TECHNOLOGY ROUNDUP

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Technology Information Section (TIS)
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Load Banks upto 1 Mega Watt

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Forthcoming Tech Events

- Power Technology Pakistan
- National Conference on Agricultural Engineering & Sciences
- 56th International Conference on Nanoscience, Nanotechnology & Advanced Materials IC2NM
- South Asian International Conference
- 8th International Conference on Environmental Science & Technology
- International Energy and Sustainability Conference 2016
- 9th Nano Congress for Next Generation
- 5th International Conference on Agriculture, Science and Engineering (ICASE2016)

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Indigenous Technology

Waste Marble Powder as Filler Material

Concrete is the most commonly used construction material worldwide. The durability, economy and quality of construction make concrete a popular choice as a construction material. However concrete requires proper compaction which is done using vibrators, making concrete to reach every corner of formwork. Self compacting concrete (SCC) is a type of concrete which can flow and spread through reinforcement and narrow sections which fills the empty spaces completely without any mechanical vibration. This type of concrete requires large quantity of powder, for which either fine pozzolanic (e.g. fly ash, ground granulated blast furnace slag and silica fume, or non-pozzolanic additions (crushed limestone or sand stone etc) are used. The composition of this blend of cement and filler material is significant in SCC, as high amount of cement with lower water content may cause autogenous shrinkage. Therefore, the use of non-pozzolans material with cement needs to be investigated. The concrete industry is among the largest consumer of raw materials. Limestone fillers are generally used in concrete. As marble stone is of limestone origin i.e. marble is formed by metamorphism of limestone,He effect of addition of non-pozzolans powder waste from marble industry is studied for its suitability in SCC. This was done keeping in view the requirement of fines in SCC and to find an effective utilization of waste marble powder (WMP). For this, five different SCC mixes were prepared, one without WMP and four other with varying amounts of WMP. These mixes in fresh state were tested for their flowability, passing-ability and segregation resistance. Hardened concrete was tested for compressive and flexural strengths. It was found that the locally available WMP can be effectively used as filler in developing SCC. It is concluded that Waste Marble Powder (WMP) can be effective filler for SCC concrete. It can be directly added to concrete without much processing. When the fresh properties such as flowability, passing-ability and segregation resistance are considered, 15% of marble powder replacement has given good results. Marble powder can be used up to 15% without much affecting compressive and flexural strengths.WMP replacement up to 15% by weight of cement can be considered as most favorable amount having particle size less than 150µm as a filler material in producing good quality SCC.

Courtesy:

Pak. J. Engg. & Appl. Sci. Vol. 18 January, 2016 (1-10)
Asif Hameed & Asad-ullah Qazi , Safeer Abbas & Abdul Rehman : Department of Civil Engineering, University of Engineering and Technology Lahore, Pakistan.

www.uet.edu.pk

Indigenous Technology

Molecular Genetic Variation for Stripe Rust Resistance in Spring Wheat

Wheat stripe rust is caused by Puccinia striiformis f.sp. tritici. It adversely affects the yield and quality of wheat grain. Seeds produced from stripe rust damaged crop have low vigour and poor emergence following germination. Stripe rust, caused by Puccinia striiformis f. sp. tritici, is a major biotic constraint to global wheat production. Stripe rust can be effectively controlled by developing resistant wheat varieties. This, however, requires identification of resistant sources to be used as parents in breeding programs. Molecular markers provide a quick way of detecting rust resistance genes in adapted wheat material. The present study was conducted to investigate genetic variation for markers linked with stripe rust resistance genes in 67 Pakistani adapted spring wheat varieties using 12 pairs of microsatellite and sequence tagged site markers. Seventy nine percent wheat varieties showed marker allele of Xgwm11 associated with stripe rust resistance gene Yr26, whereas 75% varieties had the Yr26 linked allele of sequence tagged site (STS) marker CYS5. Stripe rust resistance gene Yr5 was found in 45%, whereas Yr9 and Yr10 were present in 28% varieties tested based on the previously reported linked markers. Stripe rust resistance gene Yr17 was found in 10%, whereas Yr18 in 15% of varieties only. Three markers Xwe173, Xbarc181 and Xgwm140 did not produce the expected amplicons associated with the stripe rust resistance genes. Cluster analysis revealed considerable genetic variation for marker alleles linked with stripe rust resistance genes. Results of this study may be useful for wheat breeders in pyramiding stripe rust resistance genes in future wheat varieties of Pakistan through Marker Assisted Selection.

