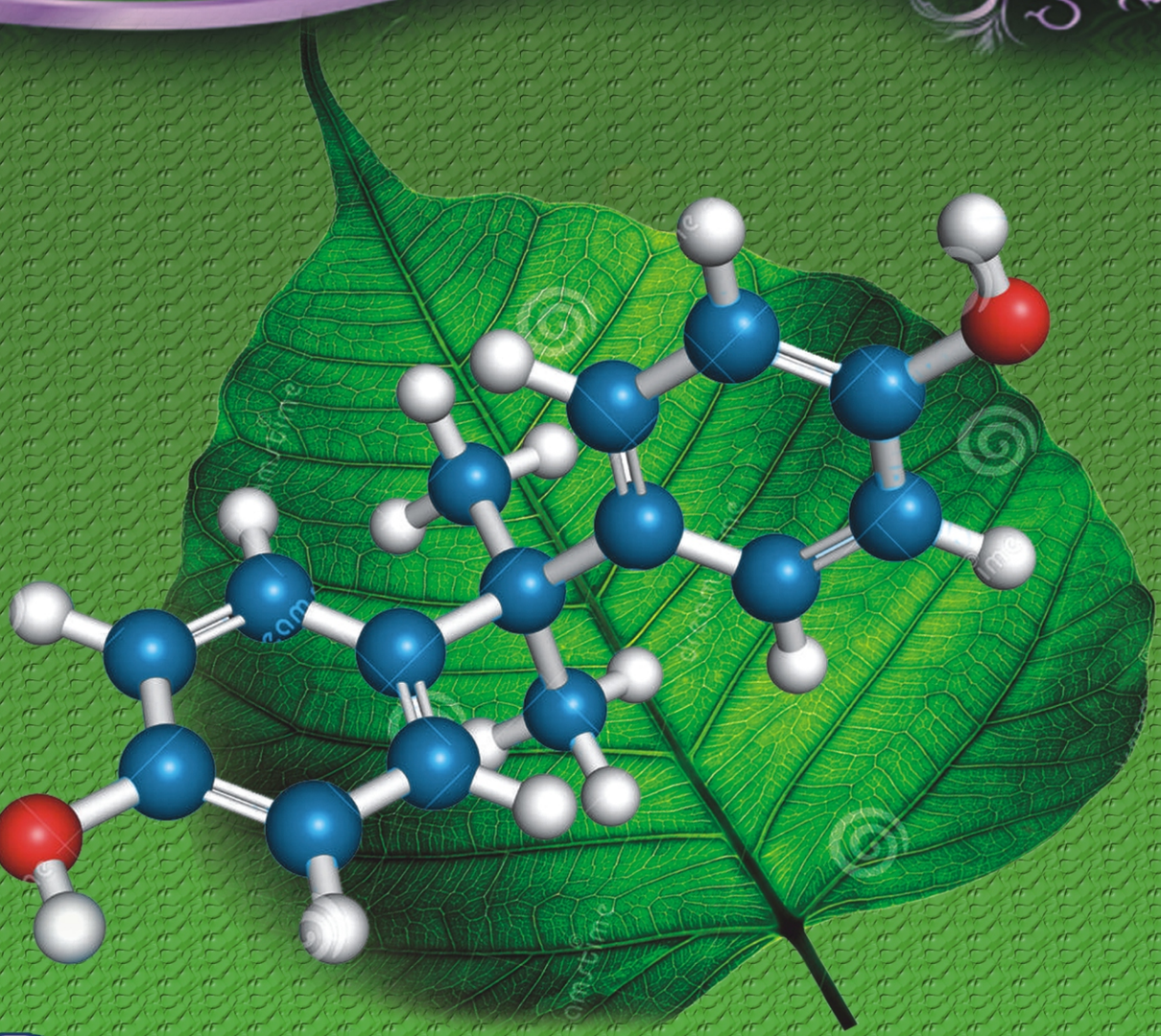
CHRYSL

Vol XIII - 2017



Post Graduate & Research Department of Chemistry
Auxilium College (Autonomous)
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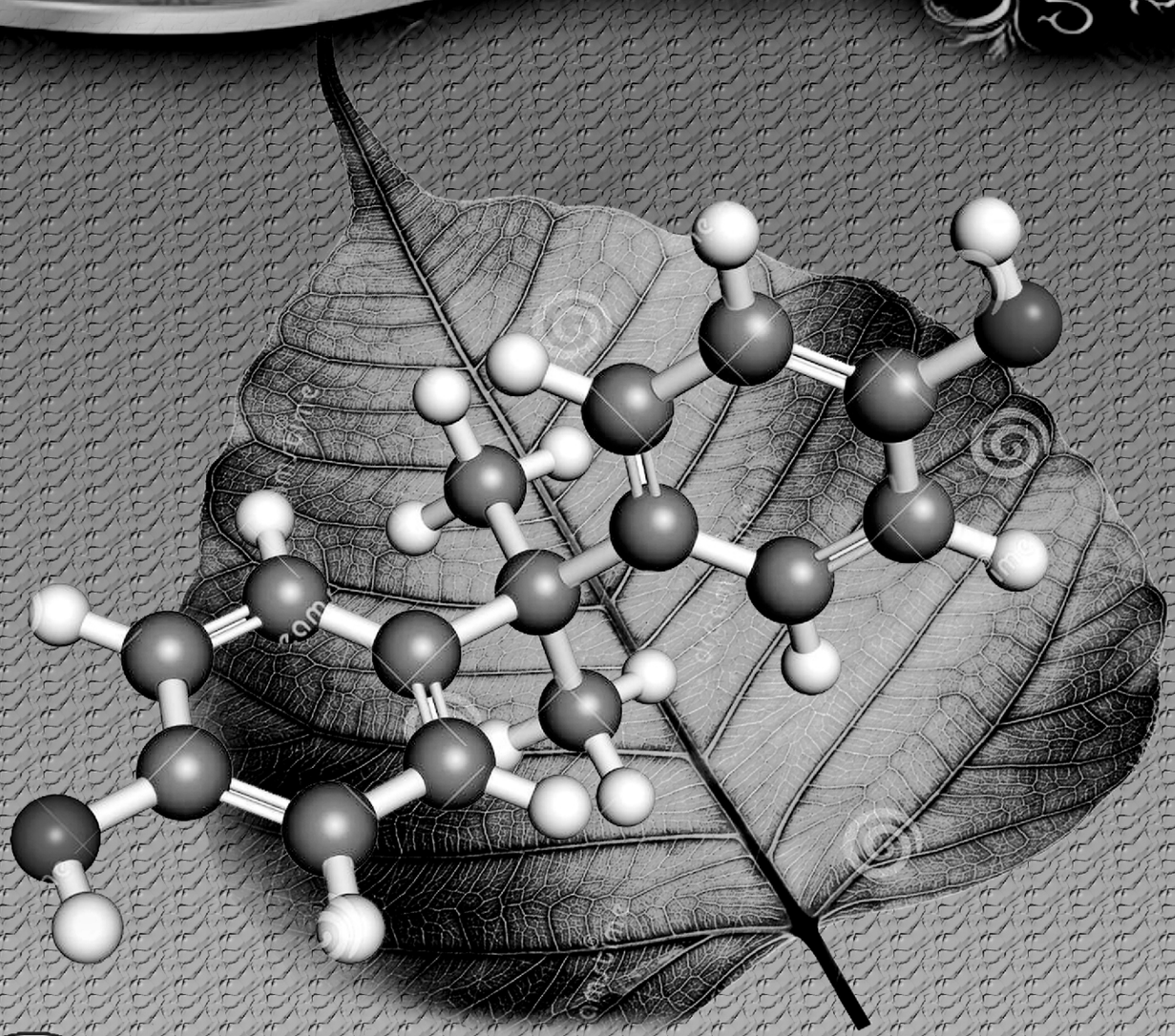

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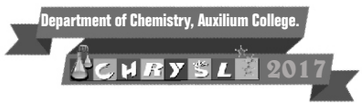


Editorial

Greetings and a warm welcome to Volume XIII of CHRYSL (Chemistry Resonating in Young Students' Lives) the annual periodical of the Department of Chemistry

"The Science of today is the Technology of tomorrow" -Edward Teller

In education and research, we witness rapid changes. The student today is an individual with feelings of self respect, self esteem, responsibility, creativity and compassion. We need to recognize, appreciate, encourage, motivate, applaud and foster the fine blend of knowledge and virtue in every student. Thus CHRYSL is to be viewed as a launch pad for the students' writing skills.

