Cover Story 2

Chemistry at Home

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As we are aware, chemistry is all around us and every fabric of our life and society is touched with chemistry. Chemistry of food that we consume, household objects such as clothes, plastics, rubber, metals etc. electronics, semi conductors, stationery, transportation and communication, cosmetics, drugs are all closely related to our day to day life. Chemistry is a creative science essential for sustainability and improvement of our way of life. New materials and new processes are developed to make our lives healthier and make our environment safer place for all living organisms. Chemistry is central in understanding of biological, physical, material, and medical phenomena. It provides a proper basis for understanding how nature works. Chemistry also plays a central role in business, commerce and manufacturing sectors. Industries benefit from understanding and by applying chemistry, which provides new products and manufacturing processes, which in turn generates monitory and commercial values leading to new business and employment. Drugs, material and machinery developments and improvements benefit us and simplify our daily lives today. Further, extraction and purification in oil industry, chemical and material storage as well as logistics and transportation industry which involves chemistry of fuel used to power vehicles are important aspects of chemistry. There is chemistry in arson and disaster insurance industry. Also chemistry is involved in new business development and management. It has applications in films, photography, sound records, painting, scalping etc. There are chemical reactions in daily life, like in the way you breathe, the food you eat, the water you drink and in every motion which is taking place around you at every second of the day. Thus chemistry is in our everyday life: in our body, at home, in nature, and in every second of our lives!

Almost anything you do during the course of a normal day involves chemistry in some way. The involvement usually begins first thing each morning; most people wake up to an alarm or radio. These common household items contain batteries, which make them very chemically dependent. These batteries contain positive and negative electrodes. The positive electrode consists of a carbon rod surrounded by a mixture of carbon and manganese dioxide. The negative electrode is made of zinc. Chemistry plays an important role in the discovery and understanding of materials contained in these and many other common household items. Things like household cleaners and water purification systems are vitally dependent on chemistry. Next, though it is not widely known, chemistry is also heavily involved with the manufacturing of things such as makeup and soap. Each time you bathe you are experiencing chemicals such as Acetyl alcohol and PropyleneGlycol, which are typical ingredients in the soap used to wash your hair and skin. Without chemistry, these materials (or combinations of these materials) might be hazardous or might not exist. The chemical coloring agents used in makeup and nail polish would not be possible without an understanding of the chemicals involved.

The gas and tires in cars we drive, the makeup we put on our faces, the soaps and cleaners used everyday, burning wood or other fossil fuels, chemistry is all around you each and every day. The associations are practically limitless.

Chemistry around the house

We are surrounded by chemistry in everyday life. Sometimes it is easy to spot, like when your science teacher does a big experiment in class. Other times, it can be pretty hard to see the everyday chemistry at work, but nearly everything you touch or use has some element of chemistry in it. Something as simple as toothpaste involves at least three chemicals, if not more. It is the mixture of fluoride, peroxide and baking soda and its chemical reaction that keeps your teeth clean.

- Water, which occupies 70% of the earth's surface is made by two chemical elements, hydrogen and oxygen.
- Soap is an emulsifier which allows oil and water to mix and so the oily mixtures on body and clothes can be removed after application of soap and water.
- Chemistry in everyday life for kids can also include why vegetables are colored. Colored vegetables consist of chemical compounds called carotenoids which have an area known as the chromophores. It absorbs certain wavelengths of light and thus there are colored vegetables.
- Food is cooked because of the steam that's present either in the water added or that which is present inside the food items.
- Onions make you cry due to the presence of sulfur in the cells which break after the onions are cut. This sulfur gets mixed with moisture and thus irritates your eyes.
- You feel hungry because of the satiety center in your brain falls short of particular hormones to function and then sends the signal of hunger.
- You fall in love, get attracted and have a feeling of belonging because of certain monoamines present in your brain which get stimulated through nerve sensors.
- If you have wondered, why the sky is blue, it is due to a phenomenon called the "Rayleigh scattering", which depends on scattering of light through particles which are much smaller than the wavelength. Hence when light passes through gases, there is scattering and the sky appears blue.
- Coffee keeps you awake because of the presence of a chemical called adenosine, in your brain. It binds to certain receptors and slows the nerve cell activity when sleep is signaled.
- Anaerobic fermentation is also a great concept which is present in the chemistry of everyday life. It is present in yogurt, breads, cakes and many other baking products. It is the multiplication of certain useful bacteria which increase the size of the food and make it more filling and soft.
- The food chain present in every ecosystem is also a major part of chemistry in everyday life. Even though it has more biological background, it eventually works because of its chemistry.