Courtesy:

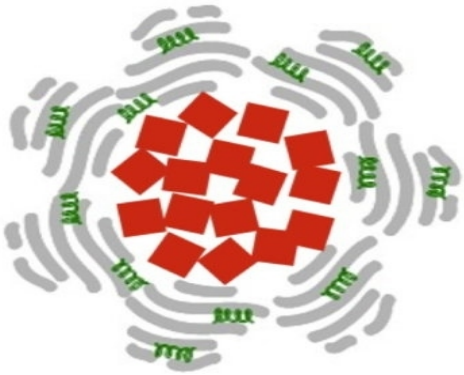
Pak. J. Agri. Sci., 2016 Vol. 53(1), 143-150
Muhammad Iqbal & Mahwish Ejaz & Armghan Shahzad & and Ghulam M. Ali:National Institute for Genomics & Advanced Biotechnology, National Agricultural Research Centre, Islamabad, Pakistan| Iftikhar Ahmed: National Agricultural Research Center, Islamabad, Pakistan

www.pakjas.com.pk

Magnetic Nanoparticles could Stop Blood Clot-caused Strokes

Houston Methodist researchers told that they can destroy blood clots 100 to 1,000 times faster than a commonly used clot-busting technique by loading magnetic nanoparticles with drugs and dressing them in biochemical camouflage. The findingis based on experiments in human blood and mouse clotting models. If the drug delivery system performs similarly well in planned human clinical trials, it could mean a major step forward in the prevention of strokes, heart attacks, pulmonary embolisms, and other dire circumstances where clots can cause severe tissue damage and death.

Researchers have designed the nanoparticles so that they trap themselves at the site of the clot, which means they can quickly deliver a burst of the commonly used clot-busting drug tPA where it is most needed. Decuzzi leads the Houston Methodist Research Institute Dept. of Translational Imaging. Decuzzi's group coated iron oxide nanoparticles in albumin, a protein found naturally in blood. The albumin provides a sort of camouflage, giving the loaded nanoparticles time to reach their blood clot target before the body's immune system recognizes the nanoparticles as invaders and attacks them. Iron oxide was chosen for the core because the researchers plan to use them for magnetic resonance imaging, remote guidance with external magnetic fields, and for further accelerating clot dissolution with localized magnetic heating. The clot-busting drug loaded into the nanoparticles is tPA, tissue plasminogen activator, an enzyme that is also found naturally in blood at low concentrations. Typically, a small volume of concentrated tPA is injected into a stroke patient's blood upstream of a confirmed or suspected clot. From there, some of the tPA reaches the clot, but much of it may cruise past or around the clot, potentially ending up anywhere in the circulatory system. tPA is typically used in emergency scenarios by health care staff, but it can be dangerous to patients who are prone to hemorrhage. Treating clots is a serious problem for all hospitals although tPA and similar drugs can be very effective in rescuing our patients, the drug is broken down quickly in the blood, meaning Doctors have to use more of it to achieve an effective clinical dose. Yet using more of the drug creates its own problems, increasing the risk of hemorrhage. If hemorrhage happens in the brain, it could be fatal.



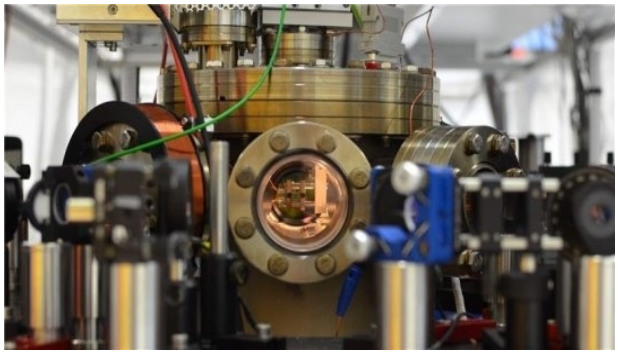
Lumsden, medical director of the Houston Methodist DeBakey Heart & Vascular Center, said that the nanoparticles being developed in Decuzzi's lab could solve both problems.The nanoparticle protects the drug from the body's defenses, giving the tPA time to work, But it also allows to use less tPA, which could make hemorrhage less likely. Researchers are excited to see if the technique works as phenomenally well for patients as what they saw in these experiments. Decuzzi, Lumsden and colleagues tested the effectiveness of tPA-loaded nanoparticles, using human tissue cultures to see where tPA landed and how long it took for the tPA to destroy fibrin-rich clots. In a series of in vivo experiments, the researchers introduced blood clots to a mouse model, injecting tPA-loaded nanoparticles into the bloodstream and using optical microscopy to follow the dissolution of the clots. In comparison to a control the clots were destroyed about 100 times faster.