Chemistry is a dynamic and rapidly changing field. It is an extraordinarily interesting subject to study, understand and apply to our lives. As the saying goes, mind like parachute works best when open and this initiative of publishing CHRYSL every year is to set the budding chemistry minds to let free to creatively bloom in the world of chemistry.

The preparation of CHRYSL is a family effort, and the quality of the final product is the committed and dedicated effort of all the staff and students of the Auxilium chemistry family. We gratefully acknowledge the invaluable support extended by Rev. (Sr.) Amalarpovam, S.J., Secretary and Dr. (Sr.) Eugene Fathima Mary L. Principal, Auxilium College. We would like to thank Dr. S. Jhancy Mary, Head, Department of Chemistry, who provided expert suggestions and the needed encouragement to improve the text.

Hope you will enjoy reading this issue.

Dr. B. Scholastica Mary Vithiya,
Assistant Professor in Chemistry,
&
Dr. D Subashini,
Assistant Professor in Chemistry.

CONTENTS

NANOTECHNOLOGY

Nanotechnology is one of the leading scientific fields today, since it combines knowledge from the fields of Physics, Chemistry, Biology, Medicine, Informatics, and Engineering. It is an emerging technological field with great potential to lead in great breakthroughs that can be applied in real life. Novel nano biomaterials, and nano devices are fabricated and controlled by nanotechnology tools and techniques, which investigate and tune the properties, responses, and functions of living and non-living matter, at sizes below100 nm. The application and use of nanomaterials in electronic and mechanical devices, optical and magnetic components, quantum computing, tissue engineering, and other biotechnologies, with smallest features, widths well below 100 nm, are the economically most important parts of the nanotechnology nowadays and presumably in the near future. The number of nanoproducts is rapidly growing since more and more nanoengineered materials are reaching the global market. The continuous revolution in nanotechnology will result in the fabrication of nanomaterials with properties and functionalities which are going to have positive changes in the lives of our citizens, be it in health, environment, electronics or any other field. In the energy generation challenge where the conventional fuel resources cannot remain the dominant energy source, taking into account the increasing consumption demand and the CO_2 emissions, alternative renewable energy sources based on new technologies have to be promoted. Innovative solar cell technologies that utilize nanostructured materials and composite systems such as organic photovoltaics offer great technological potential due to their attractive properties such as the potential of large-scale and low-cost roll-to-roll manufacturing processes. The advances in nanomaterials necessitate parallel progress of the nanometrology tools and techniques to characterize and manipulate nanostructures.

The term nanotechnology comes from the combination of two words: the Greek numerical prefix nano referring to a billionth and the word technology. As an outcome, Nanotechnology or Nanoscaled Technology is generally considered to be at a size below 100 nm (a nanometer is one billionth of a meter, 10^{-9} m). Nanoscale science (or nanoscience) studies the phenomena, properties, and responses of materials at atomic, molecular, and macromolecular scales, and in general at sizes between 1 and 100 nm. In this scale, and especially below 5 nm, the properties of matter differ significantly (i.e., quantum-scale effects play an important role) from that at a larger particulate scale. Nanotechnology is then the design, manipulation, building, production and application, by controlling the shape and size.

SPINACH WORKS AS A HIDDEN BOMB DETECTOR

Scientists in the US have made a bionic spinach plant that soaks up explosive molecules from groundwater and gives off an infrared signal. Removing contaminants from soil is a time consuming and costly endeavour. But growing plants in affected areas offers a cheap and sustainable way of dealing with waste known as phytoremediation, the field which exploits a plant's ability to absorb and concentrate nutrients in their leaves or stem. Once the waste is absorbed, the plant can simply be pulled out of the soil.

This property also makes plants ideal for detecting contaminants. Through the transpiration process, plants draw up water and other analytes from the ground, and can accumulate even trace levels of analytes within their tissues.

To exploit this potential, Scientist Wong and his colleagues made a Nano bionic plant that can both detect explosives in groundwater and alert a user to their presence in the area. The team first injected IR-fluorescent carbon nanotubes (CNTs) into a spinach plant's leaves. Once treated, the spinach's roots were wrapped in cheesecloth and the common explosives component picric acid (2,4,6-trinitrophenol) was pipetted into them. These nanotubes quench in fluorescence intensity in the presence of nitroaromatics and they also designed a reference sensor that is invariant in signal intensity. The plant draws the nitroaromatics up through the roots into its leaves, where the suppressed IR signal is imaged with a night-vision camera and sent to a smartphone via a Wi-Fi signal. With the reference sensor embedded in the leaf as well, the technique produces high contrast images. This simple Nano bionic system will offer easy adoption in the field. These explosives-sensing plants are of very high importance for environmental remediation.

FASCINATING CHEMISTRY FACTS

Chemistry is a fascinating science, full of unusual trivia! Here are some fun and interesting chemistry facts for you.

- The elements that are liquid at room temperature are bromine and mercury. However, you can melt gallium by holding a lump in the warmth of your hand.
- Unlike many substances, water expands as it freezes. An ice cube takes up about 9% more volume than the water used to make it.
- If you pour a handful of salt into a full glass of water, the water level will actually go down rather than overflowing the glass.
- There is about 250 g of salt (NaCl) in the average adult human body.
- A pure element can take up many forms. For example, both diamond and graphite are allotropic forms of pure carbon.
- The chemical name for water (H_2O) is dihydrogen monoxide.
- The only letter that does not appear on the periodic table is J.
- Lightning strikes produce O_3, which is ozone, and strengthens the ozone layer of the atmosphere.
- The only two non-silvery metals are gold and copper.
- Although oxygen gas is colorless, the liquid and solid forms of oxygen are blue.
- The human body contains enough carbon to provide 'lead' (which is really graphite) for about 9,000 pencils.
- Hydrogen is the most abundant element in the universe, while oxygen is the most abundant element in the earth's atmosphere, crust, and oceans (about 49.5%).
- The rarest naturally-occurring element in the earth's crust may be Astatine. The entire crust appears to contain about 28 g of the element.
- Hydrofluoric acid is so corrosive that it will dissolve glass. Although it is corrosive, hydrofluoric acid is considered to be a 'weak acid'.

Praveena T. I M.Sc. Chemistry
&
Bhavya S. III B.Sc. Chemistry

THE COLORS OF GEMSTONES

The most common cause of color in gemstones is the presence of a small amount of a transition metal ion. These transition metal ions have an incomplete set of 3*d* electrons. Changes in the energy of these electrons correspond to the energy of visible light. When white light passes through a colored gemstone or is reflected by it, some of the energy of the visible light is absorbed, causing 3*d* electrons in the transition metal ion to undergo an energy change. The light that is transmitted or reflected appears colored, because those colors corresponding to 3*d* electron energy transitions have been absorbed.

For example, a ruby is a crystal of alumina, aluminium oxide, containing a trace of chromium (III) ions replacing some of the aluminium ions. In ruby, each Al^{3+} ion and Cr^{3+} ion is surrounded by six oxide ions in an octahedral arrangement. This arrangement splits the five 3*d* orbitals of Cr^{3+} into two sets, the *d*xy, *d*xz, *d*yz orbitals and the dx^2-y^2 and dz^2 orbitals. These two sets have different energies. The energy difference between these sets corresponds to the energy of visible light. When white light strikes a ruby, the gem absorbs the light energy corresponding to the transition of an electron from the lower-energy set of 3*d* orbitals to the higher-energy set. The ruby reflects or transmits the remainder of the light. Because this light is deficient in some energies (those that were absorbed), the light appears colored.

Not all gem colors are produced by transition metal ions. In some gemstones, the colors are produced by the presence of foreign atoms with a different number of valence electrons than the ones they replace. These foreign atoms are called color centers. Because the replaced atoms have the wrong number of valence electrons, they can supply or receive an electron from another atom by an intervalence transition. These color centers are often produced by nuclear transformation. An example of such a transformation is the change of a radioactive carbon^{14} atom in diamond into a nitrogen atom through beta particle emission. This leaves an atom, of nitrogen in place of the original carbon atom. The nitrogen atom has one more valence electron than the carbon atom. These nitrogen atoms are the cause of the coloration of blue and yellow diamonds. Color centers can be caused artificially as well, by irradiating the gem in a nuclear reactor. Many bright blue and bright yellow diamonds are produced artificially in this manner.

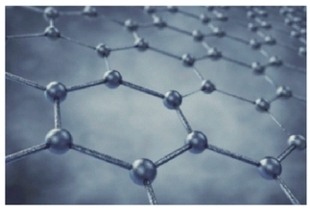
Bharathy L.
M.Phil. Chemistry

DID YOU KNOW?