Compounds used in day to day life

Soda water, sugar, and salt in solution are some compounds used in our day to day life. Table salt, baking soda, washing soda, bleaching powder, vinegar, marble or limestone ,zinc oxide used in paints are useful chemical compounds in day to day life.

A large number of substances used in our daily life such as sugar, milk, fats, oils, silk, woods and starch etc are obtained from living organisms plants or animals. These are all organic substances Organic compounds can be prepared in the laboratory.

Carbohydrates are essential to grow and maintain our life and keep healthy. We take it in the form of various food items. It is the chief energy food.

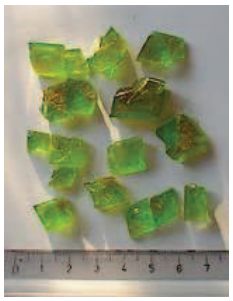
Fats are energy producing carbohydrates. Butter is an example. Our body converts the food we eat into energy and stores part of this energy as fats.

Proteins are made of amino acids. Muscles are mainly made of protein. Skin, hair and nails are also made of protein. Enzymes which help in digestion of food are made of protein. Silk from silk worm, wool of sheep, lamb, bear and other animals is a protein. Hemoglobin containing in the blood carries oxygen to our body cells. It also carries waste carbon dioxide to lungs from where it is breathed out. Meat, eggs, pulses , milk are rich in protein.

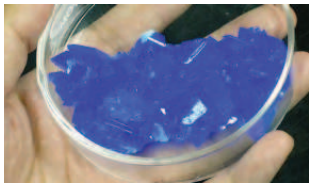
Uses of Common metals and non metals

Metals are used for a variety of purposes. They are strong, hard and rigid. So they are used in making automobiles, aero planes, trains ,satellites and industrial gadgets. Iron, which is the most commonly used metal is used for making small size pins to big gadgets and in reinforced concrete in conjunction with cement to construct big buildings. Aluminium is another metal that is widely used, from the household items up to large planes as its density is low. Metals are used for making utensils and water boilers. Metals like iron,

Common name	Chemical formula	Use
Table salt	NaCL	Added to food for taste
Baking soda	NaHCO3	In baking It liberates CO2 and lightens the dough.
Washing soda	Na CO3.10H2O	Used in laundry cleaning
Glucose	C6H12O6	Energy supplement
Vinegar	CH3COOH	Food preservative
Bleaching Powder	Ca(OCL)2	As a decolorizing agent
Acid	HCL	Bath room tiles and commode cleaning agent, essential for the gastric enzyme activity
Marble	CaCO3	Used for building and flooring houses
Blue Vitreol	CuSO4.5 H2)	Added in white wash for blue tinges
Green Vitreol	FeSO4.H2O	Manufacture of ink
Zinc Oxide	ZnO	White pigment in paint
Urea	NH2CONH2	Fertilizer



Green vitreol



Blue vitreol

aluminum and copper are used for this purpose. Copper is widely used in electrical equipments and in household wiring. However now aluminum is widely used for making electrical cables as it is cheaper than copper.

Gold and silver are used to provide fine electrical contacts in computers and solar cells, and also in making jewellery. Highly reflecting mirrors are made of silver as it reflects 90% of the light falling on it. Gold and silver are most malleable and can be made into thin foils. Silver foils are used in decorating sweets. Aluminium too which can be converted into thin foils are widely used for wrapping of food items, medicines, chocolates and many other materials.

