General formula	$R-O-R'$	Methoxy propane	

2. General properties of ethers can be discussed under:

i) Physical state:

At room temperature, ethers are colourless, neutral liquids with pleasant odour. The lower aliphatic ethers are highly flammable gases and volatile liquids.

ii) Solubility

Ethers are less soluble in water than are the corresponding alcohols. Lower molecular weight ethers are fairly soluble in water since they can easily form hydrogen bonds with water molecules. But when the Hydrogen content increases there is rapid decline in hydrogen bonding thereby reduction in solubility.

iii) Density

Most of the simple ethers are less dense than water, although the increase in relative molecular mass leads to increase in density, some aromatic ethers are denser than water.

iv) Boiling Point.

Low molecular mass ethers have a lower boiling point than the corresponding alcohols but these ethers containing alkyl radicals larger than four carbon atoms, the decrease is true.

v) Reactivity

Ethers are inert at moderate temperature. Their inertness at moderate temperature leads to their wide use as reaction media.

3. Preparation of Ethers.

① Partial dehydration of alcohols:

Simple ethers can be manufactured from alcohols by catalytic dehydration. The alcohol in excess and concentrated tetraoxosulphate(VI) acid is heated at a carefully maintained temperature of 140°c. this process is known as continuous esthesification. If excess alcohol is not used, the temperature is as high as 170-180°C, further dehydration to yield alkene occurs.

$$2\,ROH \xrightarrow[140^{\circ}C]{\text{Conc. } H_2SO_4} R\text{-}O\text{-}R + H_2O$$

Example.

$$2\,CH_3CH_2OH \xrightarrow[140^{\circ}C]{\text{Conc. } H_2SO_4} CH_3CH_2\text{-}O\text{-}CH_2CH_3 + H_2O$$

② Williamson Synthesis of Ethers.

The alkylhalide is reacted with sodium alkoxide which leads to the formation of ethers. The reaction generally follows the $SN2$ mechanism for primary alcohols.

$$R - X + R - ONa \longrightarrow R - O - R' + NaX$$

Alkoxides are strong bases and they can react with alkyl halides leading to elimination reaction. This method exhibits higher productivity in the case of secondary alkyl halides.

4. Uses of ethylene oxide.

i. Ethylene oxide is used as an intermediate in the hydrolytic manufacture of ethylene glycol.

ii. Ethylene oxide is used in the preparation of nonionic emulsifying agents, plastics, plasticizers and several synthetic textiles.

iii. Ethylene oxide is used as a gasous sterilizing agent.

1. i) CH_3OCH_3 → Methoxymethane

ii) $CH_3CH_2OCH_2CH_3$ → Ethoxyethane

iii) $(CCH_3CH_2CH_2CH_2)_2O$ → Buthoxymethane

iv) $CH_3CH_2OCH_3$ → Methoxyethane

v) $CH_3CH_2CH_2OCH_2CH_3$ → Ethoxypropane

SHINKAI WILLIAMS

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MECHATRONICS

CHM 102