

#“:MATERIALS USED IN OUR DAILY LIFE:”#

The branch of chemistry which deals with the production of **raw** materials and preparation and process for the materials used in daily life is known as industrial chemistry. The major products of industrial chemistry are **cement, glass, fibers, ceramic, soap, detergents, plastics etc**

***Cement:** → Cement is grey powder composed of the mixture of calcium aluminate and calcium silicate used in construction works.

It is prepared by heating a mixture of **limestone** [CaCO_3] and **special type of clay** [$\text{Al}_2\text{O}_3 \cdot \text{SiO}_2$] at the temperature of 1600 degree Celsius.

Limestone and clay are powdered and made **slurry** in water. It is then heated in rotatory kiln at 1600 degree Celsius.

Limestone decomposes into calcium oxide which combines with alumina and silica present in clay to form **calcium aluminate and calcium silicate**. The lumps of **calcium aluminate and silicate** are called **cement clinkers**. 2% - 3% of **gypsum** [$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$] is added to the clinkers, powdered and is packed in air tight bags.

****Gypsum is added to the cement in order to regulate and increase the setting period of cement.**

Uses of cements: →

- A thick paste of cement, sand and water is called **mortar**. It is used in plastering and joining bricks.
- A mixture of cement, coarse sand, gravel and water is called **concrete**. It is used in roofing and flooring.
- The concrete having framework of iron rods is called **reinforced cement concrete (RCC)**. It is used in making pillars, dams and bridges.

***Glass:** → Homogenous mixture of silicates of **alkali** and **alkaline** earth metals is called glass.

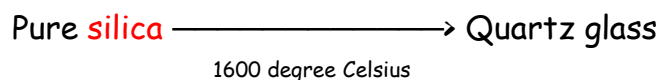
Glass contains number of silicates. It does not have fixed composition and **definite** formula. In addition to this it does not have definite melting point. Hence, glass is not a compound but it is a mixture.

The molecules of glass resemble as that of liquid and show random motion like liquid molecule. Due to this flowing property glass is called **super cooled liquid**.

Glass is a super cooled liquid. Its molecules show random motion from higher level to lower level as that of liquid. Hence, a glass window pane kept vertically for long time is found to be thicker at the bottom than at the top.

Types of Glass: - [Q W O H B L C]

a) Quartz glass: - It is obtained by heating pure silica at 1600 degree Celsius.

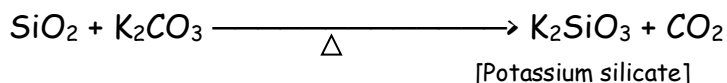
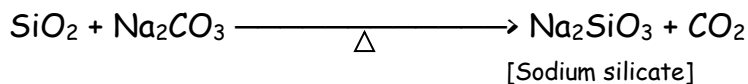


--→ A quartz glass has **very low coefficient of thermal expansion**. Hence a red hot quartz glass doesn't crack even when it is placed in cold water.

--→ It is very expensive and is least affected by chemicals.

--→ It is used in making crucibles, gems, antenna shield for space vehicles.

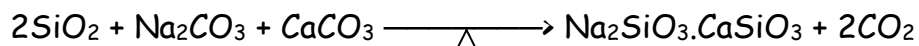
b) Water glass: - It is prepared by heating a mixture of **silica** and **sodium carbonate or potassium carbonate**.



--→ It is water soluble, hence it is called water glass.

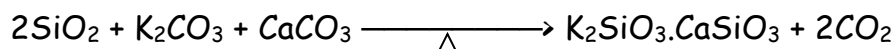
--→ It is used in making fire proof materials and silica garden. {HW}

- c) Ordinary glass: - It is prepared by heating a mixture of silica, **sodium carbonate** and **calcium carbonate**.



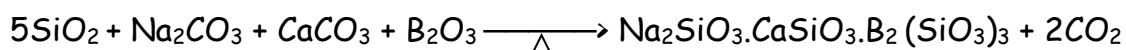
- =-> It is also called **soda lime glass**.
- =-> It is also called soft glass because it easily softens on heating.
- =-> Little amount of **lead monoxide** can be added to the mixture of ordinary glass preparation in order to increase the refractive index of glass.
- =-> It is used in making window panes, glass sheets and lab apparatus.

- d) Hard glass: - It is prepared by heating the mixture of silica, potassium carbonate and calcium carbonate.