Certain metals in combined form are used by us in everyday life. Salt is one of the constituents of common salt. Sodium chloride is widely used as a major raw material for many useful chemicals for the industry. Calcium oxide, silicon oxide and Aluminium oxide are the main constituents of cements. When mixed with water, these react slowly to form the mixture of calcium and Aluminium silicates called concrete.

Common non metals are oxygen, nitrogen, chlorine, and iodine. Oxygen is used by plants and animals for living. Oxygen is also used in combustion reactions in factories, homes, aeroplanes and missiles. Nitrogen in its compound form provides nutrients to plants. Fertilizer which is added to enhance the growth of plants contain nitrogen compounds. Chlorine is used for water purification in view of its ability to kill germs. Iodine is used to make Iodoform that is used as an antiseptic and in photographic films. Iodine is used to cure wounds. Tincture iodine is a solution of iodine in alcohol that has antiseptic properties. Also small amount of iodine is required in human diet.

Helium being a light gas is used to fill balloons. Argon is used to fill ordinary light bulbs and in welding metals.

Various items made of alloys , a homogenous mixture of two or more metals or a metal and a non metal, are widely used in day to day life. Steel is manufactured by adding a little amount of carbon to iron. It is used in making railway tracts and bridges. Stainless steel is used in our homes in the form of kitchen utensils. Good quality magnets are made from an alloy that contains Aluminium, nickel and cobalt in steel.

Bronze is an alloy of copper and tin. It is much harder than copper and can be cast easily. Aluminum alloys are light strong and corrosion resistant. The Duralium consists of aluminum, copper, manganese, and magnesium. It is used in making parts of aircrafts, pressure cookers etc. The Aluminum alloys are used for making kitchen utensils and aircrafts. As they are resistant to sea water they are used in ship building.

Plastics

Plastics are synthetic high polymers which have larger molecules and hence high molecular weight. Larger molecules of plastics are obtained by polymerization reactions.

Synthetic fibers

As plastics, synthetic fibers are also greatly used in day to day life. Synthetic fibres used are Nylon, Terylene, Dacron, Orlon etc. They are synthesized from various chemical substances.

Sources of Drugs

A large number of chemical compounds are used for the cure of various diseases.

Minerals: liquid paraffin, Ferrous Sulphate (for anemia) Manganese Sulphate (for stomach ache), Bismuth Carbonate for diabetes) Aluminum Hydroxide (to reduce acidity in stomach)

Animals: Insulin(for diabetes) Gonadotrophines, Thyroid extract (for goiter), Antitetanus serum (A.T.S.) etc

Plants: Morphine (for pain), Quinine (for malaria) Digitoxine (for heart Troubles), Atropine (for eye disease) etc.

Micro-organisms: Penicillin(for Syphilis and gonorrhea etc), Streptomycin (for tuberculosis), Chloromycetin (For typhoid),Tetracycline (for pneumonia), Erythromycin (for throat disease) etc.

Synthesis: Aspirin, sulfa drugs, tranquilizers, Hypnotics etc

Soaps and detergents

Soaps are the chief cleansing agents and are mainly used for cleaning the body and clothes. Chemically soaps are mixtures of metallic salts of higher fatty acids such as Stearic, Palmitic and oleic acids. Soaps are usually obtained by the saponification of natural oils and fats with alkali such as caustic soda (NaOH) or caustic potash (KOH) or washing soda (Na_2CO_2). Soap is formed by molecules with a "head" which likes water (*hydrophilic*) and a long chain that hates it (*hydrophobic*).Then when soap is added to the water, the long hydrophobic chains of its molecules join the oil particles, while the hydrophilic heads go into the water. An emulsion of oil in water is then formed, this means that the oil particles become suspended in the water and are liberated from the cloth. With the rinsing, the emulsion is taken away. In summary, soap cleans by acting as an emulsifier. It allows oil and water to mix so that oily grime can be removed during rinsing. Soaps form lather with water and clear oily dirt and dust. They also contain , colors and scents.

Detergents are synthetic organic substances and are chemically quite different from soaps although they are widely used in place of soaps. They produce more lather with water than soap and also clean more. They do not form insoluble compound with calcium and magnesium ions.

