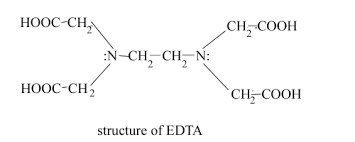
**QUESTION BANK WITH KEY SEM-1 ECE-A&B,(2017-18)**

1.Explain the determination of hardness of water by EDTA method 2.Write a note on a)Break Point Chlorination b)Reverse Osmosis c) vulcanization of rubber 3.Differentiate between a)thermoplastics and thermosetting Polymers b)addition and condensation polymerization 4.Mention the applications of a)Conducting polymers b)Bakelite c)Nylon6,6 d)Buna-s rubber e)PVC

**1. ESTIMATION OF HARDNESS OF WATER BY EDTA METHOD:**

Principle: EDTA is Ethylene Diamine Tetra Aceticacid. As it is insoluble in water, we use its

disodium salt. Structure of EDTA



By nature, Eriochrome Black T indicator is blue in colour. When EBT indicator is added to water sample, it forms a wine red coloured unstable Ca-Mg-EBT complex.This reaction is carried out using a basic ammonia buffer of PH 8- 10. When EDTA is titrated against the complex, EDTA replaces all the EBT and forms a stable Ca / Mg –EDTA complex. The liberated EBT indicates the end point as steel blue.

Ca2+ / Mg2+ + EBT **--------🡪** [Ca / Mg –EBT] in water

Blue unstable wine red complex

[Ca / Mg –EBT] + EDTA  [Ca / Mg –EDTA] + EBT

(Wine red/unstable) (Stable) (Steel blue)

So, the end point is the colour change from wine red to steel blue.

**4.Procedure:** It involves four steps. **(i)Preperation of standard hard water:**

1 ml of Std. Hard water = 1 mg of CaCO3 (Given)

So, 20 ml of Std. Hard water = 20 mg of CaCO3

V1 ml of EDTA is required for = 20 mg of CaCO3

Therefore, 1ml of EDTA = 20 / V1 mg of CaCO3

**(ii) Standardisation of EDTA** :

1.The burette is filled with EDTA solution.

2.20ml of hard water is pipette out in a conical flask and

3.10ml of P**H**=10 basic buffer + 2-3 drops EBT Indicator …..…colour changes to wine red

4.It is now titrated with EDTA solution till colour changes to blue.This I the end point. 5.Let the titre value be V1 ml.

Therefore, 1000ml of sample requires = V2/V1 X 20/20 X 1000 mg of CaCO3 Total hardness = V2/V1 X 1000 =………...ppm

**(iii) Estimation of Total hardness:**

1.The burette is again filled with EDTA solution.

2.20ml of sample water is pipette out in a conical flask and

3.10ml of P**H**=10 basic buffer + 2-3 drops EBT Indicator …..…colour changes to wine red

4.It is now titrated with EDTA solution till colour changes to blue.This I the end point. 5.Let the titre value be V2 ml

Total hardness = V3/V1 X 1000 = ………..ppm

**(iv)Estimation of Permanent hardness:**

1 Burette is filled with EDTA Standard solution.

2 100ml sample water is boiled upto 1/3rd of its volume,cooled,filtered and again filled upto 100ml. with distilled water. 3.20ml of this water is pipette out in a conical flask and

3.10ml of P**H**=10 basic buffer + 2-3 drops EBT Indicator …..…colour changes to wine red to blue.

4.It is now titrated with EDTA solution till colour changes from wine red to blue.This is the end point.

5.Thus Permanent Hardness =(V3-V1)/V1X1000 = ……………….. ppm.

**Total hardness = Temporary hardness + permanent hardness (OR) Temporary hardness = Total hardness – permanent hardness = …………PPM**

**2.Breakpoint chlorination:**The point at which the added chlorine completely removes bacteria, NH3, Organic and inorganic impurities is known as “Breakpoint chlorination”. Water contains: Bacteria ,Ammonia, Organic impurities(sewage) d)Inorganic salt impurities(Effluents,H2S,Fesalts) 1. When we add chlorine, first it kills bacteria and oxidizes some inorganic impurities. . The added chlorine is completely consumed. (a).

3. Further addition of chlorine is used to combine with ammonia to form chloramines compounds. So, the residual chlorine content is increased

4.As saturation level is attained, the chloramines begin to decompose to release chlorine

which is utilized to remove all the types organic and inorganic impurities. So, residual

chlorine level decreases. (c).

5.At point (c), the added chlorine removes all the types of impurities. So, the point is known

as “ Break point chlorination”.

