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### Ideal energy storage material for electric vehicles



The energy-storage goal of a polymer dielectric material with high energy density, high power density and excellent charge-discharge efficiency for electric and hybrid vehicle use has been achieved by a team of Penn State materials scientists. The key is a unique three-dimensional sandwich-like structure that protects the dense electric field in the polymer/ceramic composite from dielectric breakdown. "Polymers are ideal for energy storage for transportation due to their light weight, scalability and high dielectric strength," says Qing Wang, professor of materials science and engineering and the team leader. "However, the existing commercial polymer used in hybrid and electric vehicles, called Biaxially oriented polypropylene (BOPP), cannot stand up to the high operating temperatures without considerable additional cooling equipment. This adds to the weight and expense of the vehicles."

The researchers had to overcome two problems to achieve their goal. In normal two-dimensional polymer films, such as BOPP, increasing the dielectric constant, the strength of the electric field, is in conflict with stability

and charge-discharge efficiency. The stronger the field, the more likely a material is to leak energy in the form of heat. The Penn State researchers originally attacked this problem by mixing different materials while trying to balance competing properties in a two-dimensional form. While this increased the energy capacity, they found that the film broke down at high temperatures when electrons escaped the electrodes and were injected into the polymer, which caused an electric current to form. "That's why we developed this sandwich structure," Wang says. "We have the top and bottom layers that block charge injection from the electrodes. Then in the central layer we can put all of the high dielectric constant ceramic/polymer filler material that improves the energy and power density."

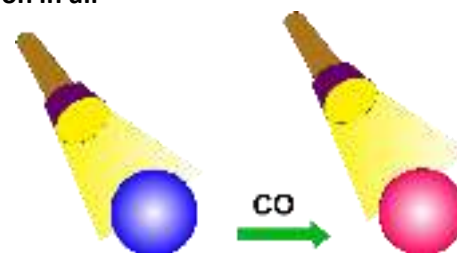
The outer layers, composed of boron nitride nanosheets in a polymer matrix, are excellent insulators, while the central layer is a high dielectric constant material called barium titanate. "We show that we can operate this material at high temperature for 24 hours straight over more than 30,000 cycles and it shows no degradation," Wang says.

Source

[www.sciencedaily.com/releases/2016/08/160822152734.html](http://www.sciencedaily.com/releases/2016/08/160822152734.html)

Collected by P. Naveen.

### Ru (II) complex based sensor for carbon monoxide - Detection in air



**Editorial:** We are very much happy to publish this online issue of ALU Chem News from Department of Industrial Chemistry, Alagappa University, Karaikudi, Tamilnadu, India dedicated to the emerging field of Chemical Sciences and Technology. This Newsletter is dedicated to publish the most exciting and latest research news with respect to the areas like Organic, Inorganic, Physical, Analytical, Industrial, Environmental, Polymer, Green, Electro and Textile Chemistry. This ALU Chem News focuses the breakthroughs in Basic Chemical Research and Technology. This ALU Chem News will give the Information about the Admission & Fellowship deadlines for the higher studies in the field of Chemical Sciences. Open Access Online Publication gives a worldwide audience larger than that of any subscription based Journal in the field of Chemical Sciences and Technology. We look forward your feedback and comments for the betterment of future ALU Chem News publications. **P. Naveen Kumar & K. Bama**

**\*The materials are collected from the sources given at the bottom of the articles. We sincerely acknowledge all the authors and publishers of these sources.**

Development of novel chemosensors for sensing toxic compounds including gases were attractive and important research area in past decades. Commercialization of the sensor compounds into sensor materials has attracted the scientists now. Hence peoples effected to fabricate or prepare sensor materials for direct application. Carbon monoxide (CO) is one of the toxic gases to humans when encountered in concentrations over 35 ppm. Inhale of very low concentration for a long time also heavily affects humans. However, CO also serves as the second gas massager in the body which plays an important role in human normal biological functions. CO has received a great deal of clinical attention as a biological regulator, for example, anti-inflammatories, modulating in vasorelaxation, vascular smooth muscle, and tissue injury. There is an article published in "medical news today" an US paper on this July. This article seriously highlighted CO as a silent killer because of its colourless, tasteless and odourless nature. There were over 400 Americans die every year from accidental carbon monoxide poisoning that are not caused by fires. The main reason for car AC deaths are on because of CO gas. The development of fluorescent sensors with the capability of real-time, spatial, and temporal tracking and monitoring of CO at the cellular level remains challenging.

Only several numbers of probes were reported for sensing CO in atmosphere and inside the biological system. In 2010 Sancenon and co-workers developed CO sensors based on binuclear rhodium derivatives. This is the first one shows distinguishable colour change in the presence of CO gas.<sup>1</sup> After this, the first single fluorescent turn-on sensor for detecting CO in living cells was described by Chang et al.<sup>2</sup> Wilton-Ely and Martinez-Manez et al. reported the first example of the design of a ruthenium(II) complex for CO detection in the air.<sup>3</sup> Beyond this, some recent publications established the sensing of CO in living cells. Weiyong Feng and co-workers prepared a fluorescent probe for CO in living cells.<sup>4</sup> Similarly, Zheng and co-workers developed a tow-photon fluorescent probe for imaging CO in living tissues.<sup>5</sup> Even though there is void of novel, cost effective, anti-toxic probes for sensing CO in both open and in-vivo atmosphere.