1. The letters 'J' and 'Q' are not found in the periodic table.
2. The most expensive element is Francium (Fr).
3. The heaviest element found so far is Unnoctium.
4. Our human body is mostly made up of six elements which are oxygen, carbon, hydrogen, nitrogen, calcium, and phosphorus.
5. Elements that are liquid at 25° C are Br_2 (reddish-brown liquid) and Hg(shiny silvery metal).
6. "ONe" is a compound made of oxygen and neon.
7. We cannot taste food without saliva.
8. DNA is a flame retardant.
9. The total weight of the ants in the world is more than the total weight of the human in the world.

GRAPHENE-SPIKED SILLY PUTTY PICKS UP HUMAN PULSE

A dash of graphene can transform the stretchy known as Silly Putty into a pressure sensor able to monitor a human pulse or even track the dainty steps of a small spider. The material, dubbed G-putty, could be developed into a device that continuously monitors blood pressure. It also demonstrates a form of self-repair that may herald smarter graphene composites.



Since graphene was first isolated in 2004, researchers have added these atom-thin sheets of carbon to panoply of different materials, hoping to create composites that benefit from its superlative strength and electrical conductivity. But there have been surprisingly few attempts to blend it with 'viscoelastic' materials such as Silly Putty, which behaves as both an elastic solid and a liquid.

Medical uses

The researchers mixed graphene flakes, roughly 20 atomic layers thick and up to 800 nanometers long, with homemade Silly Putty, a silicone polymer, to produce dark grey G-putty that conducted electricity. Crucially, its electrical resistance changed dramatically when the researchers

applied even tiny amounts of pressure. The putty was at least ten times more sensitive than other nanocomposite sensors. When they wired up a lump of G-putty and held it to a student's neck, the pulse from his carotid artery was clearly visible in those resistance changes. In fact, the pulse profile was so detailed that they could convert it into an accurate blood-pressure reading. The sensor could also monitor respiration when placed on the student's chest. And, as a slightly bizarre encore, it recorded the individual steps of a spider weighing just 20 milligrams.

Mobile flakes

Coleman's team found that the graphene flakes form a conducting network within the putty, and deforming the material, breaks that network apart, rapidly increasing its electrical resistance. G-putty's low viscosity then allows the graphene flakes to move back into position and reform the network. “It's a self-healing phenomenon,” he says. Companies such as Nokia are interested in graphene sensors for health applications. But G-putty would have to clear a series of hurdles including proving that it can be made in large-scale quantities, and real-world testing to assess its long-term performance before it could be commercialized.

HEALTH TIPS

1. Eating fruits and vegetables may help the human body make its own aspirin.
   People who intake benzoic acid, a natural substance in fruits and vegetables, make their own salicylic acid, the key component that gives aspirin its anti inflammatory and pain relieving properties.

2. Baking soda can whiten our teeth.

3. Garlic can help to treat athletes' foot.

MICROBES CONVERT WASTEWATER INTO USEABLE ELECTRICITY

Millions of tiny microbes infest the water that carries the detritus of human life and society. Some of them steadily break down the organic material in waste streams and produce electrons in the process. By harvesting these electrons, scientists have created microbial fuel cells. New research shows how such biological power plants can be stacked to create usable current. Willy Verstraete and his colleagues at Ghent University in Belgium tested the fuel cells in an array of configurations: in series, in parallel and individually. Over the course of more than 200 days, the researchers fed the microbes a diet of anaerobic and aerobic sludge, as well as hospital and potato processing factory wastewater. By the end of the experimental time frame, the short-term power densities, a measure of power produced per unit of mass of the fuel cells had tripled. The team also found that the parallel stack was most efficient at producing an electric charge, consistently creating stronger current.

The scientist's main discovery, however, had to do with the co-evolution of the electrochemical properties of the fuel cell and the actual microbial community. At the start of the experiment, the tiny power plants relied on a diverse community of proteobacteria, including several species of Geobacter and Shewanella, and produced power somewhat inefficiently. But by the end of the experiment when performance was at its peak, one species, Brevibacillus agri, made up the majority of the electron-producing microbes. This microbial evolution calls for further research into the electron-producing properties of various species and their interaction.

PERIODIC TABLE PUNS

1. What you do in a play - Actinium (Ac)
2. Thanksgiving guest - Indium (In)
3. Tasty part of your mouth - Tungsten (W)
4. Warrior princess - Xenon (Xe)
5. A sinking ship - Titanium (Ti)
6. Place for washing dishes - Zinc (Zn)
7. What a cloud does - Uranium (U)
8. Golden state - Californium (Cf)
9. What you do a wrinkled shirt - Iron (Fe)
10. Get clean with this - Chlorine (Cl)
11. A "prize" element - Nobelium (No)
12. A very smart person - Einsteinium (Es)
13. $E = mc^2$ - Einsteinium (Es)
14. Imitation diamond - Zirconium (Zr)

PRESSURE TURNS NITROGEN GAS INTO SOLID SEMICONDUCTORS

A new kind of nitrogen is what researchers at the Carnegie Institution of Washington have created by applying immense pressure to ordinary nitrogen gas. Nitrogen gas (N_2) is abundant on earth, making up about 75 percent of the planet's atmosphere. The triple bond between the two nitrogen atoms makes the gas a very stable compound. At low pressure and temperature, nitrogen forms molecular crystals and becomes an electric insulator. But scientists predicted that by raising the pressure on these crystals to 50 to 94 gigapascals, the nitrogen molecules could be transformed into monoatomic metallic solids. (One gigapascal is roughly 10,000 times the atmospheric pressure experienced at sea level.)

The researchers not only managed to create such solid nitrogen but also found that, unlike its molecular crystal predecessor, the nitrogen becomes a semiconductor in this state. Moreover, they managed to keep the nitrogen in solid form after lowering the pressure back down to normal levels (at temperatures below 100K). "The fact that the major portion of the air has been turned into a semiconducting solid and brought back to be stable at ambient pressure is an important breakthrough for us," team leader Russell Hemley says. The results of this study confirmed theories that were used to predict new properties, such as high-temperature superconductivity in metallic hydrogen. The researchers initially wanted to convert hydrogen in this manner and they hope to eventually do so.

NANOBOTS AND NANOMACHINES

The new technology inventions of nanobots could radically change our lives. Everything from computer, energy, medicine and the environment is being revolutionised by the development of nano machines. Tiny robot is capable of manipulating matter at atomic level.

The prefix "NANO" means nanometer is a measurement of 1-billionth of a meter or about 10,000 times thinner than a human hair. It is the distance that is approximately the length of a few atoms to 20 atoms placed next to each other depending on the type of atom.

These nano machines have the mechanical property similar but not identical to how man builds machine, with motor, bushing glasses and so forth.

Imagine, a tiny nanobot injected to your blood stream with sole purpose of hunting down and destroying harmful bacteria and viruses. In nano-labs, the nanobots carrying anti-cancer drug have been used to recognise and then inject them with their pay loads.

Scientists have also used nanobots for restoration and re-generation by introducing new genetic materials into damaged or diseased cells. Currently, the blue prints that exist for nanobots will be capable of evaluating your state of health including identifying the potential disease risk, by simply analysing a drop of your blood.

CLEANING WATER WITH ULTRASOUND

Chemicals may not be needed to destroy water pollutants; instead ultrasound at just the right frequency might do the trick. Ultrasound creates bubbles in water through a process called cavitation. When the bubbles collapse, the gas inside of them becomes very pressurized and is at high temperatures for a very short period of time. The temperatures and pressures are such that organic contaminants can degrade.

To figure out which frequency of ultrasound would be most efficient for water purification, the scientists looked at another process related to cavitation called sonoluminescence, in which water bubbles bombarded with sound actually emit light. The reason it would be different is that the nature of the bubble collapse, as well as the number of bubbles in the solution, are going to depend on frequency.

Hua's team placed a glass container of about one liter of water on a steel transducer that produced ultrasound waves. They also dropped 1,4 Dioxane, an organic contaminant, into the water. Then they zapped the mix with ultrasound frequencies of 205, 358, 618 and 1,071 KHz. Other scientists have conducted similar series of experiments in the past, but Hua's team was the first to leave all conditions but the ultrasound frequency consistent.

They found that at 358 KHz the compound reacted faster than at any other frequency. Hua hopes ultrasound will become an alternative to the conventional chemical methods of water purification. It is very easy to use and does not require highly trained operators.

CHEMISTRY-NOT A MYSTERY

Chemistry is not a mystery. Most of the common people think that chemistry is just a subject full of equations which is not related to human life. Despite their thoughts, the real fact is, Chemistry is the back bone of our life.

