3) INDUSTRIAL PRODUCTION OF ALCOHOLS

A) Starch containing materials including molasses, potatoes, cereals, e.t.c. on warming with malt to 60°C for a specific period of time are converted into maltose by the enzyme diastase contained in the malt.

$$2(C_6H_{10}O_5)_n + nH_2O \xrightarrow{60^\circ C/\text{diastase}} nC_{12}H_{22}O_{11}$$

Carbohydrate — maltose

The maltose is broken down into glucose on addition of yeast which contains the enzyme maltase and at a temperature of 15°C

B) $$C_{12}H_{22}O_{11} + H_2O \xrightarrow{15^\circ C/\text{maltase}} 2C_6H_{12}O_6$$

Maltose — glucose

The glucose at constant temperature of 15°C is then converted into alcohol by the enzyme Zymase contained also in yeast.

C) $$C_6H_{12}O_6 \xrightarrow{15^\circ C/\text{Zymase}} 2CH_3CH_2OH + 2CO_2$$

Glucose — Ethanol.

4) $$CH_3CH(CH_3)\overset{\delta^+}{H}C=\overset{\delta^-}{O} + CH_3CH_2CH_2CH_2\overset{\delta^-}{Mg}\overset{\delta^+}{Cl}$$

$$CH_3CH(CH_3)-\underset{H}{\overset{CH_2CH_2CH_2CH_3}{C}}-OMgCl$$

$$\xrightarrow{H^+\ OH^-}$$

$$CH_3CH(CH_3)CH\,CH_2CH_2CH_3 + Mg(OH)Cl$$

~~$CH_3CH(CH_3)CH\,CH_2CH_2CH_3$~~

$$CH_3(CH(CH_3)CH(OH)CH_2CH_2CH_3 + Mg(OH)Cl$$

2-Methylheptan-3-ol.

7) Reduction of 2 methylpropanal

$$CH_3CH(CH_3)HC=O \xrightarrow[LiAlH_4/(C_2H_5)_2O]{} CH_3CH(CH_3)CH_2OH$$

8) Conversion of Propan-1-ol to Propan-2-ol.

$CH_3CH_2CH_2OH + H_2SO_4$

↓

$CH_3CH_2CH_2\boxed{OH_2}OSO_3H$

↓ $-H_2O$

$CH_3CH=CH_2 + H_2SO_4$

↓ $H^+ OH^-$

$CH_3CH_2(OH)CH_3$

$CH_3CH(OH)CH_3$

Propan-2-ol

(Markonikov's product).

(1) CLASSIFICATION OF ALCOHOLS.

(A) BASED ON THE NUMBER OF HYDROGEN ATOMS ATTACHED TO THE CARBON ATOM CONTAINING THE HYDROXL GROUP; If the numbers of hydrogen atoms attached to the carbon atom bearing the hydroxyl group are three or two, it is called a primary alcohol (1°), if it is one hydrogen atom it is called Secondary alcohol (2°) if no hydrogen atom is attached to the carbon atom bearing the hydroxyl group, it is called a tertiary alcohol (3°).

E.g CH_3OH Methanol (1°), $CH_3CH(OH)CH_3$ Propan-2-ol (2°)

$(CH_3)_3C-OH$ 2-Methylpropanol-2-ol (3°).

(B) BASED ON THE NUMBER OF HYDROXYL GROUPS THEY POSSESS; Monohydric alcohols have one hydroxyl group present in the alcohol Structure. Dihydric alcohols are also called Glycols and have two hydroxyl groups present in the alcohol structure while tri-hydric alcohols or triols have three hydroxyl groups present in the structure of the alcohol. Polyhydric alcohols or polyols have more than three hydroxyl groups.

E.g $CH_3CH_2CH_2OH$ Propanol (Monohydric alcohol).

$HOCH_2CH_2OH$ Ethane-1,2-diol (Dihydric alcohol)

$OHCH_2CH(OH)CH_2OH$ Propane-1-2-3-triol (Trihydric alcoho

(2) Solubility; Lower alcohols with up to three carbon atoms in the molecules are soluble in water because these lower alcohols can form hydrogen bond with water molecules. The water solubility of alcohols decreases with increasing relative molecular mass. All monohydric alcohols are suitable in organic solvents. The solubility

Of simple alcohols and polyhydric alcohols is largely due to their ability to form hydrogen bonds with water molecules.