Source

<https://www.imperial.ac.uk/people/j.wilton-ely/publications.html>

Collected by B. M. Ashwin.

### Nano bionic plants can sniff out bombs



Researchers at Massachusetts Institute of Technology (MIT), Cambridge in USA design an environmental sensor from living spinach plants (*Spinacia oleracea*). By embedding leaves with carbon nanotubes, MIT engineers have transformed spinach plants into sensors that can detect explosives and wirelessly relay that information

to a handheld device similar to a smartphone. This is one of the first demonstrations of engineering ,electronic systems into plants, an approach that the researchers call "plant nano bionics" In the journal Nature Materials, the scientists explain how they can turn plants into bomb-sniffing machines with the help of tiny cylinders of carbon that can detect "nitro aromatics" chemical compounds often used in explosives. As the plant absorbs air and groundwater from the environment around it, the carbon tubes will register any nitro aromatics and begin to emit a fluorescent signal. The signal gets picked up by an infrared camera and relayed to a small computer or smartphone, which then sends an email to the user.

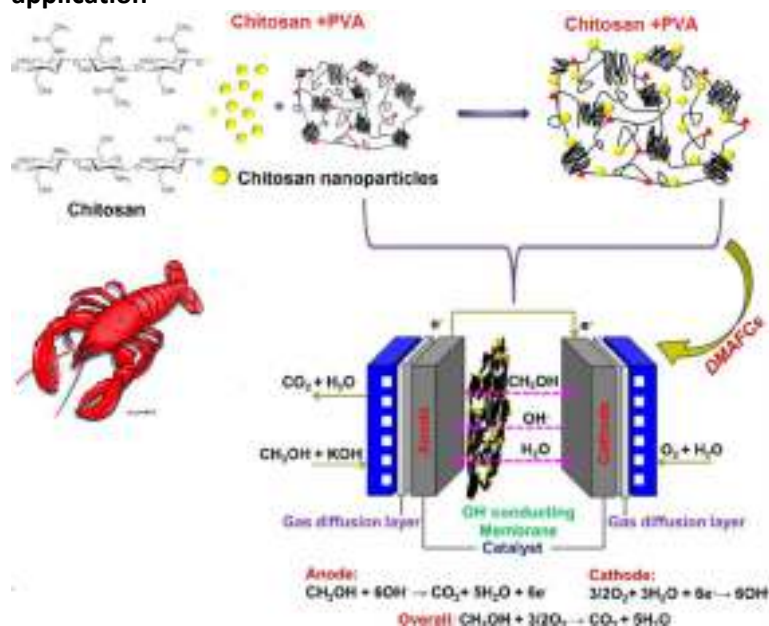
In this study, the researchers embedded sensors for nitro aromatic compounds into the leaves of spinach plants. Using a technique called vascular infusion, which involves applying a solution of nanoparticles to the underside of the leaf, they placed the sensors into a leaf layer known as the mesophyll, which is where most photosynthesis takes place. They also embedded carbon nanotubes that emit a constant fluorescent signal that serves as a reference. This allows the researchers to compare the two fluorescent signals, making it easier to determine if the explosive sensor has detected anything. If there are any explosive molecules in the groundwater, it takes about 10 minutes for the plant to draw them up into the leaves, where they encounter the detector. To read the signal, the researchers shine a laser onto the leaf, prompting the nanotubes in the leaf to emit near-infrared fluorescent light. This can be detected with a small infrared camera connected to a Raspberry Pi, a tiny credit-card-sized computer similar to the computer inside a smartphone. The signal could also be detected with a smartphone by removing the infrared filter that most camera phones. Using this setup, the researchers can pick up a signal from about 1 meter away from the plant, and they are now working on increasing that distance. This approach holds great potential for engineering not only sensors but many other kinds of bionic plants that might receive radio signals or change colour. Generally plants are very environmentally responsive, it can detect small changes in the properties of soil and water potential. These sensors could also help botanists learn more about the inner workings of plants, monitor plant health, and maximize the yield of rare compounds synthesized by plants such as the Madagascar periwinkle, which produces drugs used to treat cancer.

Source

<http://www.nature.com/nmat/journal/vaop/ncurrent/full/nmat4771.html>

Collected by R. Mangaiyarkarasi

## Low cost proton exchange polymer-based electrolyte membranes derived from biopolymer could effectively improving the fuel cells application