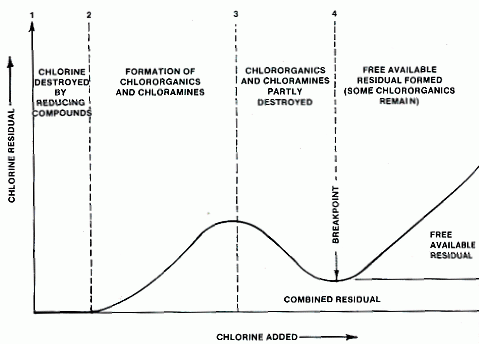
6. After this point, further addition of chlorine is not at all utilized and simply increases the

residual chlorine content.(along cd)

**Advantages of break point chlorination: (Significance)**

i)It is used to kill Bacteria and destroy other impurities which is safe for drinking purpose(eg:Ammonia,,Organic impurity (sewage) ,Inorganic salt impurities ( Effluents, H2S , Fe salts) from water.

ii)It prevents the growth of any weeds in water.iii)



**2b.Reverse Osmosis Method: (Desalination): Hyperfiltration/ Super filtration/**

**brakish water treatment**

1. Removal of common salt (NaCl) from water is called ‘ Desalination’.

2. Various methods:

Reverse Osmosis, Distillation, Electro dialysis, Freezing, Solar distillation, etc.,

3. Brakish water: Water containing dissolved salts with a peculiar salty taste.

4. *Osmosis*: When two different concentrated solutions are separated by a semi permeable

membrane, due to osmotic pressure, low concentrated solvent flows to higher one. This is

known as osmosis.

5. But when we apply an excess and opposite *Hydrostatic pressure(15-40kg/cm2)* to

overcome the osmotic pressure, then higher concentrated solvent will flow to the lower one.

This is known as reverse osmosis.

6. During this RO process , only the water flows across the membrane and it prevents the

salt migration. So, this method is also called as ‘ Super filtration’.

7. The membrane is madeup of cellulose acetate,cellulose butyrate,polymethacrylate

**Advantages of Reverse Osmosis:**

1.High life time

2.Removes ionic, non-ionic and colloidal silica impurities , which can not be removed by demineralization method.

3. Low capital cost.

4. Simple operational procedure.

5. The membrane can be replaced within a few minutes, thereby providing uninterrupted water supply.



**3.Vulcanization:**

Vulcanization discovered by Charles Goodyear in 1839. To improve the quality of raw rubber sulphur is added to it which is known as Vulcanisation.In this process the raw rubber is heated at 100 – 1400C with sulphur. Sulphur combines chemically at the double bonds of different rubber spring and provides cross-linking between the chains. This cross-linking during vulcanization brings about a stiffening of the rubber by anchoring and prevents intermolecular movement of rubber springs. Theamount of sulphur added determines the extent of stiffness of vulcanized rubber. For example, ordinary rubber (say for battery case) may contain as much as 30% sulphur.

**Advantages of vulcanization:**

i. The tensile strength increase. ii. Vulcanized rubber has excellent resilience.

iii. It has boarder useful temperature range (-40 to 1000C)

iv. It has better resistance to moisture, oxidation and abrasion.

v. It is resistance to organic solvents like CCl4, Benzene petrol etc.

vi. It has only slight thickness. vii. It has low elasticity.

**3a.Differences between Thermoplastics and Thermosetting Polymers :**

|  |  |
| --- | --- |
| **Thermoplastics** | **Thermoset plastics** |
| **1.** These are processed by addition  polymerization.  . | **1.** These are proceed by condensation  Polymerization**.**  .  . |
| **2.** Softens on heating and retaining the same chain on cooling. | **2.** These are infusible and insoluble  mass on heating i.e., heat resistance. |
| **3.** They are along chain linear polymers  without any branched or cross linked  chain | **3**. They are branched or cross-linked  Polymer |
| **4.** On repeated heating and cooling, there is  no change in chemical nature. | **4.** Some sort of chemical changes occur  On heating. |
| **5.** These plastics undergo purely physical  Process | **5.T**hese Plastics undergo physical as well  As chemical process |
| **6.** By heating the plastics, they can be  proceed. | **6**. These plastics cannot be proceed by  heating. |
| **7.** Waste thermoplastics can be recovered | **7. .** Waste thermosetting cannot be recovered. |
| 8. eg: Polyethylene,PVC.Teflon | 8. eg: Bakelite |

**3b.Differences between Addition andCondensation polymerization:**

|  |  |
| --- | --- |
| **Addition or Step polymerization** | **Condensation or polymerization** |
| 1.These are processed by addition  polymerization.  . | 1. These are proceed by condensation  Polymerization**.**  .  . |
| 2.Monomer should possess double or triple bond. | **2. Monomer shoulh have two similar or different functional groups** |
| 3.This polymerization yields an exact multiple of basic monomeric molecules | 3. Monomers condense to form a polymer |
| 4. By- products re formed | 4. By-products are formed by elimination of H2O, HCl |
| 5. Results in homo chain polymer | 5.Results in hetro chain polymer |
| 6. Lewis acids or bases are catalysts | 6. Mineral acids or bases are catalysts |
| 7. Reaction results in high M.Wt polymers at once | 7.High M.Wt polymers increases steadily with the reaction |
| 8.MWt of the resulting polymers is integral multiple of monomers M.Wt | 8. MWt of the resulting polymers is not the integral multiple of monomers M.Wt |
| 9.Produces thermoplastics | 9. Produces thermosetting polymers |
| 10. eg:Poly-ethylene | 10. eg: Nylon6:6 |

