CHEMISTRY STUDY MATERIALS FOR CLASS 10
(NCERT Based notes of Chapter -04)

GANESH KUMAR DATE:- 03/07/2021

CARBON AND ITS COMPOUND

SOME IMPORTANT CARBON COMPOUNDS – ETHANOL AND ETHANOIC ACID

Almost all the compounds are useful to us in a number of ways. Most of the fuels, medicines, paints, explosives, synthetic polymers, perfumes and detergents are basically organic compounds. In fact, organic chemistry has made our life colourful and also comfortable.

Two commercially important compounds are ethanol and ethanoic acid

ETHANOL (C_2H_5OH)

Ethanol or ethyl alcohol or simply alcohol is one of the most important members of the family of alcohols.

(1)Manufacture of ethanol from molasses

Molasses is a dark coloured syrupy liquid left after the crystallization of sugar from the concentrated sugar cane juice. Molasses still contain about 30% of sucrose which cannot be separated by crystallization. It is converted into ethanol by the following steps:

(i) Dilution -

Molasses is first diluted with water to bring down the concentration of sugar to about 8 to 10 percent.

(ii) Addition of ammonium salts

Molasses usually contains enough nitrogenous matter to act as food for yeast during fermentation. If the nitrogen content of the molasses is poor, it may be fortified by the addition of ammonium sulphate or ammonium phosphate.

(iii) Addition of yeast

The solution from step (ii) is collected in large 'fermentation tanks' and yeast is added to it. The mixture is kept at about 303K for a few days. During this period, the enzymes invertase and zymase present in yeast bring about the conversion of sucrose into ethanol.

The fermented liquid is technically called wash.

$$\underset{\text{Sucrose}}{C_{12}H_{22}O_{11}} + H_2O \xrightarrow{\text{invertase}} \underset{\text{Glucose}}{C_6H_{12}O_6} + \underset{\text{Fructose}}{C_6H_{12}O_6}$$

$$\underset{\text{Glucose or Fructose}}{C_6H_{12}O_6} \xrightarrow{\text{zymase}} \underset{\text{Ethanol}}{2C_2H_5OH} + 2CO_2\uparrow$$

FERMENTATION is the slow chemical change taking place in an organic compound by the action of enzymes leading to the formation of smaller molecules.

(iv) Distillation of wash

The fermented liquid containing 15 to 18 percent alcohol and the rest of the water is now subjected to fractional distillation. The main fraction drawn is an aqueous solution of ethanol which contains 95.5% of ethanol and 4.5% of water. This is called rectified spirit. This mixture is then heated under reflux over quicklime for about 5 to 6 hours and then allowed to stand for 12 hours. On distillation of this mixture, pure alcohol (100%) is obtained. This is called absolute alcohol.

PROPERTIES OF ETHANOL

PHYSICAL PROPERTIES

(i) Ethanol is a clear liquid with burning taste.

(ii) Its boiling point is 351K which is higher than corresponding alkane.

(iii) It is completely miscible with water in all proportions.

CHEMICAL PROPERTIES

(i) DEHYDRATION

(a) Intra molecular dehydration: Ethanol, when heated with excess conc. H_2SO_4 at 443 K undergoes intra molecular dehydration (i.e. removal of water within a molecule of ethanol).

$$\underset{\text{Ethanol}}{CH_3CH_2OH} \xrightarrow[443K]{Conc.H_2SO_4} \underset{\text{Ethene}}{CH_2=CH_2}+H_2O$$

(b)Inter molecular dehydration: When excess of alcohol is heated with conc. H_2SO_4 at 413K two molecules condense by losing a molecule of water to form ether (i.e. removal of water from two molecules of ethanol).

$$C_2H_5\text{- }OH + HO\text{- }C_2H_5 \xrightarrow[413K]{Conc.H_2SO_4} \underset{\text{Diethyl ether}}{C_2H_5\text{-O-}C_2H_5}+H_2O$$

(ii) Reaction with sodium : Ethanol reacts with sodium metal to form sodium ethoxide and hydrogen gas.

$$2C_2H_5OH + 2Na \longrightarrow \underset{\text{sodium ethoxide}}{2C_2H_5ONa} + H_2\uparrow$$

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