Fuel cells are environmental friendly devices for energy conversion, power generation, and one of the most promising candidates as zero-emission power sources. Fuel cells are electrochemical devices which convert the chemical energy obtained from a redox reaction directly into electrical energy. These cells consist of an electrolyte material or membrane that is packed between two thin electrodes (porous anode and cathode). There are different types of fuel cells that are generally characterized by electrolyte material. These cells are mainly consisted of: Alkaline Fuel Cell (AFC), Molten Carbonate Fuel Cell (MCFC), Phosphoric Acid Fuel Cell (PAFC), Proton Exchange Membrane Fuel Cell (PEMFC), Solid Oxide Fuel Cell (SOFC), and Biofuel Cell. Among the fuel cells, proton exchange polymer-based electrolyte membranes offer advantages such as high efficiency and high energy density. However, polymer electrolyte membrane is the most expensive component of a polymer electrolyte-based fuel cell. Therefore, cost effective and eco-friendly polymer electrolytes from renewable sources can become a promising substitute for synthetic polymers in fuel cells. Chitosan, as a natural polymer, is one of the promising membrane materials and has been studied widely. It is the N-deacetylated derivative of chitin which is naturally abundant polysaccharide and the supporting material of crustaceans, insects, etc. Chitin is easily obtained from crabs or shrimp shells and fungal mycelia. Chitosan is inert, hydrophilic and is insoluble in water, alkali and organic solvents. Its solubility in dilute organic acids allows for gel formation in various configurations. Chitosan has been studied as membrane material for ultrafiltration, reverse osmosis, pervaporation, and lithium batteries. The removal of proteins in chitin by heat treatment causes its deacetylation simultaneously. Free amine and hydroxyl functional groups on the chitosan's backbone enable various chemical modification of chitosan to tailor it for specific applications such as polymer electrolyte membrane for the separation of metal ions, amino acids and protein by adsorption, ultrafiltration, electro-ultrafiltration, fuel cell application and pervaporation. Utilization of a chitosan biopolymer for fuel cell technologies is novel

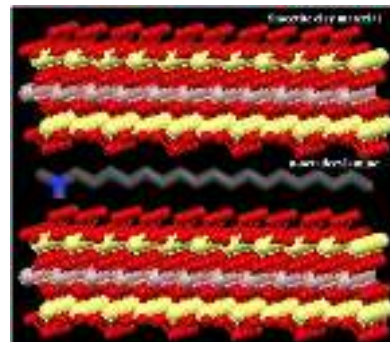
and challenging where biological products are usually considered as waste, non-hazardous, low cost and environmentally benign.

Source

<https://sustainablechemicalprocesses.springeropen.com/articles/10.1186/2043-7129-1-16>

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## Green synthesis of organophilic clays for enhanced surfactant properties



Organophilic clays are a promising material for essential research. It is a very important form of smectite derivatives with a wide range of industrial applications due to the simple and environmentally benign nature. Many researchers have been working on synthesis of organophilic clay synthesis for both fundamental research and industrial applications. Interestingly, Ogawa et al. developed a material of organoamines for intercalation into the interlayers of the clay materials and it was conducted by solid-solid reactions using an agate mortar and a pestle at room temperature. Even though there are many researchers are working on intercalation of organophilic clay materials, the study of organoamines into smectites has been very few.

A new organophilic clays material has been developed by solid-state intercalation of organoamines into the acidic clay. By using acidic clay, the effects of the byproducts can be neglected, so the present solid-state reaction of acidic clay can be useful for industrial applications. This reaction is mainly based on the acid-base reaction between the acidic site in the interlayers of the clay and the organoamines (n-octadecylamine and oleylamine). The given product of organophilic clays is almost identical to the organoammonium clays prepared by a conventional ion exchange reaction with organoammonium chloride in aqueous media. The reactions taken place at the room temperature by simple mixing, facile, and environmentally benign nature suggesting that the possible application of the present solid-state reactions for the preparation of organophilic clays industries. Additionally, oleylamine gave better results in terms of viscosity of the suspension compared the n-octadecylamine system, showing the important roles

of surfactant molecular nature of the organophilic clays. The facile and environmental free method of synthesis can be very useful in the industrial applications. Accordingly, the application of the solid-solid reaction for the preparation of functional hybrid materials is worth investigating further toward environmentally benign synthesis.

Source

[http://www.academia.edu/20420622/Synthesis\\_and\\_Characterization\\_of\\_Organophilic\\_Clay\\_from\\_Cuban\\_Chiqui\\_Gomez\\_Bentonite](http://www.academia.edu/20420622/Synthesis_and_Characterization_of_Organophilic_Clay_from_Cuban_Chiqui_Gomez_Bentonite)

Collected by K. Bama

### Ultra fast batteries from scrap metal



As renewable energy sources like solar become a bigger part of our energy picture, the question of how to reliably store power for that proverbial rainy day becomes more and more important. Researchers are working on plenty of different battery technologies. U.S geological survey reported roughly 17.5 million tons of steel and 1.15 million tons of brass are not recycled and end up destined for junkyards. In this case, seeing the treasure takes a little chemistry knowledge. Steel is an alloy of iron and other elements, mostly carbon. Brass is an alloy of copper and zinc. It so happens that an artifact called the "[Baghdad Battery](#)," which approximately dates to the first century BC, consists of nothing but a terra-cotta pot, an iron rod and a copper sheet. According to Baghdad battery Cary pint research team at Vanderbilt University design a ultrafast battery from scrap metal by Anodization process. It is a chemical treatment, commonly used on aluminium, to provide a durable finish to the metal. When scraps of steel and brass are anodized by a combination of chemicals and electrical current, researchers found that their surfaces were restructured into "nano meter-sized networks of metal oxide." These surfaces can store and releasing energy when reacting with the battery's water-based liquid electrolyte. Because the electrolyte is water-based and thus non-flammable, the researchers noted that combustion is not an issue, as it can be with lithium-ion batteries. The team then placed their anodized metals into a glass jar, and added a solution of potassium hydroxide to construct a working battery Low-voltage anodization processes are developed that isolate nanostructured redox-active copper oxide and iron oxide materials from these multicomponent alloys, which we show to be well-suited for energy storage applications. The individual electrodes boast superb specific capacitance values of up to 800 and 265 F/g (270 and 45 mAh/g) for the steel and brass, respectively, and when paired into a full cell yield