Example

Paracetamol (acetaminophenol) is a pain killer and a fever reducer. The exact mechanism of action is not known.

Preparation

Hydroquinone , ammonium acetate and acetic acid are mixed in an argon atmosphere and heated slowly to 230^{o}C. The mixture is stirred at that temperature for 15 hours. After cooling the acetic acid is evaporated and the precipitate is filtered, washed with water and dried to give paracetamol as a white solid.

Uses

Paracetamol is used to treat many conditions such as headache, muscle aches, arthritis, toothache, cold and fever. It relieves pain in mild arthritis but has no effect on the underlying inflammation and swelling of the joint.

ATOM-THIN PATCH COULD HELP CONTROL DIABETES WITHOUT NEEDLES

A wearable, graphene-based patch could one day maintain healthy blood glucose levels in people by measuring the sugar in sweat and then delivering the necessary dose of a diabetes drug through the skin. The device takes scientists a step closer to the “coveted prize” in diabetes care: a noninvasive method to monitor and control blood glucose levels.

For the new patch, the researchers, led by Dae-Hyeong Kim of Seoul National University, decided to detect glucose in sweat because previous studies had shown that levels of the sugar in perspiration match those in blood. The new device uses layers of the fluoropolymer Nafion to absorb sweat and carry it toward the device's sensors, which are built on modified graphene. The team doped the graphene with gold atoms and functionalized it with electrochemically active materials to enable reactions needed to detect glucose. In the patch's glucose sensors, the enzyme glucose oxidase reacts with the sugar and produces hydrogen peroxide, which, through an electrochemical reaction, extracts current from the doped graphene. This produces an electrical signal proportional to the amount of glucose present. The patch also contains pH and temperature sensors that help ensure that the glucose sensor's signals accurately reflect the sugar's concentration in sweat. To monitor the levels, the patch sent its sensor signals to a device that analyzed them and then wirelessly relayed the data to a smartphone.

CHEMISTRY JOKES

Q: Organic chemistry is difficult.

A: Those who study it have alkynes of trouble.

Explanation: An alkyne is a common type of carbon compound with one carbon-to-carbon triple bond. They are frequently used and studied in organic chemistry. It's pronounced like "al kine." So, alkynes of trouble sounds like all kinds of trouble.

Q: Why can you never trust atoms?

A: They make up everything!

Explanation: Atoms are the smallest pieces of matter, they make up all of the elements and molecules and proteins and everything else on Earth. They literally make up everything we see, but in the joke they are suggesting that the atoms lie so don't trust them.

Q: Anyone know any jokes about sodium?

A: Na

Explanation: The symbol for sodium on the periodic table is "Na," which when said as a word is pronounced like nah, another way to say no.

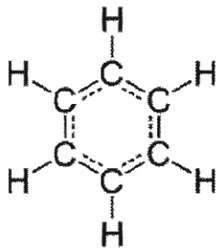
Q: Why are chemists great for solving problems?

A: They have all the solutions.

Explanation: In chemistry a solution is the proper name for a mixture where one substance is completely dissolved in another like sugar or salt in water. Solutions are also the answers to problems.

Q: What do chemists call a benzene ring with iron atoms replacing the carbon atoms?

A: A ferrous wheel.



Explanation: A benzene ring is a hexagon-shaped ring made out of hydrogen and carbon atoms, so it basically resembles a wheel. "Ferrous" is used as an adjective to describe something with iron in it, so a wheel of iron is a Ferrous wheel, which sounds similar to Ferris wheel, the carnival ride.

FACTS IN CHEMISTRY

DNA as a flame retardant

Coating cotton cloth with DNA, researchers found the genetic material reduced the fabric's flammability. When it is heated, the phosphate from DNA produces phosphoric acid which replaces the water in cotton fibers as a flame-retarded residue. The bases, which contain nitrogen, react to produce ammonia which inhibits combustion

A rubber tyre is technically one single, giant, polymerized molecule

Some molecules can be very big, but most are still microscopic. Not the vulcanized tyre,

though it's all one, big, freaking molecule! Basically, the vulcanized tyre is all made of large polymer chains that have been crosslinked together with covalent bonds.

Your car's airbags are packed with salt sodium azide, which is *very* toxic

When a collision takes place, the car's sensors trigger an electrical impulse which in the fraction of a second dramatically raises the temperature of the salts. These then decompose into harmless nitrogen gas, rapidly expanding the airbag.

Famed chemist Glenn Seaborg was the only person who could write his address in chemical elements

He would write **Sg, Lr, Bk, Cf, Am**. That's Seaborgium (Sg), named after Seaborg himself; Lawrencium (Lr), named after the Lawrence Berkeley National Laboratory; Berkelium (Bk), named after the city of Berkeley, the home of UC Berkeley; Californium (Cf), named after the state of California; Americium (Am), named after America.

CHEMISTRY FACTS

1. The only two non-silvery metals are gold and copper.

A metal is an element that readily forms positive ions (cations) and has metallic bonds. These elements have electrons that are loosely held to the atoms, and will readily transfer them. This is why metals are great electrical and thermal conductors - because the electrons move energy. Most metal electrons reflect colors equally. So the sun's light is reflected as white. Gold and copper, however, happen to absorb blue and violet light leaving yellow light. It's worth noting here that copper is also the only metal that is naturally antibacterial.

2. **If you pour a handful of salt into a glass of water the water level will go down**.

When you step inside a bath tub, the water level will immediately go up, as per **Archimedes's law** but when you add a volume of sodium chloride (salt) to a volume of water, the overall volume actually decreases by up to 2% . The net reduction in observed volume is due to solvent molecules which become more ordered in the vicinity of dissolved ions.

WATER

Properties of water

Water is the most abundant molecule on the earth's surface and one of the most important molecule of study in chemistry.

What is water?

Water is a chemical compound. Each molecule of water H_2O or HOH, consists of two atoms of hydrogen bonded to one atom of oxygen.

Facts about water

- ✓ Other names for water are; Dihydrogen monoxide, Oxidane, Hydroxylic acid and hydrogen hydroxide.
- ✓ Molecular formula for water is H_2O
- ✓ Molar mass of H_2O; 18.01528 g/mol
- ✓ Density 1000 kg, Liquid (4 degrees) or 917 kg, solid. This is why ice floats on water.
- ✓ Melting point: 0°C, 32°F, (273.15K)
- ✓ Boiling point;100°C, 212° F,(373.15K)
- ✓ Crystal structure; hexagonal
- ✓ Molecular shape; bent
- ✓ Pure liquid water at room temperature is odourless, tasteless and nearly colourless. Water has a faint blue colour, which means more apparent in large volumes of water.

FLUORINE

1. Fluorine is the most reactive and most electronegative of all the chemical elements. It is the only element that does not vigorously react with oxygen, helium neon and argon. It is also one of the few elements that will form compounds with noble gases: xenon, krypton and radon.

2. Fluorine is the lightest halogen; with atomic number 9. It is a pure non-metallic element and is a gas at room temperature and pressure.

3. Fluorine reacts violently with hydrogen as discovered by Henry Moisson, who was awarded the 1906 Nobel Prize for Chemistry for isolating fluorine in 1886. Moisson was also poisoned by the reactive element. He was also the first person to make artificial diamonds by compressing charcoal.

4. It is the13th most abundant element in the earth's crust. It is so reactive that it is not found naturally in pure form, but only in compounds. The element is found in minerals including fluorite, topaz and feldspar.

5. Fluorine is found as fluoride in toothpaste and drinking water, drugs including: chemotherapeutic drug 5-fluorouracil and etchant hydrofluoric acid. It is used in refrigerants (chlorofluorocarbons or CFCs).

6. Because it is so reactive, it is difficult to store. Hence as hydrogen fluoride it is safer and easier to transport and hard when it is pure fluorine.

7. Fluorine changes from an extremely pale yellow diatomic gas (F_2) into a bright yellow liquid at 188^{o}C.

WATER DROP LENS

Physicist and inventor, Bruno Berge, has created a liquid optical lens. Using a process known as electro-wetting, a water drop is deposited on a metal substrate and covered by a thin insulating layer. When a voltage is applied to the metal, it modifies the angle of the liquid drop. The liquid lens is comprised of two liquids, water and oil; one is a conductor while the other is an insulator. A variation in the voltage causes a change to the curvature of the liquid to liquid interface, which changes the focal length of the lens. The use of liquids allows for low cost construction. There are no moving parts and electrical consumption is extremely low. The lens has a large inverse focal length range, quick response, high optical quality and can operate in a wide temperature range.