www.houstonmethodist.org

Physicists Build Engine Consisting of One Atom

The result of experiments undertaken by the QUANTUM work group at the Institute of Physics of Johannes Gutenberg University Mainz (JGU) and theoretical physicists of Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU) describes an innovative form of heat engine that operates using only one single atom. Heat engines have played an important role in shaping society ever since the Industrial Revolution. As in the case of motor vehicle engines, they transform thermal energy into mechanical force our modern lifestyle would be impossible without them. At the same time, progress in miniaturization is resulting in the creation of ever smaller devices.

A team of researchers used a Paul trap to capture a single electrically charged calcium atom. This atom can be heated with the help of electrically-generated noise and cooled by using a laser beam. As a result, the atom is subjected to a thermodynamic cycle. This means that the particle moves back and forth within the trap, thus replicating the stroke of a typical engine.

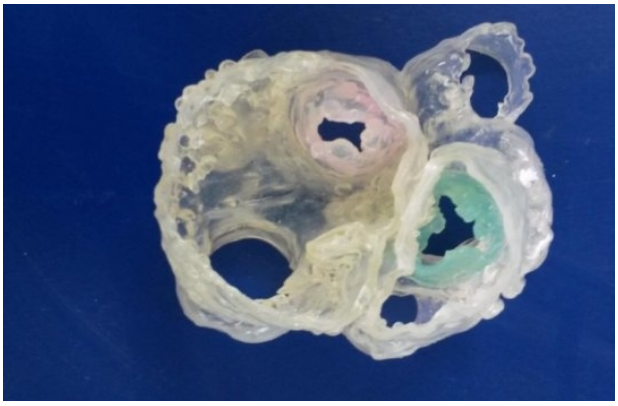


The atom not only acts in the same way as an engine but also stores the energy. The researchers performed extensive tests to determine the thermodynamic behavior of their engine. They state that their single particle engine can generate power of 10-22 watts and operates at 0.3 percent efficiency. If the power of the single atom engine was scaled up from the tiny mass of an atom, its output would be equivalent to that of a car engine. By reversing the cycle, they could even use the device as a single atom refrigerator and employ it to cool nano systems coupled to it. However, the principal objective of this research is that the creation of a nano-engine of this kind provides insight into thermodynamics at the single-particle level, which is currently a very hot topic in research. Plans are afoot to further lower the operating temperature of the engine in order to investigate thermodynamic quantum effects. In theory, it is assumed that the power of a heat engine can be increased by linking it to a quantum heat bath, thus providing a wealth of possibilities that can be used to move beyond the standard accepted boundaries of classical thermodynamics and construct new types of engines.

www.uni-mainz.de

3-D Heart Printed using multiple Imaging Techniques

Congenital heart experts from Spectrum Health Helen DeVos Children's Hospital have successfully integrated two common imaging techniques to produce a three-dimensional anatomic model of a patient's heart. The 3D model printing of patients' hearts has become more common in recent years as part of an emerging, experimental field devoted to enhance visualization of individual cardiac structures and characteristics. But this is the first time the integration of computed tomography (CT) and three-dimensional transesophageal echocardiography (3DTEE) has successfully been used for printing a hybrid 3D model of a patient's heart. A proof-of-concept study authored by the Spectrum Health experts also opens the way for these techniques to be used in combination with a third tool -- magnetic resonance imaging (MRI). According to Jordan Gosnell, lead researcher Hybrid 3D printing integrates the best aspects of two or more imaging modalities, which can potentially enhance diagnosis, as well as interventional and surgical planning. Previous methods of 3D printing utilize only one imaging modality, which may not be as accurate as merging two or more datasets. The team used specialized software to register images from the two imaging modalities to selectively integrate datasets to produce an accurate anatomic model of the heart. The result creates more detailed and anatomically accurate 3D renderings and printed models, which may enable physicians to better diagnose and treat heart disease. Computed tomography (CT) and magnetic resonance imaging (MRI) are established imaging tools for producing 3D printable models. Three-dimensional transesophageal echocardiography (3DTEE) recently was reported by Joseph Vettukattil, M.D., and his Helen DeVos Children's Hospital colleagues to be a feasible imaging technique to generate 3D printing in congenital heart disease.