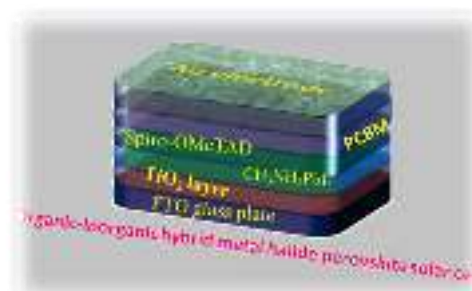
energy storage capability of up to 20 Wh/kg, power densities of up to 20 kW/kg, and cycling stability over 5000 cycles.

Source

<http://pubs.acs.org/doi/abs/10.1021/acsenergylett.6b00295>

Collected by K. Kalaiselvi

### Organic-Inorganic hybrid metal halide light harvester based planar heterojunction perovskite solar cells:



Recent years, the solar cell based on Organic-Inorganic metal hybrid halide perovskite absorbers promises to transform the fields of dye-sensitized, organic, and thin film solar cells. The solution processed photovoltaics incorporating perovskite absorbers have achieved efficiencies of **20.1%** in planar structure device, the liquid dye sensitized solar cell (DSSC), evaporated and tandem organic solar cells, as well as various thin film photovoltaics; thus establishing perovskite solar cells as robust candidate for commercialization. Since the first reports in late 2012, interest has soared in the innovative device structures as well as new materials, promising further improvements. However, identifying the basic working mechanisms, which are still being debated, will be crucial to design the optimum device configuration and maximize solar cell efficiencies. Here we distill the current state-of-the-art and highlight the guidelines to ascertain the scientific challenges as well as the requisites to make this technology to market-viable. The rise of the organic–inorganic hybrid halide perovskite has stunned the photovoltaic community with its remarkable performance and rapid progress in the past 5 years. The perovskites derive their name from the mineral structure of Calcium Titanium Oxide (**CaTiO<sub>3</sub>**), discovered by German mineralogist Gustav Rose in the year 1839. This structure was later characterized by Russian mineralogist Lev A. Perovski, from which it derives its name. The family of perovskite materials adopt the chemical formula **ABX<sub>3</sub>**, where A and B are cations of dissimilar sizes, and X are anions, typically oxygen, halogens, or alkali metals. Historically, oxide-based perovskites have been the most actively studied of the perovskite family as a result of their superior ferroelectric, magnetic and superconductive properties.

The first halide-based perovskite structure was observed in cesium lead halides (**CsPbX<sub>3</sub>**) by Moller in 1958. It was observed that photoconductive properties could be tuned through varying halide components to achieve different spectral responses. The first appearance of the organic cation, methylammonium (MA), in halide perovskites was seen by Weber and Naturforsch in 1978 for I, Cl, and Br. In the 1990s, Mitzi and co-workers focused on layered organic-inorganic halide perovskites that featured strong excitonic characteristics and demonstrated applications in thin film technologies. **In 2009**, a power conversion efficiency of 3.8% was achieved by replacing Br with I. **In 2011**, Park and co-workers achieved an efficiency of 6.5% by employing perovskite nanoparticles on TiO<sub>2</sub> to serve as sensitizers for improved absorption over conventional dyes.

Source

[http://www.nature.com/nphoton/journal/v8/n6/full/nphoton.2014.82.html?WT.feed\\_name=subjects\\_green-photonics](http://www.nature.com/nphoton/journal/v8/n6/full/nphoton.2014.82.html?WT.feed_name=subjects_green-photonics)

Collected by **K.Sakthi Velu**

### Carbon dioxide capture and separation using framework materials

Separation of CO<sub>2</sub> from other gases is a key part of technological processes in the energy sector. Methods to capture CO<sub>2</sub> include: chemical absorption, physical adsorption, cryogenic separation and membrane separation. Adsorption-based methods such as pressure-swing, vacuum-swing, and temperature-swing adsorption, are the most promising technologies for CO<sub>2</sub> capture because of the low costs, controllability, simplicity, low energy demand, high adsorption capacity, and easy regeneration of the adsorbents. Porous materials which have been studied as adsorbents include: zeolites, activated carbon and metal-organic frameworks (MOFs). Of these, carbon-based materials have the advantages of fast adsorption/desorption kinetics, high surface area, large pore volume, low density, reusability, minimal costs, potentially environmentally benign nature, chemical inertness, and high thermal stability. Mesoporous materials have attracted considerable attention due to their gas adsorption capability, which is associated with their unique properties, including their periodic ordered mesoporous structure, large pore size, narrow pore size distribution and large surface area.

