

## Man Made Substances

**1. Fertilizers :** The substances added to the soil to make up the deficiency of essential elements are known as fertilizers, these are either natural or synthetic (chemical). For a chemical fertilizer, the following requirements should be met :

(i) It must be sufficiently soluble in water

(ii) It should be stable so that the element in it may be available for a longer time.

(iii) It should contain nothing injurious to plants.

**Among the chemical fertilizers the two important categories are :**

**Phosphatic Fertilizers :** All naturally occurring phosphates are orthophosphates, the most abundant of these being rock phosphate  $[\text{Ca}_3(\text{PO}_4)_2]$ , which is mostly consumed by the fertilizer industry in the manufacture of 'superphosphate of lime'—triple superphosphate' and 'nitrophos'—a combined phosphatic and nitrogenous fertilizer. Other phosphatic fertilizers are ammonium dihydrogen orthophosphate and diammonium hydrogen orthophosphate, which also counteract nitrogen deficiency.

**Nitrogenous Fertilizers :** Plants need nitrogen for rapid growth and increase in their protein content. For this reason, nitrogenous fertilizers become more important. The chief nitrogenous fertilizers are ammonium sulphate, calcium cyanamide, sodium nitrate, ammonium nitrate urea, diammonium phosphate and ammonium phosphate.

**2. Dyes :** Coloured substances used for colouring textiles, foodstuffs, silk, wool, etc are called dyes.

Different classes of dyes are given below.

(i) **Nitro dyes :** These are polynitro derivatives of phenol where nitro group acts as a chromophore and hydroxyl group as auxochrome. These are less important industrially because the colours are not fast.

**(ii) Azo dyes :** These are an important class of dyes and are characterised by the presence of azo group ( $-\text{N}=\text{N}-$ ) as the chromophore. The groups like  $\text{NH}_2$ ,  $\text{NR}_2$  or  $-\text{OH}$ , etc., present in the molecule containing one or more azo groups act as the auxochromes.

**(iii) Triphenylmethane dyes :** These dyes contain the paraquinoid moiety as a chromophore and  $-\text{OH}$ ,  $-\text{NH}_2$  or  $-\text{NR}_2$  as auxochrome. These dyes are not fast to light and washing and hence are mainly used for colouring paper or typewriter ribbons, e.g. malachite green which is used for dyeing wool and silk directly and cotton after mordanting with tannin.

**(iv) Mordant dyes :** Those dyes which are fixed on the fibre with the help of a mordant are known as mordant dyes. For acidic dyes, basic mordants (such as hydroxides of iron, aluminium and chromium) are used, while for basic dyes, acidic mordants (i.e. tannic acid) are used. Here the fabric is first dipped into a solution of mordant and then into the dye solution. The colour produced depends on the nature of the mordant used.

**(v) Vat dyes :** These are water insoluble dyes and are introduced into the fibre in its (soluble) reduced form, also known as leuco form (colourless). These are called vat dyes because reducing operation (using sodium hydrosulphite) was formerly carried out in wooden vats. Indigo is a vat dye and is used for dyeing cotton.

**Cement :** It is a complex material containing the silicates of calcium and aluminium. A paste of it in water sets into a hard rocky mass called the setting of cement. A paste of sand, cement and water called mortar is very conveniently used for joining bricks and plastering walls.

A mixture of stone chips (gravel) sand cement and water, known as concrete, sets harder than ordinary mortar. It is used for flooring and making roads. Concrete with steel bars and wires called reinforced concrete (RC) forms a very strong material. It is used for constructing roofs, bridges and pillars.

**Glass :** Supercooled liquid is called glass.  $\text{SiO}_2$  is its common constituent.

**(a) Soda glass or soda lime glass :** It is Sodium calcium silicate ( $\text{Na}_2\text{O} \cdot \text{CaO} \cdot 5 \text{SiO}_2$ ). It is the cheapest of all glasses and used for making window panes and bottles and easily attacked by chemicals.

**(b) Potash glass :** It contains potassium in place of sodium, it has higher softening temperature as also a greater resistance to chemicals. So used for chemical apparatus; beakers, flasks, funnels etc.

