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MBBS CHM 102

1 Classification of Alcohols
There are two major ways to classify Alcohols. They are:

a Number of Hydrogen present on the carbon carrying the functional group (OH).

i Primary Alcohol (1°): With two or three hydrogens
Example: CH_3CH_2OH

ii Secondary Alcohol (2°): With just one hydrogen
Example: $CH_3CH(OH)CH_3$

iii Tertiary Alcohol (3°): With no hydrogen
Example: $(CH_3)_3C-OH$

b Number of OH (functional group) present in the Compound

i Monohydric Alcohol – With just one (OH)
Example: C_2H_5OH – Ethanol

ii Dihydric Alcohol or Diols – With two (OH)s
Example: $HOCH_2CH_2OH$
Ethane-1,2-diol

iii Trihydric Alcohol or Triols – With three (OH)s
Example: $OHCH_2CH(OH)CH_2OH$
Propane-1,2,3-triol

iv Polyhydric Alcohol or Polyols – With more than three (OH)s
Example
$CH_3CH(OH)CH(OH)CH(OH)CH(OH)CH(OH)CH_3$
Heptane-2,3,4,5,6-pentaol

2 Solubility of Alcohols

a In Water: Alcohols are soluble in water due to hydrogen bonding. This only applies to alcohols with low molecular mass (up to three carbon atoms) because these lower alcohols can form hydrogen bond with water molecules. The water solubility of alcohols decreases with increasing relative molecular mass

b In Organic solvents: All monohydric alcohols are soluble in Organic solvents. The solubility of simple alcohols and polyhydric alcohols is largely due to their ability to form hydrogen bonds with water molecules.

3 Industrial manufacture of ethanol (fermentation)

- Step 1

Breaking of Carbohydrates into disaccharides

$$\underset{\text{Carbohydrate}}{2(C_6H_{10}O_5)_n} + nH_2O \xrightarrow[60^\circ C]{\text{Diastase (malt)}} \underset{\text{maltose}}{C_{12}H_{22}O_{11}}$$

- Step 2

Breaking of Disaccharide into Monosaccharide

$$\underset{\text{Maltose}}{C_{12}H_{22}O_{11}} + H_2O \xrightarrow[15^\circ C]{\text{maltase (yeast)}} \underset{\text{Glucose}}{2C_6H_{12}O_6}$$

- Step 3

Breaking down of Monosaccharide (Glucose) to Ethanol.

$$\underset{\text{Glucose}}{C_6H_{12}O_6} \xrightarrow[15^\circ C]{\text{Zymase (yeast)}} \underset{\text{Ethanol}}{2CH_3CH_2OH(l)} + 2CO_2(g)$$

4 C_4H_9

4 $$C_4H_9MgCl + CH_3(CH_3)CH_2\overset{H}{\overset{|}{C}}=O \rightarrow CH_3(CH_3)CH_2-\underset{C_4H_9}{\overset{H}{\overset{|}{C}}}-OMgCl$$

$$CH_3(CH_3)CH_2-\underset{C_4H_9}{\overset{H}{\overset{|}{C}}}-OMgCl \xrightarrow{H^+\ OH^-} CH_3(CH_3)CH_2-\underset{C_4H_9}{\overset{H}{\overset{|}{C}}}-OH + Mg(OH)Cl$$

7 $$CH_3(CH_3)CH_2CHO \xrightarrow[[H_2]]{LiAlH_4/(C_2H_5)_2O} CH_3(CH_3)CH_2CH_2OH$$

8 Conversion of Propan-1-ol to propan-2-ol

$$\underset{\text{Propan-1-ol}}{CH_3CH_2CH_2OH} + H_2SO_4 \rightarrow CH_3CH_2OH_2OSO_3H$$

$$CH_3CH_2OH_2OSO_3H \xrightarrow{H_2O} CH_3\underset{\underset{H}{|}}{C}HCH_2OSO_3H$$

$$\downarrow H_2SO_4$$

$$CH_2{=}CHCH_3 + H^+ \quad OH^-$$

$$\downarrow$$

$$CH_3CHCH_3$$

Propan-2-ol