Microporous materials have found various applications of technical relevance such as in separation, gas storage, and catalysis. Microporous organic polymers (MOPs) consisting of purely organic networks has attracted attention towards gas sorption and selectivity. This MOPs contains variety of materials that include hyper-cross linked polymers, porous aromatic frameworks, covalent organic frameworks, covalent triazine frameworks. Porous organic materials having nitrogen to their backbone, which enhance the CO<sub>2</sub> selectivity over nitrogen. In recent years, considerable interest to develop N-heterocyclic carbenes (NHCs) based materials for selective CO<sub>2</sub> capture. In the aspect of CO<sub>2</sub> capture, fixation, and activation, NHCs can be utilized in many ways. Mainly, this is reflected in the capture of CO<sub>2</sub> directly to form NHC-CO<sub>2</sub> adducts, which generate imidazole salt based ionic liquids to capture CO<sub>2</sub>.

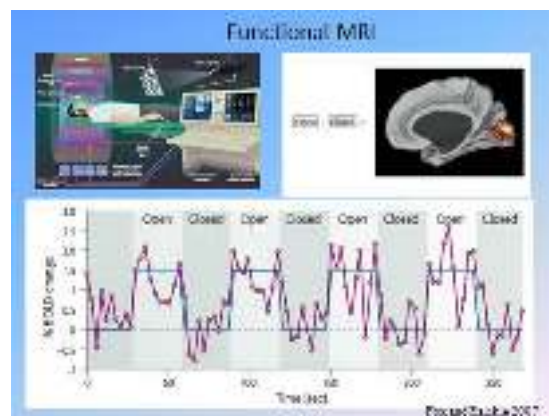
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<http://onlinelibrary.wiley.com/doi/10.1002/anie.201600658/abstract>

Collected by **C. Saravanan**

### Tracking blood circulation in brain – Application of functional magnetic resonance imaging

Functional Magnetic Resonance Imaging (fMRI) is a system that can track blood circulation and can show the intensity of activation of a localized area of the brain during a specific activity.



Such as reading a book, activates the occipital cortex while decision making activates frontal cortex. Thus this technique is used for mapping brain activity in a noninvasive and safe way with excellent temporal resolution. Doctors say that fMRI is not only used in diagnosing diseases of the brain but also enables to learn what we're thinking and feeling. Thus fMRI can be used as detector for telling the truth. fMRI is hence used in medical field for better understanding of brain and its related diseases. fMRI is based on the same technology as magnetic resonance imaging (MRI) that uses a strong magnetic field and radio waves to create detailed images of the body. But instead of creating images of organs and tissues like MRI, fMRI looks at blood flow in the brain to detect areas of activity. The changes in blood flow are captured on a computer which helps doctors to understand more about how the brain works. In a document published in THE HINDU, dated October 4, 2016, 'How to power your life', states that fMRI pattern in those who do regular exercise, have 'C' shaped structure with the caudate nucleus and a part of the basal ganglia showing highly active. This is caused by flooding of that area by a neuro transmitter called dopamine. This area is the reward area of the brain and such activation makes the person feel happy. Also exercises releases hormone called BDNF (Brain Derived Neurotropic Factors) which neutralized stress and endorphins which takes away the pain and fatigue of the exercise which is resulted in such activation.

Source

<http://fmri.ucsd.edu/Research/whatisfmri.html>

Collected by **N. Kavitha**

## Endocrine disruption and life threatening chemicals



**Endocrine disruptors** are chemicals (endocrine disrupting chemicals – **EDCs**) that, at certain doses, can interfere with endocrine (or hormone) systems. Endocrine disruptors are present in food, textiles, drugs, household, and personal care products such as plastic bottles, toys, and cosmetics. These disruptions can cause cancerous tumors, birth defects, and other developmental disorders. Important evidence suggests that endocrine disruption may be a factor in autism spectrum disorders (ASDs). By analyzing samples and data from a prospective birth group study, a team of U.S. and Canadian researchers have identified a handful of EDCs. ASDs encompass a complex set of disorders that have been associated with more than 800 potential genetic risk factors. The Centers for Disease Control and Prevention revised its estimates of the number of children with ASDs to 1 in 68, up from 1 in 88. Scientists suspect that **environment and genetics interact on the fetus prenatally** or very early in life to increase or decrease the risk of autism. These chemicals included pesticides, phenol derivatives and polychlorinated biphenyls.

**Pesticides on a Plate:** Nearly half of all fresh produce is affected by more and more heavy use of the pesticides. A huge amount of our everyday food is contaminated with pesticide – with up to 98 % of some fruits carrying traces of the chemicals. Overall, the **proportion of supermarket foods with pesticide** residues has almost doubled in a decade. 46 % of fresh fruit and vegetables such as grapes and apples contained residues up from 25 %. In terms of processed food, residues were found in almost 97 % of flour and 73.6 % of bread. Scientists found 91.3 % of grapes were contaminated, while almost three in 100 were above the legal maximum residue level. They were also found on 98 % of oranges, 90.6 % of apples and 73 % of carrots. Pesticide Action Network UK today suggests that the most common pesticide found were carbendazim. This group said there is evidence linking it to **developmental damage to mammals in the womb, as well as cancers and birth defects**. It was found on apples, beans with pods, cucumbers, grapes, oranges, pine-apples, pre-packed salads, raspberries, rice, some citrus fruits and spinach. Heavy use of certain pesticides, such as chlorpyrifos, has been associated with the decline in bees, vital to pollinate food and other crops. In theory, consumers can protect themselves by washing or peeling produce. Experts at the Agri-Food and Biosciences Institute in Northern Ireland found residues of the antioxidant diphenylamine and the fungicide carbendazim on apples were not decreased by washing.