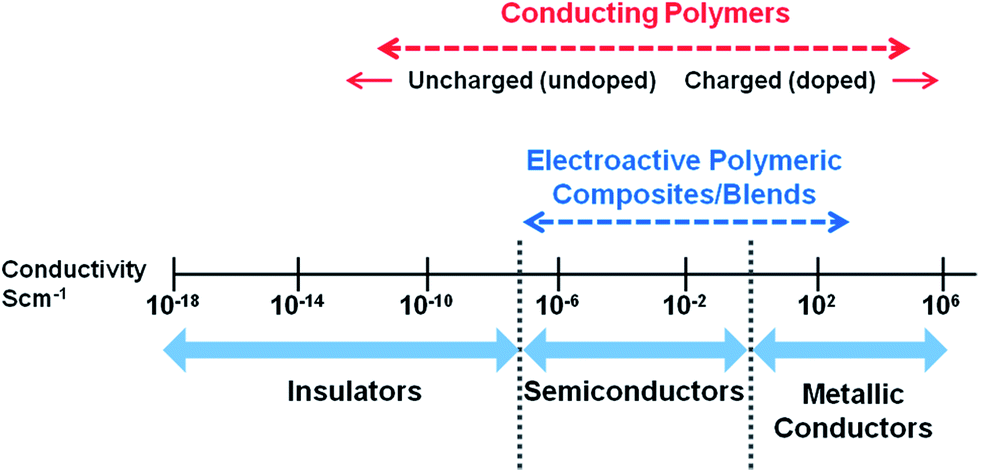
**4)Applications of a)Conducting polymers b)Bakelite c)Nylon6,6 d)Buna-s rubber**

**4a.Conducting polymers :** The polymers (organic compounds) that can conduct electricity due to alternate double bonds(conjugation) and movement of electron takes place through pi-orbital overlap are known as conducting polymers. Ex: Poly Aniline,Poly Acytelene,Poly Pyrrole, etc . They have metallic and semiconductor characteristics.

Their conductivities lies in between metals and semi conductors.

**Advantages:**They are light in weight, inexpensive and easily processable.

**Applications:** Conducting polymers are used in: 1.Rechargeable batteries 2.Photo voltaic cells, 3.InLED’S(Light emitting diodes) 4.Electron beam lithiography, 5.Solar cells 6.Optical sensors etc.

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**b)Bakelite:** It is prepared by condensing phenol with formaldehyde in presence of acidic/alkaline

catalyst, forming O- and P- hydroxyl methyl/phenol which reacts to form linear polymer.

During the reaction hexamethylene tetramine(HMTA) is added, which converts to insoluble solid of cross-linked structure Bakalite.

**Applications**: It is used for making electric insulator parts like switches, plugs, switch boards

etc. For making moulded articles like telephone parts cabinet of radio and television.

**c)Nylon-6,6**: It is prepared by Hexamethylene diamine and Adipic acid are polymerized in 1:1 ratio.

**Properties**: This is linear polymer not resistant to alkali and mineral acids.

Oxidising agents like hydrogen peroxide, potassium permanganate etc. are able to degrade the

fibres.

**Applications:** Nylon-6,6 is mainly used for moulding purposes for gear bearings and making

car tyres, used for fibres etc.

This is mainly used in manufacture of tyre cord. Other uses include manufacture of carpets,

rope, fibre cloth etc.

**d)Buna – S or STYRENE RUBBER:**

**Properties:** Styrene rubber resembles natural rubber in processing characteristics as well as

quality of finished products.

It possesses high abrasion-resistance, high load-bearing capacity and resilience. However, it

gets readily oxidized, especially in presence of traces of ozone present in the atmosphere.

Moreover, it swells in oils and solvents. It can be vulcanized in the same way as natural rubber

either by sulphur or sulphur monochloride (S2Cl2). However, It requires less sulphur, but more

accelerators for vulcanization.

**Applications:** Mainly used for the manufacture of motor tyres. Other uses of these elastomers are floor

tiles, shoe soles, gaskets, foot-wear components, wire and cable insulations, carpet backing,

adhesives, tank-linings, etc.

**e)PVC :** Poly Vinyl Chloride is obtained by heating a water emulsion of vinyl chloride in presence of a

small amount of benzoyl peroxide or hydrogen peroxide in an auto clave under pressure.

Vinyl chloride, so needed is generally prepared by treating acetylene at 1 to 1.5 atmospheres

with hydrogen chloride at 600C to 800C in the presence of metal chloride as catalyst.

CH = CH + HCl -------------------🡪CH2 = CH Cl

Acetylene Vinyl chloride

**Properties**: It occurs as a colourless rigid material.

It is having high density and low softening point.

It is resistant to light, atmospheric oxygen, inorganic acids and alkalis.

It is most widely used synthetic plastic.

**Applications:** It is mainly used as cable insulation, leather cloth, packing and toys.

It is used for manufacturing of film, sheet and floor covering.

PVC pipes are used for carrying corrosive chemicals in petrochemical factories.