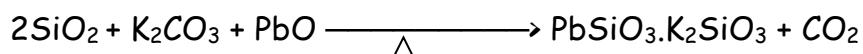
- =-> It is also called **potash lime glass**.
- =-> It is used in making hard glass lab apparatus like **hard glass test tubes**, beakers etc

- e) Borosilicate glass: - It is prepared by heating the mixture of silica, sodium carbonate, boron oxide and calcium carbonate.



- =-> It is resistant to chemical reaction and heat and also known as **Pyrex glass**.
- =-> It is used in making superior quality lab apparatus like test tubes, beakers, condensers and kitchen wares.

- f) Lead crystal glass: - It is prepared by heating a mixture of silica, potassium carbonate and lead monoxide.



- =-> It is also called **optical or flint glass**.
- =-> It is used in making lenses, prisms, electric bulbs, and television and radar tubes.

g) Colored glass: - Colorful glass is made by adding small amount of metallic oxide to the molten raw material of glass preparation is called colored glass. Different colors are given by different metal oxides and they are:

Cobalt oxide → Blue

Nickel oxide → Black

Chromium oxide → Green

Manganese oxide → Purple

Cuprous oxide → Red

Ferric oxide → Yellow / Brown

Tin oxide → white

=> Colorful glasses are used in making sunglasses, window panes, and traffic signals, disco lights etc.

***Ceramics**: → Ceramics are the objects made from special type of clay, hydrated aluminium silicate $[Al_2O_3.SiO_2.2H_2O]$. The pure white clay used in making ceramics is called Kaolin or China clay.

The mixture of clay and other materials are crushed, powdered, sieved and mixed with water to form slip. It is then moulded into different shapes by hand, potter's wheel or die pressing. The articles are then dried and baked.

The process of coating a layer of tin oxide or lead oxide over ceramics is called glazing. It makes the surface smooth, attractive and water proof.

Properties of Ceramics: →

- a) They can withstand high temperature.
- b) They are not affected by chemicals.
- c) They are bad conductor of heat and electricity.

Uses of Ceramics: -

- a) They are used in making household pottery, tiles, cups, flower vase, bathroom fittings etc
- b) They are used or making furnace, electrical fittings etc
- c) They are also used to make artificial teeth, bone joints etc

***Fibers:** → Hair like strands which are extremely long compared to their width are called fibers. They are of two types. They are artificial fibers and natural fibers.

a) Natural fibers: - Those fibers which are obtained from plants and animals are called natural fibers. E.g. wool, silk, cotton, jute etc

Merits of natural fibers: →

- They are comfortable to wear.
- They retain our body heat.
- They absorb a lot of sweat.

Demerits of natural fibers: →

- They are attacked by insects.
- They are expensive.

b) Artificial fibers: - Manmade fibers are called artificial fibers. They can be **regenerated / recycled fibers** or **synthetic fibers**.

****Regenerated fiber**: - The artificial fibers prepared by applying chemical processes on natural raw materials are called regenerated or recycled fibers.

E.g. Rayon is the first manmade fiber from plant cellulose. Rayon resembles silk in appearance. Hence, it is also called artificial silk.

****Synthetic fiber**: - Those fibers which are manufactured from chemicals are called synthetic fibers.

1. Nylon fibers: → They are first synthetic **polyamide** fibers. They are light and strong. They are used to make ropes, socks, carpets, tyres, fishing nets, parachute, dresses etc
2. Terylene fibers: → Polyester, fortel, kodel etc are the examples of Terylene fibers. When they are blended with cotton (terycot) or wool (terywool), they are used in making suits.

3. Acrylic fibers: → Creslan, Orlon etc are the examples of acrylic fibers. They resemble wool in appearance and are used in making sweaters and gloves.

Merits of synthetic fibers: →

- They are not attacked by insects.
- They are cheap.
- They absorb less amount of water and dry up quickly.

Demerits of synthetic fibers: →

- They catch fire quickly.
- They absorb less sweat.

*Monomer, Polymer and Polymerization: →

Small organic molecules that link together to form giant macromolecules (polymer) are called monomers. E.g. Ethene, Vinyl chloride, Styrene.