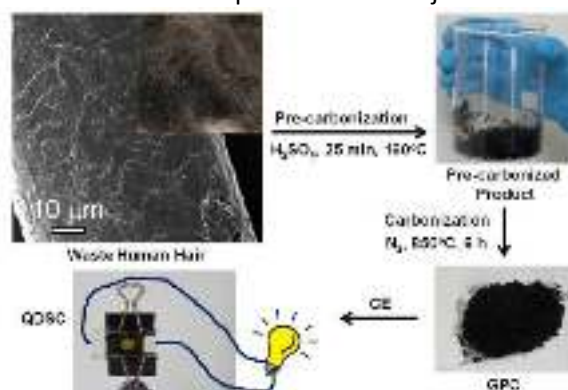
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<http://dx.doi.org/10.1289/ehp.122-A137>

Collected by P. Karthika

## Green counter electrode derived from human hair for solar cell

Researchers at the Indian Institute of Science Education and Research (IISER) in Kolkata have used human hair to produce cost-effective, metal-free cathodes for use in solar cells. This is the first instance where a bio-waste-derived electrode has been used as cathode in a quantum dot sensitised solar cell device. While metal-free cathodes produced in the past have not performed as well as the traditional metal-based ones, the performance of graphitic porous carbon cathode produced by a team, led by Prof. Sayan Bhattacharyya from the Department of Chemical Sciences, has been at par with metal-based cathodes. The results have been published in the journal **Carbon**.



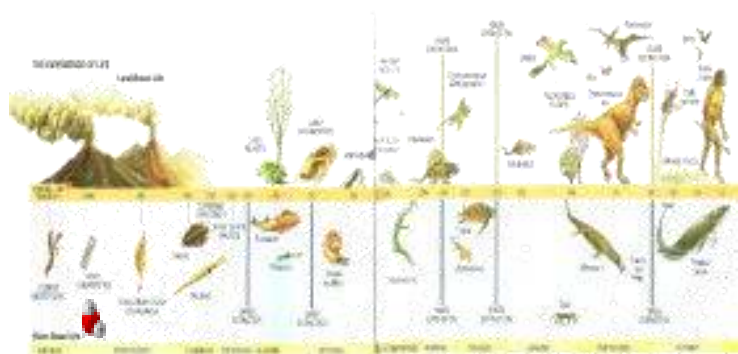
The graphitic porous carbon cathode shows an impressive performance to help converting visible sunlight to electricity [power conversion] much higher than commercially available activated carbon cathodes and are comparable with commonly used cathodes made of platinum metal and metal sulphides. Green cathodes have the potential to bring down the cost of solar cells. Besides its higher efficiency to convert visible sunlight to electricity, the cathode was found to generate high open-circuit voltage, which is at par with conventional platinum and activated carbon cathodes. Thereby, the power conversion efficiencies can also be enhanced. Producing graphitic porous carbon cathode using waste human hair is also simple, quick and inexpensive. Unlike in the case of other synthetic porous carbons, no physical or chemical activation process or templates were required to produce the pores of 2-50 nm diameter. The porosity, along with high surface area to volume ratio, plays an important role in adsorption-desorption of electrolyte. The cleaned and dry human hair was first treated with sulphuric acid at 165 degrees C for 25 minutes to achieve precarbonisation. It was then heated to different temperatures in the presence of an inert gas for six hours to carbonise and bring better electrical conductivity for efficient charge transfer. A material with high electrical conductivity can be produced by carbonising at higher temperature, but it will not be highly porous. "With increasing temperature, the

pores collapse and the porosity starts reducing. Therefore, a trade-off is required between electrical conductivity and porosity, so they found 850 degrees C was the optimum temperature to achieve highly catalytic graphitic porous carbon for fabricating efficient green cathodes. Though others had developed methods to produce porous carbon matrices using human hair for supercapacitor applications, large-scale production of porous carbon with graphitic edges and catalytically active sites by a facile synthesis procedure has been rare.

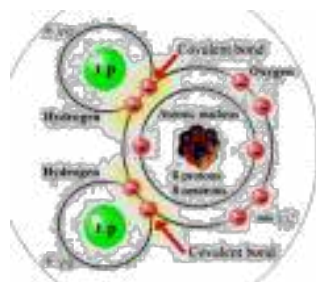
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<http://www.sciencedirect.com/science/article/pii/S0008622316304663>

Collected by R. Mangaiyarkarasi

**The cradle of life**

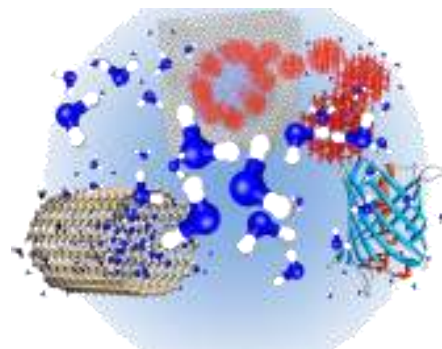


About 10 to 20 billion years ago, a massive explosion likely marked the beginning of the universe. The process of evolution began with this explosion, which eventually led to the origin and diversification of life on earth. The same processes were responsible for the evolution of molecules that led to the evolution of life. Thus, our study of life on earth begins with chemistry and physics. 'The chemistry of life is water chemistry'. Above picture shows that the way in which life first evolved was determined in large part by the chemical properties of the liquid water in which that our greatest evolution occurred. Life created in water and grown there for 3 billion years earlier than spreading to land. when life was originating, at that time, water acted like a medium in which other molecules interact without being held in place and could move around by ionic bonds or strong covalent. Life evolved as a result of these interactions. Most fundamental to all living organisms is the fact that many biological and physical properties of cell macromolecules, particularly the nucleic acids and proteins, derive from their interactions with water molecules of the surrounding medium.