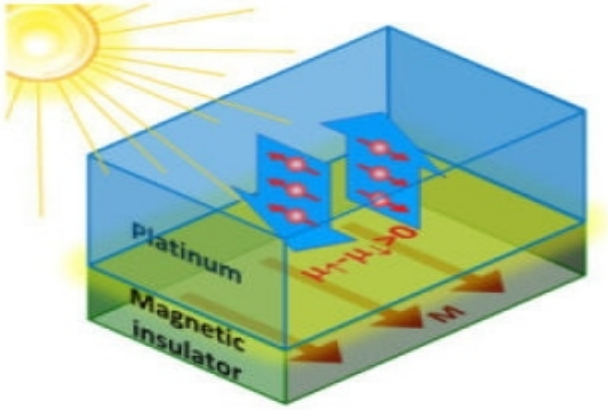


According to Vettukattil, each imaging tool has different strengths, which can improve and enhance 3D printing: CT enhances visualization of the outside anatomy of the heart. MRI is superior to other imaging techniques for measuring the interior of the heart, including the right and left ventricles or main chambers of the heart, as well as the heart's muscular tissue. 3DTEE provides the best visualization of valve anatomy. This is a huge leap for individualized medicine in cardiology and congenital heart disease. The technology could be beneficial to cardiologists and surgeons. The model will promote better diagnostic capability and improved interventional and surgical planning, which will help determine whether a condition can be treated via transcatheter route or if it requires surgery. Vettukattil is known internationally for

his work and research with three and four-dimensional echocardiography. Most notably, he developed the advanced technique of multiplanar reformatting in echocardiography, a method used to slice heart structures in infinite planes through the three dimensions in a virtual environment similar to a cardiac pathologist dissecting the heart to reveal underlying pathology. Commonly used with other diagnostic technologies, such as CTs, Vettukattil pioneered its use in echocardiography to evaluate complex heart defects. Further research is required to evaluate the efficacy of hybrid 3D models in decision-making for transcatheter or surgical interventions.

www.spectrumhealth.org

The Light Stuff: New way to Produce Electron Spin Currents



The scientists, led by Professor of Physics Mingzhong Wu in CSU's College of Natural Sciences, are the first to demonstrate using non-polarized light to produce in a metal called a spin voltage a unit of power produced from the quantum spinning of an individual electron. Controlling electron spins for use in memory and logic applications is a relatively new field called spin electronics, or spintronics. Wu and his group's passion is to find new, better ways to control electron spins. Spintronics exploits the notion that electron spins can be manipulated and used to process and store information, with a fraction of the power needed in ubiquitous, conventional electronics.

Consider that the iPhone and every electronic device out there is built upon centuries of science around charge current -- the physics of positive or negative charges flowing through a device. The perennial problem is the enormous power consumption of charge-current devices, and the electrical resistance that causes power loss in the form of heat which is why laptop keeps overheating. It is these power and heat barriers that are holding smaller, more powerful electronics back. And it is why science is turning to spintronics, because it offers a completely new way of making a device work. To utilize power from an electron spin, there no charge current necessary. All that is needed is a magnetic field or a magnetic material, which can orient the spins "up" or "down." The up and down spins are the analogue to positive and negative charges. What CSU scientists have found a brand-new method for creating spin currents. Existing methods include using a charge current, microwaves or a heat source. But for the first time, the CSU team demonstrates using light to generate their spin currents. Other scientists have done similar things, but they used a special kind of polarized light. But, the CSU scientists used unpolarized, plain light -- "a halogen bulb purchased at Ace Hardware". They demonstrated a "pure" spin current involving no charge movement whatsoever. It was an unprecedented feat. The breakthrough came about while the scientists were studying a different way to make spin currents, using heat from their halogen bulb, called the Spin Seebeck effect. They noticed some background data they could not explain. Ever curious, they checked all possibilities and determined this seemingly light-induced spin current could be a new quantum phenomenon. They tested it by designing unique control measurements involving different magnetic insulators and metallic thin films, such as platinum. After replicating their results in the lab, they turned to theoreticians at UC Irvine and Fudan University to help them interpret the physics of what they had discovered, and who are co-authors on the Nature Physics paper.