HEAT

Water boils at 100°C. Iron melts at 3000°C. The temperature at the outer surface of the sun is 6000°C. At this temperature, things exists only at the vapour state. The temperature at the core of the sun is one crore degree celsius. These temperatures are unbelievable. But no one knows the heat that existed during the evolution of the Universe. According to the big bang theory, 1500 crore years before, the temperature was 10 thousand crore degree Celsius. Even the basic unit of matter i.e atoms could not have existed at that temperature. After one second, the temperature decreased to 1000 crore degree Celsius. This is also a very high temperature . It is thousand times higher than the temperature at the core of Sun. At this temperature only the sub-atomic particles formed. On further cooling these sub-atomic particles combined to form atoms. Thus after this, all things in the universe evolved from atoms of different elements. As far as earth is concerned, the above temperatures are too much for humans, because in summer season we feel very difficult to go out at 100° F. The highest temperature officially recorded on earth is 136°F (58°C).

CONDUCTING POLYMERS AND THEIR APPLICATIONS

Polymers are poor conductors of electricity, due to non-availability of large number of free electrons. The polymeric materials which possess electrical conductivities on par with metallic conductors are known as conducting polymers. Polymers with polyconjugated structures are insulators in pure state, but when treated with oxidizing or reducing agents can be converted into polymer salts with electrical conductivities comparable to metals. Conducting polymers have drawn considerable attention because of their economic importance, good environmental stability and electrical conductivity as well as due to their useful mechanical, optical and electronic properties. Some of the widest applications of conducting polymers include use in electrostatic materials, conducting adhesives, electromagnetic shielding against electromagnetic interference (EMI), artificial nerves, aircraft structures, diodes, and transistors.

Conductivity

Conductivity can be defined simply by Ohm's law, V = IR where R is the resistance, I the current and V the voltage present in the material. The conductivity depends on the number of charge carriers (number of electrons) in the material and their mobility. In a metal it is assumed that all the outer electrons are free to carry charge and the impedance to flow of charge is mainly due to the electrons “dumping” in to each other.

TYPES OF CONDUCTING POLYMERS

The main chain contains	No heteroatom	Nitrogen containing	Sulfur containing
Aromatic cycles	Poly(fluorine)s Polyphenylenes Polypyrenes Polyazulenes Polynaphthalenes	Poly(pyrrole)s(PPY) Polycarbazoles Polyindoles Polyazepines Polyanilines (PANI)	Poly(thiophene)s(PT) Poly(3,4-ethylenedioxythiophene) (PEDOT) Poly(p-phenylenesulfide)(PPS)
Double bonds	Poly(acetylene) (PAC)		
Aromatic cycles and double bonds	Poly(p-phenylene vinylene) (PPV)		

Prerequisites for a polymer to become conductive

- The polymer has to consist of alternating single and double bonds, called conjugated double bonds.
- Every bond contains a localized "sigma" bond which forms a strong chemical bond.
- Every double bond also contains a less strongly localised "pi" bond which is weaker.
- Plastic has to be disturbed by doping either by removing electrons from (oxidation) or inserting them into (reduction) the material. Two types of doping are :

$(CH_n) + 3x/2\ I \qquad (CH_n)^+ + I^-_3$ (oxidation with halogen)

$(CH_n) + xNa \qquad (CH_n)^{x-} + xNa^+$ (reduction with alkali metal)

Methods of Doping

Chemical oxidants: iodine, nitronium species, transition metal salts.

Chemical reducing agents: sodium naphthamide.

Electrochemical methods: dopants such as ClO_4^-, BF_4^- and other complex species.

Applications

- **Coatings:** Prevents buildup of static charge in insulators. Absorbs the harmful radiation from electrical appliances which are harmful to the nearby appliances. Conducting plastics are used in circuit boards.
- **Sensors:** Polypyrroles can detect NO_2 and NH_3 gases by changing its conductivity.
- **Biosensors:** Polymerization of polyacetylene in the presence of enzyme glucose oxidase and suitable redox mediator like triiodide gives rise to a polymer which acts as glucose sensor.
- **Polymeric ferroelectric RAM (PFRAM)**

  Dipole is used to store data. Provides low cost per bit with high chip capacity. Low power

consumption. No power required in standby mode. Is not a fast access memory.

- **Artificial nerves:** Neural probe applications require materials with high surface area, hydrophobicity and cell specificity to improve and maintain good SNR for detection of neuron signals.
- **Brain cells:** A neural electrode is interfaced with the surrounding brain tissue through the *insitu* polymerization of PEDOT.
- **Displays:** Does not require a glass substrate as amorphous silicon does. It could be made on a piece of plastic. Deposition techniques could reduce costs dramatically.
- **Conductive adhesive:** Monomers are placed between two conducting plates and it allows it to polymerize. Conducting objects can be struck together allowing electric current to pass through the bonds.

Vidhya V.
M.Phil. Chemistry

CHEMISTRY QUIZ

1. What is the importance of Na_2CO_3 extract to be clear and colorless?
   ANS: This provides a better setting to observe formations of precipitates, color changes which take place during the experiment.

2. Is the Na_2CO_3 extract basic or acidic?
   ANS: It is slightly basic.

3. What type of bond is present in an inorganic salt?
   ANS: Electrovalent type of bond is present is in an inorganic salt.

4. Name the acid radicals detected with dil.H_2SO_4?
   ANS: $(CO_3)^{2-}$,S^{2-},$(SO_3)^{2-}$,$(NO_2)^-$.

5. Name the acid radicals detected by concentrated H_2SO_4?
   ANS: Cl^-, Br^-,$(NO_3)^-$,CH_3COO^-.

6. Name the radical which produce CO_2 on heating?
   ANS: Carbonate.

7. Name the salts which produce cracking sound when heating?
   ANS: Lead nitrate, Barium nitrate, Potassium bromide, Sodium chloride.

8. What is lime water?
   ANS: Solution of $Ca(OH)_2$ in water is called lime water.

9. Why is Bunsen burner provided with air holes?
   ANS: To regulate the supply of air to the fuel gas.

Deepika V.
I B.Sc Chemistry

DRUG DELIVERY

The importance of drug delivery to chemists, medicinal and otherwise, has increased since the advent of integrated drug discovery processes. Physicochemical and biological barriers, pathways for drug delivery, formulation, pharmacokinetic and pharmacodynamic issues, metabolism, and cell culture models used in studying drug delivery are just some of the topics that make drug delivery an exciting field for researchers.

Two-Dimensional Nanomaterials (2DNM) for Cancer Nanotheranostics

Nanotheranostic agents have emerged as a robust driving force for cancer therapeutics and diagnostics. Of them, 2DNMs have shown great potentials in cancer nanotheranostics due to their extraordinary physicochemical properties. The state-of-the-art facets of 2DNMs are recapitulated for their targeted bio-imaging, selective cancer cell obliteration, tailored phototherapy and customized drug delivery.

Immune Cell-Mediated Biodegradable Theranostic Nanoparticles for Melanoma Targeting and Drug Delivery

By taking advantage of innate immune cell's ability to target tumor cells, a novel drug delivery system is developed by using THP-1 cells as both nanoparticle-carriers and navigators to achieve cancer-specific drug delivery. The “self-powered” immune cell-mediated theranostic biodegradable photoluminescent poly (lactic acid) nanoparticle-based drug delivery system represents a potentially significant advancement in targeted theranostic cancer nanotechnologies.

Selenium-Containing Polymer Metal-Organic Frameworks Nanocomposites as an Efficient Multiresponsive Drug Delivery System

The multiresponsive P@ZIF-8 as an advanced biocompatible drug delivery system (DDS) has been successfully prepared. The as-prepared P@ZIF-8 has excellent biocompatibility, good loading capacity, and controllable drug release and is suitable for doxorubicin storage/release as a smart DDS. These results suggest that hybrid nanocomposites may provide new possibilities for controllable drug release in biomaterials.

Active Regulation of On-Demand Drug Delivery by Magnetically Triggerable Microspouters

A triggerable device, termed a microspouter, is designed and fabricated for active and precise control of localized drug delivery. It is able to be triggered to spout drug solution on demand.

Vinitha T.
I M.Sc. Chemistry

INTERESTING USES OF CALCIUM

Calcium is a chemical element with symbol Ca and atomic number 20. It is a soft grey group 2 alkaline earth metal, fifth most abundant element by mass in the earth's crust. Calcium is produced in supernova nucleosynthesis. Calcium is an essential trace element in living organisms. It is the most abundant metal by mass in many animals, and it is an important constituent of bone, teeth and shells. The word calc means lime. It was discovered by sir Humphrey Davy in 1808. Calcium has a wide variety of applications almost associated with calcium compounds and salts.