Water is a transparent and nearly colorless chemical substance that is the main constituent of Earth, that has a simple atomic structure. It consists of an oxygen atom ( ${}_8\text{O}^{16}$ ) bound to two hydrogen atoms ( ${}_1\text{H}^1$ )

by two single covalent bonds. The resulting molecule is stable: it satisfies the octet rule, has no unpaired electrons, and carries no net electrical charge. The central oxygen atom in water attracts the electrons it shares with the two hydrogen atoms. This charge separation makes water a polar molecule. "The polarity of water underlies its chemistry and the chemistry of life" (Raven et. al, biology) The water molecule is awfully a polar that have partial positive and negative charges. Opposite charges attract and forming some weak linkages called hydrogen bonds. Hydrogen bonds and hydrophobic (Greek, "water-fearing") interactions are very weak and transient, lasting on average only  $10^{-11}$  sec, but collectively they have a very significant guide on the three-dimensional structures of polysaccharides, nucleic acids, membrane lipids and proteins. In chemical and biological science, water chemistry has constant valuable for beginning of all research. Due to this, first look of water chemistry has significant importance than all things.



*Recent developments and Ongoing research*

A novel indulgence of amazing water assets of solid surfaces in the closer proximity at the nanoscale has been developed. More rationally designed contrast agents for improved Magnetic Resonance Imaging performances are the first applications of the discovery. A new study states that batteries can provide pure water from saline sea. The proposed mechanism of that is electricity passes through a saline water-contained battery draws. Then, discrete the salt ions away from the water via electrochemical reaction.

Reaching clean water to societies in dry areas of our world remains a current challenge. After many of research, finally they found harvest water from air that have been proposed as a solution. Before development, this technology consumes a lot of energy. But based on current new modeling results, scientists now report that a new structure design would require less energy and harvest high-quality water.

Source  
<https://youtu.be/3QWoEOAIozM>

Collected by S. Karthick

### A Chameleon Planet, Last of Pluto Data, and Lithium's Source

**Lithium Formation in Novas:** Carl Sagan famously said the nitrogen in our DNA, the calcium in our teeth, the iron in our blood, the carbon in our apple pies were made in the interiors of collapsing stars. We are made of starstuff."And it's not just what we find in us humans-every element has an astronomical origin. Between ten seconds and twenty minutes after the Big Bang, the first and lightest elements formed in primordial nucleosynthesis-about 75 percent hydrogen, 25 percent helium, and trace amounts of [lithium](#) and [beryllium](#). Two hundred million years later, when the first stars began to shine, fusion in their cores transformed hydrogen into helium and forged increasingly heavier elements through iron (with heavier elements produced in nova and supernova explosions) a process that still continues in stars throughout the Universe. **But lithium posed a problem:** we knew that 25 percent of existing lithium comes from primordial nucleosynthesis, but we were not able to trace the origins of the remaining 75 percent," says Luca Izzo, of the Institute of Astrophysics of Andalusia (IAA-CSIC). To investigate the conundrum, Izzo and colleagues used the European Southern Observatory's [Very Large Telescope](#) to study a nova dubbed Sagittarii 1015 N.2 that appeared in the constellation Sagittarius for eighty days in March 2015. They were able to trace the evolution of the unstable element Beryllium-7, which decays into lithium in 53.2 days, indicating the presence of lithium in the nova. While [other studied novas](#) have indicated trace amounts of lithium, IAA-CSIC's find points to an eventual creation of unprecedented amounts of the element. "We're talking about an **amount of lithium ten times greater than that in the Sun,**" says Izzo. "With these amounts in mind, two similar novae a year would suffice to account for all the lithium in our galaxy, the Milky Way. Novae seem to be the predominant source of lithium in the universe," he concludes.

Source

<http://www.calacademy.org/explore-science/a-chameleon-planet-last-of-pluto-data-and-lithium%E2%80%99s-source>

Collected by K. Bama

### Water detected on metallic asteroid Psyche



Scientists have detected the presence of water on Psyche, the largest metallic asteroid in our solar system and the target of a proposed NASA mission. Previous observations of Psyche had shown no evidence of water-rich minerals on its surface. However, new observations from the NASA Infrared Telescope Facility in Hawaii show evidence of water or hydroxyl on its surface. While the source of these molecules on Psyche remains a mystery, scientists propose a

few possible mechanisms for its formation. Water-rich minerals detected on Psyche may have been delivered by carbonaceous asteroids that impacted Psyche in the distant past, said researchers including Joshua Emery, from University of Tennessee in the US. Psyche is about 300 kilometer across and is made of almost **pure nickel-iron metal**. Located in the asteroid belt, it is thought to be the remnant core of a budding planet that was mostly destroyed by impacts billions of years ago. The study was published in the *Astronomical Journal*.