**(c) Optical glass :** It is used for making lenses, prisms and optical instruments like telescopes and microscopes. It contains boric oxide ( $\text{B}_2\text{O}_3$ ) and silica ( $\text{SiO}_2$ )

**Types :** **(i) Crown glass :** Contains  $\text{K}_2\text{O}$  &  $\text{BaO}$  as the basic oxide

**(ii) Flint glass :** Contains  $\text{PbO}$  as the basic oxide

**(d) Crooks glass : for spectacles :** Absorbs ultraviolet rays which are harmful for the eyes.

**(e) Lead crystal and crystal glass** Lead glass sparkles used for making decorative items. It contains 2 % or more of  $\text{PbO}$  called lead crystal. If it contains more than 4% lead oxide called crystal glass.

**(f) Borosilicate glasses :** It contains less alkali ( $\text{K}_2\text{O}$  or  $\text{CaO}$ ) and more  $\text{SiO}_2$  than potash glass and some  $\text{B}_2\text{O}_3$

**(g) Coloured glass :** It is used for making artificial jewellery, crockery and stained glass window .

**(h) Milky glass :** Milky glass is prepared by adding tin oxide ( $\text{SnO}_2$ ), Calcium phosphate ( $\text{Ca}_3(\text{PO}_4)_2$ ) or cryolite ( $\text{Al}_3\text{Na}_3\text{F}_9$ ) to the melt glass. All these substances are white so look milky.

**(i) Glass laminates :** It is made by fixing polymer sheets between layers of glass. It is used to make windows & Screens of cars, trains and aircraft specially manufactured glass laminates are used bulletproof material.

**Some common man-made polymers and their uses.**

**Paints :** Chemical, contains a pigment as a vehicle and a thinner.

**White pigment** : Zinc oxide, white lead and titanium dioxide. The pigment is mixed with a vehicle, which is an oil like linseed or soyabean oil or a polymer. A thinner is a solvent such as turpentine oil or kerosene.

**Luminous paints** : Glow when exposed to light. Paints are applied on a surface to protect it from corrosion and weathering or to give it an attractive look.

**Soaps and Detergents** : Soaps are the sodium or Potassium salts of fatty acids. They are made by the saponification of fats. Detergent are made from some petroleum products.

**Antibiotic** : Medicinal compounds produced by moulds and bacteria, capable of destroying or preventing the growth of bacteria in animal systems.

**Antibody** : Kinds of substances formed in the blood, tending to inhibit or destroy harmful bacteria, etc.

**Antidote** : Medicine used against a poison, or to prevent a disease from having effect.

**Antigen** : Substance capable of stimulating formation of antibodies.

**Antimony** : A brittle crystalline, silvery white metal.

**Antipyretic** : A substance used to lower body temperature.

**Pesticides** : Many living organism destroy crops or eat away grains. They are collectively known as pests. To kill chemical used called pesticides

**Insecticides** : D.D.T. aluminium phosphate gammexine.

**Fungicide** : Bordeaux mixture  $\text{CaSO}_4 \cdot \frac{1}{2} \text{H}_2\text{O} + (\text{OH})_2$

**Rodenticides** : Aluminium phosphide.

**Herbicides** : Benzipram, benzadox.

**Medicines** : To cure diseases by biological changes in the body.

**Analgesics** : Painkillers are called analgesics eg, Aspirin, Paracetamol and morphine.

**Antimalarial drugs** : Used to treat malaria quinine derivatives eg, chloroquine.

**Destroy microorganism** : Penicillin, Aminoglycosides, ofloxacin, Homophonic.

**Sulphadugs** : Alternatives of antibiotics, sulphanilamide sulphadiazine, Sulpha gunamidine.

**Antacid** : Substances which remove the excess acid and raise the pH to appropriate level in stomach are called antacids. It is caused by excess of HCl in the gastric juice magnesium hydroxide, magnesium carbonate, magnesium trisilicate, aluminium phosphate are common antacids.

**Epsom salt** : Hydrated magnesium sulphate ( $MgSO_4 \cdot 7H_2O$ ), used in medicines to empty bowels.

**Chloroform** : A sweetish, colourless liquid. It is used as a solvent and anaesthetic.

**Saccharin** : A white crystalline solid which is 550 times sweeter than sugar, but does not have any food value. It is used by diabetic patients.

**DDT** : Dichloro diphenyl trichloro ethane, a white powder used as an insecticide.