1. Calcium metal is used as a deoxidizer, desulfurizer and decarbonizer for the production of some ferrous and non ferrous alloys.
2. Calcium carbonate is used in manufacturing cement and mortar, lime, limestone and aids in production in the glass industry. It also has chemical and optical uses as mineral specimens in tooth pastes.
3. Calcium hydroxide solution also known as limewater is used to detect the presence of carbon dioxide in a gas sample bubbled through a solution. The solution turns cloudy where carbon dioxide is present.
4. Calcium arsenate is used in insecticides.
5. Calcium carbide is used to make acetylene gas (for use in acetylene torches for welding) and various plastics.
6. Calcium chloride is used in ice removal and dust control on dirt roads, as a conditioner for concrete, as an additive in canned tomatoes, and to provide body for automobile tyres.
7. Calcium nitrate is used as a food preservative.
8. Calcium cyclamate is used as a sweetening agent in several countries.
9. Calcium gluconate is used as a food additive and in vitamin pills.
10. Calcium hypochlorite is used as a swimming pool disinfectant, as a bleaching agent and an ingredient in deodorant.
11. Calcium permanganate is used in liquid rocket propellants, in textile production as a water sterilizing agent and in dental procedures.
12. Calcium phosphate is used as a supplement for animal feed, fertilizer in commercial production for dough and yeast products, in the manufacture of glass, and in dental products.
13. Calcium phosphide is used in fireworks, rodenticide, torpedoes and flares.
14. Calcium stearate is used in manufacture of wax crayons, cement, certain kinds of plastics, cosmetics and as a food additive in the production of water resistant materials and in the production of paints.
15. Calcium sulphate (gypsum) is used as common black board chalk, as well as in hemihydrate from plaster of Paris.
16. Calcium tungstate is used in luminous paints and fluorescent lights and in X-rays.

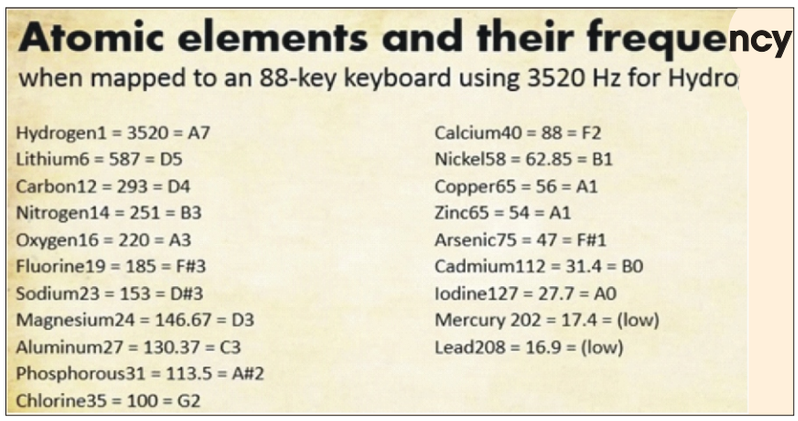
Samyuktha A. D.
I B.Sc. Chemistry

NOW YOU CAN HEAR CHEMISTRY

Health Ranger translates molecules into music in stunning video demonstration that will blow your mind (and your ears).

Mike Adam wanted to hear more about this extraordinary harmonic code found in the Table of Elements and the laws of physics and chemistry. In one of the videos he demonstrated what he now calls "Elemonics" the science of translating chemistry and molecules into audible music by sequencing elements using the inverse of their atomic mass units (i.e. frequencies) as documented in the Table of Elements.

In essence, he has discovered a way to map the elements to a standard 88-key keyboard using their documented atomic masses. Hydrogen is mapped to 3,520 Hz (high A7 key on the keyboard) as the only arbitrary choice in this mapping, and the rest of the elements are mapped in relation to Hydrogen. Since Carbon has a mass of 12, for example, it gets mapped to 3,520 / 12 which equals 293.3 Hz. That corresponds to the D4 key on an 88-key keyboard.



Using this translation, he was then able to play molecules as musical sequences, allowing the world to HEAR nutritional chemistry for the first time.

How he discovered Elemonics

This incredible revelation came to him during a walk in nature as he was pondering a particular ionization problem with a Time-of-Flight mass spec instrument at a forensic food laboratory.

He was having difficulty ionizing a certain target analyte using the ESI (electrospray ionization) in negative ionization mode, and he was playing around with a thought experiment that explored whether a solution might be found in identifying the harmonic resonance of the molecule in question, then shattering the ionic bonds with ionization voltage broadcast at a resonant frequency.

Normally in mass spec systems, the fragmentation voltage is set at a fixed frequency. But what if people had control over that frequency as a parameter in the mass spec analysis? Certain frequencies of voltage could turn out to be far more effective at molecular fragmentation.

This, in theory, could achieve more efficient molecular fragmentation, exposing each fragment to easy ionization and subsequent detection via mass-to-charge ratio discrimination. In this case, he is proposing a post-ionization fragmentation and secondary ionization, which he doesn't think is available in current mass spec systems. If this could be achieved, the mass spec software can easily analyze molecular fragmentation to identify the original molecule, using what are essentially "fragmentation fingerprints" to piece together the original pre-fragmented molecule. In effect, he would end up with a bunch of smaller M^+H fragments, each with much higher IP (ionization potential) which translates into far greater detection sensitivity for the analyte in question.

Sr. Bashanti Ekka.
I M.Sc. Chemistry

PHYTOREMEDIATION

Phytoremediation is the use of plants for the removal of contaminants and metals from the soil and water, or to render them harmless. Phyton = Plant (in Greek) & Remediate = To remedy (in Latin). It is basically the decontamination or stabilization of the polluted area using plants. These plants can be herbs, shrubs or trees, and they may be able to accumulate organics and heavy metals high above the levels found in nature (Brown, 1995; Ma et al., 2000).

Soil Pollution is defined as the buildup in soils of persistent toxic compounds, chemicals, salts, radioactive materials, or disease causing agents, which have adverse effects on plant growth and animal health. It is caused by the presence of xenobiotic (humanmade) chemicals or other alteration in the natural soil environment. The most common chemicals involved are petroleum hydrocarbons, polynuclear aromatic hydrocarbons (such as naphthalene and benzo(a)pyrene) , solvents, pesticides, lead and other heavy metals .

Heavy metals are metallic chemical elements having atomic weight between 63.54 and

METAL	ROUTE OF ENTRY	HARMFUL EFFECTS
Mercury	Inhalation,ingestion and absorption through skin	Irritation of respiratory system; lung, liver and kidney damage
Lead	Inhalation and ingestion	Lung and liver damage; loss of appetite, nausea etc
Nickel	Inhalation	Lung, liver and kidney damage
Arsenic	Inhalation and ingestion	Irritation of respiratory system, Liver and Kidney damage, Loss of appetite, nausea and vomiting etc
Cadmium	Inhalation and ingestion	Lung, liver and kidney damage; Irritation of respiratory system
Chromium	Inhalation, ingestion, and absorption through skin	Lung damage and Irritation or respiratory system

Biological mechanism of heavy metal uptake

The major processes involved in hyper accumulation of trace metals from the soil to the shoots by hyper accumulators include:

1. Bioactivation of metals in the rhizosphere through root microbe interaction
2. Enhanced uptake by metal transporters in the plasma membranes
3. Detoxification of metals by distributing to the apo plasts like binding to cell walls and chelation of metals in the cytoplasm with various ligands, such as phytochelatins, metallo thioneins, metal binding proteins
4. Sequestration of metals into the vacuole by tono-plast located transporters

Hyperaccumulators are conventionally defined as species capable of accumulating metals at levels 100 fold greater than those typically measured in common non accumulator plants.

Types of plants used

1. **Indian mustard** (Brassica juncea L.) Info: Brassica juncea (L.) Czern. Indian Mustard
   It can remove three times more Cd than others, reduce 28% of Pb, up to 48% of Se, and it is effective against Zn, Hg and Cu as well.
2. **Willow** (Salix species). (White Willow)
   They deal with Cd, Ni and Pb, and work even in mixed heavy metals like diesel fuel polluted sites.
3. **Poplar tree** (Populus deltoides). (Populus deltoides W. Bartram ex Marshall eastern cottonwood)

Chlorinated solvents such as trichloroethylene, or the well-known carcinogenic carbon tetrachloride (95% of substance removed) are the organic pollutants that hybrid poplars face better, according to research from National Institute of Environmental Health Sciences.