There have been tremendous technical advances in controlling light. But now in this discovery they have linked light to spin control. Using a simple light source to produce a spin current offers new opportunities for power control and generation. The researchers will continue exploring making spin currents with light by swapping out materials and trying different light sources. They demonstrated light control in the infrared range said. Moving into the visible or UV range would likely offer more robust applications for devices. The framework for generating and detecting spin currents is non-trivial, meanwhile,

there are hundreds of years of generating charge currents and knowing how to measure them and manipulate them and characterize them. Spintronics is a new field, and devices are just now coming onto the market that utilizes some small part of this.

www.colostate.edu

Urine turned into Sustainable Power Source for Electronic Devices

Researchers at the University of Bath have developed an innovative miniature fuel cell that can generate electricity from urine, creating an affordable, renewable and carbon-neutral way of generating power. In the near future this device could provide a means of generating much needed electricity to remote areas at very little cost of £1-£2. With growing global pressures to reduce reliance on fossil fuels and the associated greenhouse gas emissions, microbial fuel cells could be an exciting alternative. A microbial fuel cell is a device that uses natural biological processes of 'electric' bacteria to turn organic matter, such as urine, into electricity. These fuel cells are efficient and relatively cheap to run, and produce nearly zero waste compared to other methods of electricity generation. In practice, urine will pass through the microbial fuel cell for the reaction to happen. From here, electricity is generated by the bacteria which can then be stored or used to directly power electrical devices.

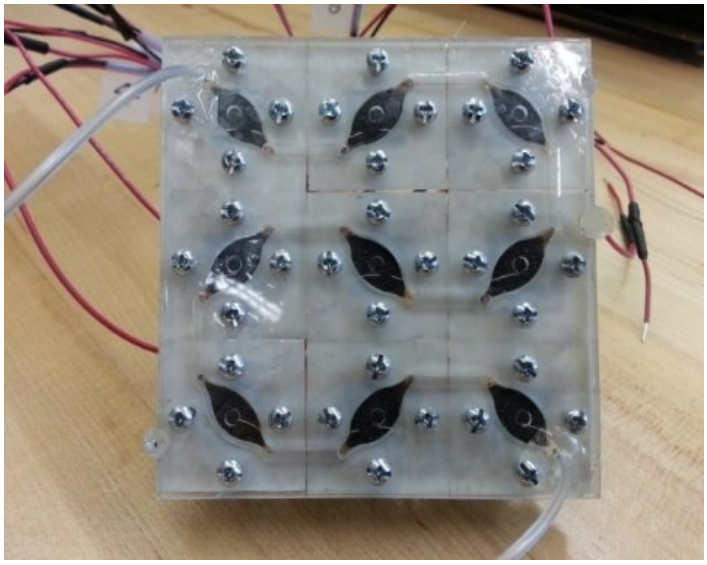
The research team from the University's Department of Chemical Engineering, Department of Chemistry and the Centre for Sustainable Chemical Technologies (CSCT), have worked with Queen Mary University of London and the Bristol Bioenergy Centre, to devise this new kind of microbial fuel cell that is smaller, more powerful and cheaper than other similar devices. This novel fuel cell measures one inch squared in size and uses a carbon catalyst at the cathode which is derived from glucose and ovalbumin, a protein found in egg white. This biomass-derived catalyst is a renewable and much cheaper alternative to platinum, commonly used in other microbial fuel cells. The researchers worked on the cell's design to maximize the power that could be generated. By increasing the cell's electrodes from 4mm to 8mm, the power output was increased tenfold. Furthermore, by stacking multiple units together, the power was proportionally increased. Currently, a single microbial fuel cell can generate 2 Watts per cubic metre, enough to power a device such as a mobile phone. Whilst this value is not comparable with other alternative technologies such as hydrogen or solar fuel cells and other methods of bioenergy digesters, the significant advantage of this technology is its extremely cheap production cost and its use of waste as a fuel, a fuel that will never run out and does not produce harmful gasses. The research team is now looking at ways of improving the power output of the microbial fuel cell and is confident that by optimising the design of the cell, they will be able to increase the cell's performance.

