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CHM 102

1a Primary Alkanol:- In a primary alkanol, the hydroxyl group is attached to a primary [terminal] carbon atom in the molecule. It is characterised by $-CH_2OH$ - Examples,

i) Ethanol - CH_3CH_2OH
ii) Methanol - CH_3OH.

ii) Secondary Alkanol:- In a secondary alkanol the OH group is on a secondary carbon atom. It is characterised by CHOH. Examples.

i) $CH_3CH[OH]CH_3$ - Propan-2-ol.
ii) $[CH_3]C-OH$ - 2-Methylpropan-2-ol

2 In the grignard synthesis of Alkanols, react a named grignard reagent with $CH_2CH_2CH_2CH_2C=OCH_2CH_2CH_3$. Show the reaction steps?

Step 1

$CH_2CH_2MgBr + CH_3CH_2CH_2CH_2C=OCH_2CH_2CH_3$

$\longrightarrow CH_3CH_3$ -

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(iii) Yeast containing enzymes maltose and zymase is added to mixture, and kept at room temperature [about 27°C] for about three [3] days. During this period, enzyme zymase [IV] oxide. The reaction is exothermic.

$C_{12}H_{22}O_{11(aq)} + H_2O_{(l)} \xrightarrow{\text{Maltase}} 2C_6H_{12}O_{6(aq)}$
[maltose] [glucose]

$C_6H_{12}O_{6(aq)} \xrightarrow{\text{zymase}} 2C_2H_5OH_{(aq)} + 2CO_2$
[Glucose] [Ethanol]

The mixture is distilled, to obtain 95% ethanol that boils at 78°C.

(4) Reduction of carbonyl compounds

(i) $CH_3CHO \xrightarrow{LiAlH_4/(C_2H_5)_2O} CH_3CH_2OH$
Ethanal. Ethanol (1°)

(ii) $CH_3CH_2C=O \xrightarrow{LiAlH_4/(C_2H_5)_2O} CH_3CH_2CHOH$
Propanone Propanol (2°)

Alkanals are reduced to the corresponding primary alkanols by reducing agents such a lithium tetra hydridoaluminate [III], $LiAlH_4$ that provides the nascent hydrogen, [H], which causes reduction. [refer to (i)]

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STEP I

$CH_3CH_2MgBr + CH_3CH_2CH_2CH_2C=OCH_2CH_2CH_3 \rightarrow CH_3CH_2-C(CH_2CH_2CH_3)(CH_2CH_2CH_3)-OMgBr$

STEP II

Dilute acid is then added to this to hydrolyze it

$CH_3CH_2-C(CH_2CH_2CH_3)(CH_2CH_2CH_3)-O-MgBr + H_2O \xrightarrow{H_3O^+} CH_3CH_2-C(CH_2CH_2CH_3)(CH_2CH_2CH_3)-OH + MgBr(OH)$

An alcohol is formed. The key use of grignard reagent is the ability to make complicated alcohols easily.

3 Industrial Preparation of Ethanol

i) The starch containing crop such as cassava is peeled, crushed and steam-heated or pressure cooked to release with water to obtain a mash.

ii) This mash is treated with malt, yeast and warmed at 50°C for two hours. Enzyme diastase in the malt hydrolyses starch to maltose.

$2[C_nH_{10}O_5]_n(aq) + nH_2O \xrightarrow{\text{Diastase}} n[C_{12}H_{22}O_{11}(aq)]$

(Starch) (Maltose)