4. **Indian grass** (Sorghastrum nutans) (Sorghastrum nutans (L.) Nash)
   Detoxify common agro-chemical residues such as well-known pesticides and herbicides related to atrazine and metalochlor.
5. **Sunfower** (Helianthus Annuus L.) (Helianthus annuus L.common sunflower)
   Heavy metals such as Pb, Zn, N, P, K, Cd, Cu or Mn (Capability of Heavy Metals Absorption By Corn, Alfalfa And Sunflower Intercropping Date Palm), seem to be its food.
6. **Water Hyssop** (Bacopa monnieri)
   Removes lead, mercury, cadmium and chromium from bogs and wetland.

Revathy T.
M.Phil. Chemistry

LIQUIGLIDE

We all have our own techniques for extracting that last drop of tomato ketchup or mayonnaise from the bottle. Some prefer the knife in the jar trick; others simply bang and squeeze. Some inventive souls have even been known to use a dash of vinegar to swirl out the very last drop. It's not just sauces - extracting toothpaste and beauty products from plastic containers can be a tricky process too as the contents stick stubbornly to the sides of the tube.

A Norwegian company is launching a product that won't stick to the sides of the bottle but instead slips easily onto the plate. Mayonnaise from the Norwegian foods company Orkla will be the first consumer product to employ technology from LiquiGlide, the Massachusetts-based firm established to develop the coating technology. They were working on the prevention of clogging in oil and gas pipelines and how to stop ice forming on airplane wings. They came up with a system of "liquid-impregnated surfaces" where coatings cling to surfaces - such as glass or plastic - and allow the liquid to slide out seamlessly. The coatings are each made up of different materials which work with the liquid in the container - such as a mayonnaise - to allow it to slide out. In the case of some foods, a substance similar to a vegetable oil is used.

A database of hundreds of combinations of materials has been devised by the company so that the make-up of the coatings work with the corresponding liquids. When used in food packaging, the coatings are made up of foods while for shampoos and lotions, they are made up of health and beauty product ingredients, The coatings are not toxic, and could be scraped off and eaten in the case of those on the side of ketchup bottles. LiquiGlide does not manufacture the coatings but develops the formulations for companies to spray them on the inside of packaging.

How does it work? Each of the coatings is developed to correspond to the product in the container. The coating is a "liquid impregnated surface" which results in a permanently wet feel that allows liquids such as ketchup to slip out. This is achieved by layers on top of the container. First is a solid which clings to the structure of the container, such as glass. That solid traps a liquid lubricant - the next layer - and creates a permanently slippery, liquid surface. As a result, the liquid in the bottle or container is sliding on another liquid. In the case of mayonnaise, the corresponding liquid is similar to a vegetable oil.

Vijaya Lakshmi V.
I M.Sc. Chemistry

MAGICAL MAGNIFYING EFFECT OF WATER DROP

Have you ever studied an everyday object through a magnifying glass and been amazed at what you could see? Or have you ever noticed, for example in a swimming pool, that an object that is sticking out of the water looks different just above and just below the surface? In this activity you will learn a little bit more about both of these observations. Get ready to bend light, magnify letters and have fun with water drops all while getting a glimpse into how lenses work!

A light ray bouncing off an object usually travels in a straight line to your eye. Things change when a transparent material, such as glass or water, gets in the way. When a light ray traveling through air enters such a material, it changes direction, creating a sort of kink. Another kink is introduced when the ray leaves the material. Therefore, the final image of the object in your eye might be different due to the changes in direction of the light on its way to your eye. Your brain is unaware of these kinks and expects an image created by rays that travelled in a straight line. As a result, it might reconstruct a picture that is different from the initial object. Your eyes and brain might have been fooled!

Lenses use these kinks to make objects look bigger or smaller, closer or farther away. A convex lens bends light rays inward, which results in the object being perceived as larger or closer. A concave lens bends rays outward; you get the perception that objects are smaller or farther away. There is no overall bending of light for a flat lens. You perceive the object as it is.

Experiment and materials required

- A newspaper page

- Two rulers with metric measurements on them, preferably with dark markings
- One transparency film or clear sheet protector
- Drinking glass with water
- Medicine dropper (optional)
- Mobile device with a camera (optional)
- Small transparent plastic cup or tiny tasting cup with a flat bottom (optional)

Preparation

- Find a waterproof work area.
- Select an article in the newspaper with a small font. You can use your ruler to measure the height of the letters; they should be a few millimeters high.

Procedure

- Place the transparency film on top of a newspaper page.
- Create a drop of water near the middle of the transparency film. Use a water dropper or your finger to let two or three drops fall on the film and merge into one bigger drop. Examine your water drop. Is the top of the drop surface flat, curved inward or curved outward?
- Shift your transparency film so the water drop lays on top of the small print letters.
- Close or cover one eye and look from above with the other eye at the letters under the drop. Compare them with the letters next to but not covered by the drop. Do they look the same? Does one appear bigger or smaller than the other?
- Using two hands carefully lift and hold the transparency film about half an inch above the newspaper, leaving the newspaper on your work surface. You might need help lifting the transparency film if you like to cover one eye with a hand.
- Close or cover one eye and look carefully from above through the water drop at the letters on the newspaper. Do the letters appear different than when the transparency film rested on the newspaper? What happens when you move the transparency film farther up?
- Move the transparency film up and down a couple of times looking from above through the water drop with one eye. How does your perception of the letters change as you move the transparency film farther up or back down? Why do you think this happens?
- To measure the magnification factor of your water drop, put a ruler under your transparency film on your work surface and another ruler next to the drop on top of the transparency film, but be sure to prevent the ruler from touching the drop.
- Lift the transparency film with the top ruler and water drop about 1.3 centimeters up and do your best to measure the length of a millimeter indication of the bottom ruler, as seen through the water drop. (You might need help lifting the transparency film together with the ruler and

the water drop.) How many millimeters does one millimeter indication measure? This number tells you by what factor objects appear bigger when seen through your water drop. Are you surprised about the magnification factor you obtained?

- Measure the magnification factor of your water drop when you lift the transparency film higher up. Does the magnification factor change when you lift the transparency higher? Could you find ways to make the magnification factor very big?
- Repeat the activity, this time using a larger water drop. What happens to the curvature of the top surface of the water drop when you increase the size of the drop? Is it more, less or similarly curved? Do bigger water drops yield a different magnification factor?

Observations and results

Did you see how objects appear larger when looked at through a water drop? The surface of a water drop curves outward to make a dome. This outward, or convex, curvature bends light rays inward. The result is an enlarged image on the retina of your eye. The object appears bigger than it is.

- The surface of a smaller drop is even more curved, creating a bigger change in direction of the light ray. The result is a larger magnification. Changing the position of the water drop with respect to the letters and your eye will also affect the magnification factor. Due to something called the capillary effect, however, a layer of water in a cup shows a surface that is slightly bent inward. It will act as a concave lens that bends the light rays outward. As a result, letters seen through the layer of water in a cup appear smaller than they are. When you combine several lenses, the magnification factor of the set of lenses is the product of the magnification factors of the individual lenses.

- Any clear liquid will work as a lens. As long as the bottom and top surfaces of the layer or drop are not parallel, the lens will change the appearance of the object. Depending on the liquid, the magnification factor of similar drops made up of different liquids will vary.

Thara Prasannan
I M.Sc. Chemistry

UNITED NATION ORGANISATIONS THEME OF THE YEAR 2017
INTERNATIONAL YEAR OF SUSTAINABLE TOURISM FOR DEVELOPMENT

The United Nation Organizations' general assembly adopted a resolution on 4th December 2016, recognizing the importance of International Tourism and announced the theme of the year 2017 as International Year of Sustainable Tourism for Development, in fostering better understanding among people and harmony in the world.

This declaration by the UNO is a very worldwide, the rich heritage of various civilizations and bringing about recognition and better appreciation of the inherent values of different cultures, thereby contributing to the strengthening of peace, unique and excellent opportunity to enhance the contribution of tourism sector to the backbones of sustainability that is the economical, social and environmental growth of a nation.

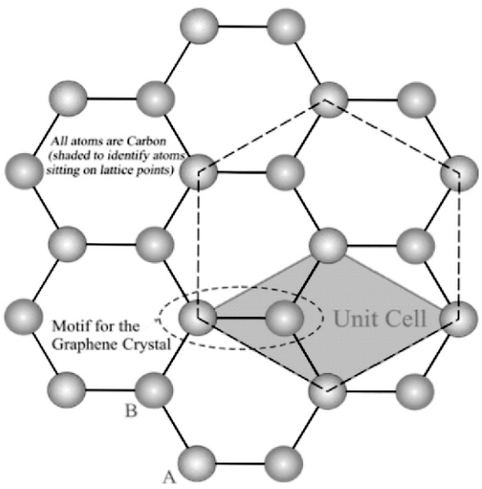
The decision to adopt 2017 as the International Year of Sustainability for Development comes at an important and crucial juncture as the international community concentrates to promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all, sustainable consumption and production and conserve and sustainably use the oceans, seas and marine resources for sustainable development.