The large organic molecule formed by the linkage of monomers is known as polymers. E.g. Polyethene, polyvinyl chloride, Polystyrene

The process in which a number of monomers combine together to form a polymer is known as polymerization

Ethene $\xrightarrow{\text{polymerization}}$ Polyethene

$n(\text{CH}_2=\text{CH}_2) \xrightarrow{\text{polymerization}} [\text{CH}_2-\text{CH}_2-\text{-----}-\text{CH}_2-\text{CH}_2]$

Polymers are of two types: -

- Natural polymers e.g. : Protein, silk, wool, starch, natural rubber etc
- Synthetic polymers e.g. : Plastic, synthetic fibers etc

*Plastic: → Plastic are the synthetic polymers made from polymeric synthetic resins. Plastic are of two types. They are:

a) Thermosetting plastic: - Those plastic which when set up into hard mass do not melt on heating and cannot be remolded are called thermosetting plastics. E.g. Bakelite

They are hard, strong and heat resistant. On heating they do not melt but becomes harder. Hence they are used as heat bearing insulator in electric switch, handles of pressure cooker, TV cabinet etc

b) Thermoplastics: - Those plastics which soften on heating and can be remolded again and again are called thermoplastics. They are of different types:

i. Polyethene: → It is the polymer of Ethene. It is used for making household articles, buckets, pipes, wire insulation etc

ii. Polyvinyl chloride [PVC]: → It is a polymer of vinyl chloride. It is used in making raincoats, handbags furniture, bottles, motor cars seat etc

iii. Polystyrene: → It is a polymer of styrene. It is hard transparent and light. It is used in making toys, thermos flask, ceiling tiles etc

Properties of plastics: →

- a) They are light and portable.
- b) They do not react with air and water.
- c) They are not affected by acids and others chemicals.
- d) They are insulators of heat and electricity.

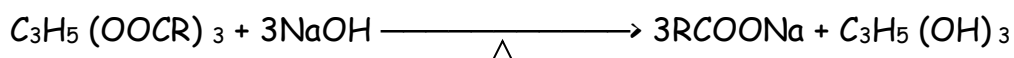
****Utility**: → Plastic can be prepared in varying shapes and size. They can be easily & quickly rejoined if there is breakage. It can be used as a good insulator. It is light and portable. Its lightness reduces weight and hence fuel consumption in vehicles. In building construction, pipeline fittings, water tank etc plastic is indispensable. It does not harm internal body due to which it can be used in surgical case. Its airproof quality makes it fit for packing purpose.

Due to their diverse uses plastic is slowly displacing other materials used in daily life.

***Soap and Detergent: →**

@ Soap: → Soap is sodium salt of higher fatty acid used for cleaning purpose. E.g. Sodium stearate [$C_{17}H_{35}COONa$], sodium oleate [$C_{17}H_{33}COONa$], sodium palmitate [$C_{15}H_{31}COONa$]

Fat or Oil + Sodium Hydroxide $\xrightarrow{\Delta}$ Soap + Glycerol



The process of formation of soap by the hydrolysis of fat or oil with alkali is called saponification. During saponification sodium chloride has to be added to cause the precipitation of soap. It decreases the solubility of soap due to which soap separates out.

Soap is then kept in moulds to give different shapes. Sodium carbonate or starch is added to improve the quality of soap. Various perfumes, colors, antiseptic etc are added to improve the quality of soap. They are biodegradable.

@ Detergent: → Detergent is sodium salts of long chain benzene sulphonic acid. E.g. Sodium lauryl sulphate, alkyl benzene sulphate, sodium pyrophosphate etc detergent are called soap less soap because they have same cleansing property in water as soaps have but their chemical nature is different from soap

Detergent are prepared from the hydrocarbons obtain from petroleum.

❖ Q. > How do soap and detergent works?

→ Soap and detergent have a long hydrocarbon chain and an ionic group. The hydrocarbon part dissolves the organic dirt and ionic part from a repelling sphere which separates out the dirt. It is then cleansed by water.

<u>Soap</u>	<u>Detergents</u>
*They have sodium salts of higher fatty acids.	*They have sodium salts of long chain benzene sulphonic acid.
*They are prepared from animal's fat or vegetable oil.	*They are prepared from hydrocarbon obtained from petroleum.
*They are biodegradable.	*They are non - biodegradable.
*They are less affective in acidic solution and hard water.	*They are affective even in acidic solution and hard water.

***Pesticides:** → The chemical compounds which are used for controlling pests are called pesticides. They are of different types:

- a) Insecticides
- b) Herbicides
- c) Fungicides
- d) Rodenticide
- e) Miticide

A good pesticide should have following properties: →

- a) It should be biodegradable.
- b) It should be less toxic to human beings and other animals.
- c) They should be cheap and easy to use.

