengineer.com

Flue gas desulphurization plant

The Republic of Korean electricity company Gunjang Energy has installed a new flue gas desulphurization unit, called Seagull, at its existing power plant at Gunsan city. The circulating fluidized bed (CFB) boiler size was 275 MW and it needed to fulfil strict emission requirements which came into force in January 2015. Therefore, a suitable flue gas desulphurization (FGD) technology to meet this limit became mandatory. Gunjang Energy wanted to install the most economical FGD

technology for these demands, and therefore selected circulating dry scrubber (CDS) technology.

The basic principle underlying a CDS is the removal of gaseous components and a downstream filter for dust removal. The flue gas from the upstream boiler flows through the CDS and then a filter, and is released into the atmosphere via induced draft fans and stack. The main component for the removal of waste gases is the CDS with the high solid concentration situated inside it. These solids contain the dust brought in by the raw gas, a metered quantity of hydrated lime as the absorbent, and over 90 per cent of FGD product, recirculated from the downstream arranged filter. Figure 1 shows the arrangement of the whole CDS system.

The FGD is located downstream of the air preheater in the power plant arrangement. The CDS system itself consists of a CDS absorber, a low pressure fabric filter with eight chambers for dedusting downstream of the CDS absorber, the connecting ductwork including the recirculation duct, the ID fans downstream of the fabric filter and the connection to the stack. All equipment has been installed in a compact and space-saving way.

Source: http://www.powerengineeringint.com

Flue gas denitration catalysts

Selective catalytic reduction with NH_3 (NH_3-SCR) is an efficient method for abating NO_x from stationary sources and is widely used in coal-fired power plants currently. Atmospheric environmental research team from the Institute of Urban Environment IUE),**Chinese** Academy of Sciences (CAS), China, taking SCR catalysts of coal-fired power plant for the object, systematacially studied deactivation and regeneration mechanism of SCR catalysts under the condition of using typical burning coal in power plants of our country. The research team through years of study found that: in the operating process of denitrification system, impurity elements in the flue gas would cover the catalyst surface and poison catalyst active sites in different ways, causing deactivation of the SCR catalyst. The research team also mastered the mechanism of regenerating the deactivated catalyst, optimized regeneration formula, effeciently restored the acticity of the deactivated catalyst, reached the aim of recycling and integrated the device that can be used for regeneration of industrialization.

The research was accomplished by doctoral student, Yanke Yu. The corresponding. author is Jinsheng Chen. The related achievements have been published in turns in several journals of the field home and abroad, such as catalysis Communications, Industrial & Engineering Chemistry Research and Chinese Journal of Catalysis and Chinese Science Bulletin. At the same time, nine of the national patent were authorized.

This work was supported by the Bureau of Science and Technology, Fujian Province, Chin, the Strategic Priority Research Program of the Chinese Academy of Sciences, and the National Natural Science Foundation of China.

Source: http://english.iue.cas.cn

Coke oven flue gas denitrification

Recently, three low-temperature DeNOx industrial units have been carried out in Jiangsu Yizhou Coking Co., Ltd., China, for removal of NOx from coke oven flue gas. These units were all loaded with high-efficiency low-temperature DeNOx catalysts developed by Prof. WANG Shudong's Group from Dalian Institute of Chemical Physics (DICP). The commercialization promotion of the coke oven flue gas denitrification was launched last year. WANG's group joined with Jiangsu WOTE Environmental Protection Equipment Engineering Co. Ltd and Jiangsu Yizhou Coking Co., Ltd to establish a low-temperature DeNOx industrial demonstration unit for reduction of NOx emissions from the 3# coke oven. This unit was put into operation las November.

According to the on-line Continuous Emission Monitoring System (CEMS) monitoring data, this efficient Selective Catalytic Reduction (SCR) catalyst showed a very high and stable NOx reduction efficiency with 90%~95%. The concentration of NOx in effluent maintained less than 70 mg/m^3. So far, the unit has been running for more than seven months and the catalysts show good stability and sulfur-resistance. Based on the results of the industrial demonstration unit, WANG's group optimized the proprietary catalyst and reactor design. The DeNOx efficiency is improved, while the pressure drop of the reactor is greatly reduced.

This year, Jiangsu Yizhou Coking Co., Ltd continued to collaborate with DICP to improve the technology for denitration construction of the remaining three coke ovens. From May to June, the three industrial units were debugged and run. Results showed that all technical indexes of the DeNOx system fulfilled its design demand. This efficient SCR catalyst showed a high and stable NOx reduction efficiency with 98%~99% during running. The concentration of NOx in effluent also reached less than 20 mg/m3, which is far below the emission standard of NOx for coking chemical industry.

Source: http://english.cas.cn

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Global Water & Wastewater Market Report 2016

This report analyzes the global water and wastewater sector's transformation in 2016. The global market comprises solutions, services, and utilities spanning both municipal and industrial users. An estimated $625 billion is expected to be spent in the treatment, transfer, and disposal of water and wastewater this year.

India Air Pollution Control Equipment Market Report 2016-2020

The report aims to provide a detailed analysis of this opportunity, undergo industry wise demand side assessment for different APCE, current market size & market share of different OEMs, projected market size, regulations & policies that will drive industry growth.

For the above two publications, contact: Research and Markets. Tel: +1-917-300-0470; Fax: +353-1-481-1716; E-mail: press@researchandmarkets.com

Thermochemical Waste Treatment: Combustion, Gasification, and Other Methodologies

This book describes recent research into methodologies and technologies for managing various forms of solid waste, while at the same time generating energy and revenue with less impact on the environment. Topics include combustion, gasification, pyrolysis, and hydrothermal carbonization.

Solid Waste Management: Policy and Planning for a Sustainable Society

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For the above two publications, contact: CRC Press. Tel: +44-0-1235-400524; Fax: +44-0-1235-400525; E-mail: tandf@bookpoint.co.uk

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