According to Dr Mirella Di Lorenzo, if they can harness the potential power of this human waste, they could revolutionise how electricity is generated. Microbial fuel cells can play an important role in addressing the triple challenge of finding solutions that support secure, affordable, and environmentally sensitive energy, known as the energy trilemma.There is no single solution to this 'energy trilemma' apart from taking full advantage of available indigenous resources, which include urine. According to Jon Chouler, Microbial fuel cells could be a great source of energy in developing countries, particularly in impoverished and rural areas. Head of the Department of Chemical Engineering, Dr Tim Mays said that Renewable 'pee-power' is a brilliant idea and its use in developing countries will have huge positive impact on people's lives in areas of energy poverty.

www.bath.ac.uk

Clean Energy generated using Bacteria-Powered solar panel

Researchers have taken the next step in the evolution of bacteria-powered energy. For the first time researchers connected nine biological-solar (bio-solar) cells into a bio-solar panel. Then they continuously produced electricity from the panel and generated the most wattage of any existing small-scale bio-solar cells 5.59 microwatts. According to researcher, Seokheun "Sean" Choi, an assistant professor in Binghamton University's Thomas J. Watson School of Engineering and Applied Science, once a functional bio-solar panel becomes available, it could become a permanent power source for supplying long-term power for small, wireless telemetry systems as well as wireless sensors used at remote sites where frequent battery replacement is impractical. This research could also enable crucial understanding of the photosynthetic extracellular electron transfer processes in a smaller group of microorganisms with excellent control over the microenvironment, thereby enabling a versatile platform for fundamental bio-solar cell studies.



The current research is the latest step in using cyanobacteria (which can be found in almost every terrestrial and aquatic habitat on the planet) as a source of clean and sustainable energy. Last year, the group took steps toward building a better bio-solar cell by changing the materials used in anodes and cathodes (positive and negative terminals) of the cell and also created a miniature microfluidic-based single-chambered device to house the bacteria instead of the conventional, dual-chambered bio-solar cells. However, this time the group connected nine identical bio-solar cells in a 3x3 pattern to make a scalable and stackable bio-solar panel.

The panel continuously generated electricity from photosynthesis and respiratory activities of the bacteria in 12-hour day-night cycles over 60 total hours. Bio-solar cell performance has improved significantly through miniaturizing innovative device architectures and connecting multiple miniature cells in a panel. This could result in barrier-transcending advancements in bio-solar cells that could facilitate higher power/voltage generation with self-sustainability, releasing bio-solar cell technology from its restriction to research settings, and translating it to practical applications in real-world. Even with the breakthrough, a typical "traditional" solar panel on the roof of a residential house, made up of 60 cells in a 6x10 configuration, generates roughly 200 watts of electrical power at a given moment. The cells from this study, in a similar configuration, would generate about 0.00003726 watts.

According to researchers it is not efficient just yet, but the findings open the door to future research of the bacteria itself. It is time for breakthroughs that can maximize power-generating capabilities/energy efficiency/sustainability. The metabolic pathways of cyanobacteria or algae are only partially understood, and their significantly low power density and low energy efficiency make them unsuitable for practical applications. There is a need for additional basic research to clarify bacterial metabolism and energy production potential for bio-solar applications.

www.binghamton.edu

Forthcoming Tech Events

National

Power Technology Pakistan
19-21, May 2016 Expo Center Lahore
www.pogeepakistan.com

National Conference on Agricultural Engineering and Sciences
30-31, May 2016
Bahauddin Zikria University Multan

56th International Conference on Nanoscience, Nanotechnology and Advanced Materials IC2NM
23-24 July, 2016 Rawalpindi

South Asian International Conference
24-26, August
Serena Hotel Islamabad

International Events

8th International Conference on Environmental Science and Technology
June 6-10, 2016
Houstan Texas, USA
www.aasci.org

International Energy and Sustainability Conference 2016
30th June-1st July 2016
TH Kolin Germany,
www.farmingdale.edu

9th Nano Congress for Next Generation
August 1-2, 2016
Manchaster, United Kingdom
www.nanocongress.conferenceseries.com

5th International Conference on Agriculture, Science and Engineering (ICASE2016)
26-29 September 2016
Abuja Nigeria
www.iatel.net

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