***Insecticides:** → The chemical which are used to destroy & control insects are called insecticides. They are of two types:

1. Organic insecticides: → Those insecticides which are composed of carbon, hydrogen and oxygen are called organic insecticides.
 - a. Organochlorine insecticides → Aldrin, Dieldrin, Chlordane, DDT [Dichloro Diphenyl Trichloroethane], BHC [Benzene Hexa Chloride]

****They are stable and have long term effects.**

b. Organophosphorous insecticide → Malathion, Parathion, Falone, Phosdrin etc

**They are less stable and degradable but highly toxic to man and human

c. Carbamate insecticide → Baygon, Turmic

**They do not leave harmful deposit on food, but are harmful to warm blooded animals.

2. Inorganic insecticide: → They are made from minerals. E.g. calcium arsenates, lead arsenate, lime sulphur etc. They protect fruits, cottons, vegetables, trees and livestock from insects.

Advantage of insecticides: →

- a) They control insects and other different stages of their life cycle.
- b) They help to control different diseases caused by insects.

Disadvantage of insecticides: →

- a) Most of them are non - biodegradable and cause long term harmful effects to living things.
- b) They pollute air and water.
- c) They destroy useful insects too.

Precaution while using insecticides: →

- a) They should be well labeled.
- b) They should be kept away from reach of children and ignorant.
- c) Instruction with insecticide should be strictly followed.
- d) They should be used in small amount.
- e) Mouth, nose and eyes should be well covered while using insecticides.

***Fertilizer:** → Those substances which are added to the soil in order to increase soil fertility and hence to improve crop yield are called fertilizers. They are of two types:

1. Organic fertilizer [Manure]: → The fertilizer obtained from decomposition of animals excreta and plant remaining is called organic fertilizer. E.g. green manure, compost manure.

Green manure is prepared by ploughing green plants directly on field and compost manure is prepared by decomposition of animals dung and plants remaining in a pit.

2. Chemical fertilizers: → Artificially prepared chemical compound used to improve soil fertility is called chemical fertilizer. They are of three main parts:

- a. Nitrogenous fertilizer: - Those fertilizers which supply nitrogen to the soil and plants are called nitrogenous fertilizers. E.g. Ammonium sulphate $[(\text{NH}_4)_2\text{SO}_4]$, Ammonium nitrate $[\text{NH}_4\text{NO}_3]$, Urea $[\text{NH}_2\text{-CO-NH}_2]$ etc

*Function of nitrogen:::

- It helps in formation of chlorophyll and protein.
- It helps in rapid growth and development of plants.

- b. Phosphatic fertilizers: - Those fertilizers which supply phosphorous to the soil and plants are called phosphors fertilizers. E.g. Ammonium phosphate, calcium super phosphate, triple super phosphate etc

*Function of phosphorous:::

- It helps in cell division and ripening of fruits.
- It increases the resistance against diseases.

- c. Potassium fertilizer: - Those fertilizers which supply potassium to the soil and plants are called potassic fertilizers. E.g. Potassium chloride, Potassium sulphate, Potassium nitrate, Potassium carbonate etc

*Function of potassium:::

- They help in tuber formation in plants.
- They help in photosynthesis.

*On the basis of nutrients they supply to the plants, fertilizers are of three types:

a) Single fertilizers: - These are the fertilizers which supply only one nutrient to the plants.

E.g. Potassium chloride, Ammonium nitrate etc

b) Mixed fertilizers: - These are the fertilizers which supply more than one primary nutrient to the plants.

E.g. Potassium nitrate, Ammonium phosphate

c) Complete fertilizers: - Those fertilizers which supply all the three primary nutrients are called complete fertilizers or NPK fertilizers. It is actually a mixture of two or more fertilizers.

E.g. Ammonium phosphate + Potassium chloride $\{(NH_4)_3PO_4 + KCl\}$

***Chemical pollution**: → The environmental pollution caused by the unscientific use of chemicals is called chemical pollution. It is caused by following factors: -

- Excessive use of insecticide, pesticide & chemical fertilizers.
- Non - biodegradable refuses wastes and plastics.
- Smoke from industries and vehicles.
- Colors used in foods.

Solution to chemical pollution: - Chemical pollution can be reduced by following ways: →

- Use of pesticides and fertilizers should be reduced.

- b) Proper filters should be used in exhaust pipe of vehicles and chimneys of factories.
- c) Non - biodegradable wastes and refuses should be recycled.
- d) By products and wastes of industries should be neutralized before they are drained.
- e) Use of colors in food should be banned.

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