Glass

Glass is used in different forms. Plate glass is much thicker than ordinary glass which is used in shop windows and doors. Plate glass is made by floating a layer of molten glass over a layer of molten tin. Safety glass is produced from plate glass by heating it first and then cooling both its outer surfaces by jets of flowing cool air. Such a glass is stronger.

Laminated or bullet proof glass: It is a stronger than even safety glass. It is produced by binding several layers of safety glass with a transparent adhesive. Laminated glass is used in air planes, windshields of cars and bullet proof screens. Optical glass is specially made so as to be free of strains and defects. It is used for making lenses for spectacles, microscopes, cameras, and telescopes and prisms and other optical instruments. Heat resistant glass is known as Borosilicate glass it has a high melting point. It does not crack with boiling water or cooking. It is used in laboratories, factories, kitchen and ovens. Photo chromic glass: It is a special variety of glass that temporarily darkens when exposed in bright light.

When the intensity of light decreases its original lighter shade is restored. This automatic darkening property of photo chromic glass is because of the presence of silver iodide. Another special type of glass is Crystal glass which is made by using lead oxide. It has a high refractive index. It therefore sparkles and is used for high quality art objects and for expensive glass ware.

Cement

Cement is a finely ground powder which when mixed with water sets and hardens into a mass. The invention of cement and concrete has changed our lives dramatically. Limestone and clay provide the four basic ingredients required for making cement: Calcium Carbonate (from limestone) , silica, alumina, and iron oxide, (from clay). Portland cement is made by crushing clay and limestone to a fine powder, blending them in the desired proportions and then heating them in the kiln at high temperature. The resulting lumps called clinkers are then mixed with gypsum and grounded to a fine powder.

However cement is seldom used by itself. It is generally mixed with sand to form Mortar, which is used for binding bricks and stones and for plastering. When mixed with gravel or broken stone and allowed to set, it forms concrete which is a sturdy material. Concrete can be molded into desired shapes to make prefabricated buildings, electrical posts and railway sleepers.

Steel rods, bars or mesh etc can be embedded in wet concrete and when it sets it sticks to these materials to form Reinforced Concrete which is much stronger. Invention of cement has made it possible for the construction of smooth, all weather roads and bridges, which have in turn revolutionized our life styles as they provide high strength materials to construct high rise buildings for offices and homes.

Paints

Paints have two basic components: the binder (or vehicle) and the pigment. The binder is dissolved in an extender to form the liquid part of the paint which provides the protective film. Oil based paints are natural oils such as fish oil and linseed oil as a binder. They also contain a solvent to dissolve oil.

Water based paints, contain highly polymerized resins such as polyvinyl acetate formulated as an emulsion on water. Paints are generally used to prevent corrosion of metals. These are also used to give an attractive shine. The steel furniture, iron bridges, railway coaches, and bodies of buses and trucks are coated with paint. The commonly used paints are made from lead or zinc.

Life limitlessly associated with chemistry

It is evident that Chemistry and chemical compounds in various forms are involved in our daily life. It may be biological, physical, chemical or environmental. Understanding of the involvement of chemistry helps the individuals, industries and business sector to a great extent. Discovery and the use of new materials continuously change the course of human civilization. Each new discovery made so far heralded a new age. Ever since man developed agriculture some 10,000 years ago, and settled into communities, his need for various kinds of materials have multiplied. Special support facilities needed various types of material for the daily life, which are produced through the knowledge of chemistry. Chemistry has contributed to the well being of human kind in all spheres of life. The declaration of the year 2011 by the International Union of Pure and Applied Chemistry (IUPAC) and the UNESCO under the unifying theme 'Chemistry - *our life, our future*' amply emphasizes the importance of chemistry in our life. This is emphasized by the goals set out by the IYC 2011 which included, increase of public appreciation of chemistry in meeting world needs, encourage interest in chemistry among young people, and generate enthusiasm for the creative future of chemistry and the chemistry related sciences. So, as you go about your daily activities, remember to thank chemistry!. "Chemistry is life!" and every day life at home is limitlessly associated with Chemistry.

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