Source

<http://www.financialexpress.com/lifestyle/science/water-detected-on-metallic-asteroid-psyche/439910/>

Collected by K. Bama

### Noble prize for supramolecular chemistry – 2016

Sir James Fraser Stoddart FRS FRSE FRSC (born 24 May 1942) is a British born chemist who is Board of Trustees Professor of Chemistry and head of the Stoddart Mechanostereochemistry Group in the Department of Chemistry at Northwestern University in the United States He works in the area of supramolecular chemistry and nanotechnology. Stoddart has developed highly efficient syntheses of mechanically-interlocked molecular architectures such as molecular Borromean rings, catenanes and rotaxanes utilizing molecular recognition and molecular self-assembly processes.



He has demonstrated that these topologies can be employed as molecular switches. His group has even applied these structures in the fabrication of nanoelectronic devices and nanoelectromechanical systems (NEMS). His efforts have been recognized by numerous awards including the 2007 King Faisal International Prize in Science. He shared the Nobel Prize in Chemistry together with Ben Feringa and Jean-Pierre Sauvage in 2016 for the design and synthesis of molecular machines. To know further about Professor Stoddart visit his official website.

Source

<http://stoddart.northwestern.edu/Index.php?View=FraserStoddart/General.php>

Collected by M. Senthil Kumaran



**Conferences:**

5th Symposium on **Advanced Biological Inorganic Chemistry (SABIC-2017)** will be held during January 7-11, 2017 at Kolkata. Organisers -Tata Institute of Fundamental Research (TIFR) and Indian Institute of Cultivation Science (IACS).

Refer the link:

<http://www.tifr.res.in/~SABIC/>

**12th National Symposium on Radiation and Photochemistry (NSRP - 2017)** will be held during March 2-4, 2017 at Manipal University, Manipal. Organiser – Indian Society for Radiation and Photochemistry (ISRPs), BARC, Mumbai and Manipal University, Manipal.

Refer the link:

<http://www.israps.org.in/nsrp2017/>

**Fellowships**

Summer Research Fellowship Programme -2017 apply online with last date 30.11.2016 Criteria: Applicants studying II and III year B. Sc. and I year M. Sc. are eligible. Percentage of marks from X to post-graduation (whichever year completed) - 65%. Only online applications are entertained.

Refer the link:

[http://web-japps.ias.ac.in:8080/fellowship2017/application\\_instructions.jsp](http://web-japps.ias.ac.in:8080/fellowship2017/application_instructions.jsp)

Ph. D Fellowships in foreign countries for organic chemistry  
<http://positions.dolpages.com/jobs/organic-inorganic-chemistry-phd/>

Ph. D Fellowships in foreign countries for polymer chemistry  
<http://positions.dolpages.com/jobs/polymersome-nanoreactors-phd-student/>

**Eiffel Scholarships in France for International Students**

The Eiffel Excellence Scholarship Program was established by the French Ministry of Foreign Affairs and International Development to enable French higher education establishments to attract top foreign students to enroll in their master's and PhD courses. The scholarship program funds master's courses lasting between 12 and 36 months and offers funding for PhD students to spend ten months in France through joint supervision or dual enrolment.

*Deadline: before 6 Jan 2017 (annual)*

Interested candidates visit following link

<http://www.scholars4dev.com/2282/eiffel-scholarships-for-international-students/>

**Science@Leuven Scholarships for International Students**

The Science@Leuven Scholarships are for motivated and talented international students who are interested in participating in an international master programme of the Faculty of Science of the K.U.Leuven, Belgium.

*Deadline: 15 Feb 2017 (annual)*

Interested candidates visit the following link

<http://www.scholars4dev.com/3222/science-scholarships-for-international-students-at-ku-leuven/>

**INSPIRE Research Fellowship**

Submission of Application for the "SCHOLARSHIP FOR HIGHER EDUCATION (SHE)" - a component of 'Innovation in Science Pursuit for Inspired Research (INSPIRE)

*Open from 15<sup>th</sup> November 2016*

*Closing on 15<sup>th</sup> January 2017*

Please see the link

<http://www.online-inspire.gov.in/>

**Marie Skłodowska-Curie actions - Research Fellowship Programme**

The Marie Skłodowska-Curie actions, named after the double Nobel Prize winning Polish-French scientist famed for her work on radioactivity, support researchers at all stages of their careers, irrespective of nationality. Researchers working across all disciplines, from life-saving healthcare to 'blue-sky' science, are eligible for funding. The MSCA also support industrial doctorates, combining academic research study with work in companies, and other innovative training that enhances employability and career development.

<http://ec.europa.eu/research/mariecurieactions/>

**Summer Research Fellowship Programme 2017 (SRFp- 2017)**

Summer research fellowship programme for PG students are announced by Indian National Science academy (INSA). Only PG students are eligible for this fellowship.

Register online using the following link:

[http://web-japps.ias.ac.in:8080/fellowship2017/application\\_instructions.jsp](http://web-japps.ias.ac.in:8080/fellowship2017/application_instructions.jsp)