We as citizens of a subcontinent with rich biodiversity must become more aware of the richness in our flora and fauna, cultural heritage and inherent values. India is one of the tourist destination that is much sort after by people all over the world for her above said unique and salient features of attraction. We must strive to uphold our values and culture, protect and preserve our biodiversity as our brothers and sisters thereby achieving our responsibility of taking our motherland to greater development in all arenas of potential growth.

Dr. B. Scholastica Mary Vithiya,
Assistant Professor, Dept of Chemistry

GRAPHENE AND ITS UNIQUE APPLICATIONS

Today about 118 elements are known in the periodic table. In 2016, four new elements with atomic numbers 113, 115, 117 and 118 named as Nihonium, Moscovium, Tennessine and Oganesson were reported. Of all the elements known, Carbon is perhaps the most fascinating element in nature. It forms the basis of DNA and hence, all life on earth. The principal forms of carbon are Graphite, Diamond, Fullerene (discovered in 1985) and nanotubes (discovered in 1991). Graphene and Diamond are three dimensional, Fullerene is zero dimensional and nano tubes are one dimensional. Could a two dimensional array of carbon atoms exist? It only remained as an unanswered question for many years though lot of research was going on towards this perspective. In 2004, a single atom thick crystallites of graphene was extracted from bulk graphite. A single sheet of graphite is called graphene. It is sp^2 hybridized, covalently bonded and the bonding between the graphene sheets in graphite is of van der walls type. Andre Geim and Kontantin Novoselov ,two Physicists discovered graphene in 2004 and they were awarded the Nobel Prize for Physics in 2010 for this wonderful discovery. The two dimensional crystalline allotrope of carbon consists of a single layer-honey comb lattice and the structure is shown in the figure.



The successful synthesis of this material was a dream that came true for researchers. It could be prepared by mechanical exfoliation, reduction of graphite oxide, supported growth and organic synthesis. The unique properties are that it is a strongest material, has high stiffness, thinnest material, bendable and stretchable, excellent conductor of heat and electricity, zero overlap semi-metal, high transparency and versatile. In the electronic structure it has two Brillouin Zones. The six corners of first Brillouin zone are called Dirac points (also called K points). The electrons and holes

are called Dirac fermions. The Dirac Points are the transition between the valence band and the conduction band. The six Dirac points can be divided into two equivalent sets of three points (K and K'). The points within each set are all equivalent because they can reach each other by reciprocal lattice vectors. The dispersion relation close to the K points looks like the energy spectrum of massless Dirac particles. The bond length is 0.142 nm long and hence it is very strong. It is the strongest material ever discovered and the ultimate tensile strength is 130 gigapascals compared to 400 megapascals for structural steel. It is very light and at 0.77 milligrams per square metre, it is 1000 times lighter than paper. A single sheet of graphene can cover a whole football field while weighing 1 gram and it is also very flexible.

Applications

Graphene tubes can be added into all three battery parts; anode, cathode and electrolyte. It improves the speed of charging and discharging as well as length of lifecycle. Graphene tubes in batteries increase energy density which facilitates faster charging. Due to the low internal resistance of the electrode, batteries containing graphene tubes are safer as there are less thermal issues. With the increased life cycle and power, with greater energy density and improved safety, we may be able to travel in electric cars for long distances in the near future. Is it not exciting?

Batteries would charge in seconds and last longer. Their lightness and flexibility could bring batteries stitched into clothing that measure heart rate. The flexibility of graphene could bring phones you could wrap round your wrist and TV screens which you could roll up like a newspaper. Is it not very interesting?

Graphene transistors could replace Silicon to produce lightning speed computers. All mobile companies are investing crores of money to use this amazing material in display technology so that the topmost layer of touch screens can sense our finger tips more efficiently. Is it not thrilling?

Graphene has been widely researched as an ideal material for sensors applications due to its unique characteristics including large surface-to-volume ratio, unique optical properties, excellent electrical and thermal conductivity. For example, it has been used in diagnostics for detection of glucose, cholesterol, haemoglobin and cancer cells.

It can be also used as a pH sensor for detection of contaminants, detection of pharmaceutical compounds or as a gas sensor - it seems the number of uses is unlimited.

In the industrial world, a graphene-based pressure sensor would be particularly attractive for the aircraft industry, given its small footprint and weight.

The coating of a mechanical cardiovascular valve in graphene allows for uniformity of size and provides more longevity to the implanted valve. This will significantly reduce sanitary expenses (for the public as well as the private sector) and significantly reduce waiting lists for implants. Other

applications in the medical sector include using graphene as a drug delivery platform and for cancer treatment. Graphene oxide may act as an anti cancer agent that selectively target cancer stem cells, shrinking tumours.

Graphene oxide can be used as an additive to paints and has anticorrosive effects. It can be used on various surfaces ranging from glass to metals to conventional bricks. With a simple chemical modification, the resulting coatings behave like graphite in terms of chemical and thermal stability but in mechanical terms they become very strong and almost as tough as graphene .Coating of graphene in paint could end deterioration of ships and cars. It seems the applications of this material is endless. Its enormous strength, thinness and conductivity means that as research continues we could soon be using technologies that we would have never imagined.

Dr. S. Jhancy Mary,
Asso.Prof. of Chemistry

DON BOSCO'S PREVENTIVE SYSTEM OF EDUCATION

The Preventive System consisting of Reason, Religion and Loving kindness proposed by Don Bosco, one of the best and influential educators of nineteenth century. Don Bosco followed persuasion and love and committed his life for the upliftment of the poor and abandoned young people of his time to make them good and honest citizens through his preventive method of education. This noble idea of Don Bosco's system of education is followed in our salesian system of education where everyone feels that they are loved and live in family atmosphere.

In the preventive system, self control must rule the whole being of the educators, our mind, our hearts and our lips. In dealing with the young people, the staff must not allow the shadow of anger to darken her/his countenance. St. Francis de Sales says, “Master your own character, and then you will succeed in mastering those of your pupils”. There are different ways to make the young to love their educators. Some of them are:

- Act like a caring Mother/Father
- Always be gentle and prudent towards the young
- Allow for the thoughtlessness of youth
- Be alert for hidden motives
- Speak kindly
- Give timely advice
- Most important element in the preventive system is correct the young people often with genuine interest and love.

  The educator must be very understanding towards her/his pupil and when the educators correct the pupils they must remember the following tips:

- Never correct in public
- Be indirect
- Withdraw some mark of affection
- Wait until the child is calm
- Pick the best moment
- Be optimistic
- Sweeten correction with comfort

A word on punishments: At times, our young people seems to reap no fruit from our corrections, yet deep down in his/her heart a wonderful change is taking place and this good effort would be entirely destroyed if we were to inflict some severe punishment on her/him. When we are kind and use our good judgment in employing punishments, we will obtain the desired effect and changes in our young people. A reproachful or severe look may serve as an excellent means of moral restraint over the young and by it the guilty person is moved to consider his own fault, to feel ashamed, and finally to repent and turn over his/her life. The educator must never stoops to humiliating expressions on the educant, on the contrary, make it clear that you entertain high hopes for him/her and assure him/her that you will be with them in times of joys and sorrows. The pupils should know the disciplinary measures, including rules and punishments, so that no one can make the excuse that he or she did not know what was commanded or forbidden.

All the educators must remember that education is a difficult art and God alone is its true master. We will never succeed in it unless He teaches us the way. While depending humbly and entirely on Him, we should try with might to acquire the moral strength from Him. Let us strive to make ourselves loved by our young people, to instill into our children the high ideal of duty and holy fear of God, and we will soon possess their hearts. Then, with natural ease, they will join us in praising God, who is our model, our patron, our exemplar in all things, especially in the education of the young people.

Dr. (Sr.) Jaya Shanthi R.
Asst. Prof. of Chemistry

Inauguration of the Chemistry Association - Lecture by Dr.A. Nirmala Grace, Director i/c, Centre for Nanotechnology Research, VIT University

PG Quiz Competition

Animation of the value of the month - Courage

Invited Lecture by
Mr. V. Nirmal Gandhi, Deputy General Manager EHS, Thirumalai Chemicals Ltd., Ranipet

I PG Paper Presentation

The Quiz team which bagged a cash prize of Rs.5000/- at VIT on National Science Day.

Thara Prasannan I M.Sc. Chemistry presenting her paper in the RUSAC Programme