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COURSE CODE: CHM 102
MATRICULATION NUMBER: 19/MHS01/163

1 The two major classifications ~~are~~ of alkanols are:

a Based on the number of hydrogen atoms attached to the carbon atom containing the hydroxyl group:

If the number of hydrogen atoms attached to the carbon ~~bearing~~ atom bearing the hydroxyl group are we three or two, it is called a primary alcohol or 1° alcohol. e.g Methanol (CH_3OH), Ethanol (CH_3CH_2OH)

If the number of hydrogen atoms attached to the carbon atom bearing the hydroxyl group is one, it is called a secondary alkanol e.g Propan-2-ol ($CH_3CH(OH)CH_3$), Butan-2-ol ($CH_3CH_2CH(OH)CH_3$)

If no hydrogen atom is attached to the carbon atom bearing the hydroxyl group, it is called a tertiary alcohol e.g 2-methylpropan-2-ol ($(CH_3)_3C-OH$), 2-methybutan-2-ol ($CH_3CH_2(CH_3)_2C-OH$)

b Based on the number of hydroxyl groups the alkanol possesses:

If one hydroxyl group is present in the alcohol structure, it is called a monohydric alcohol e.g Propanol (C_3H_7OH), Butanol (C_4H_9OH)

If two hydroxyl groups are present in the alcohol structure, it is called a dihydric alcohol e.g Ethan-1,2-diol ($HOCH_2CH_2OH$), Butan-1,3-diol ($CH_3CH(OH)CH_2CH_2OH$). It can also be called glycol.

If three hydroxyl groups are present in the alcohol structure, it is called a trihydric alcohol or triol e.g Propan-1,2,3-triol ($OHCH_2CH(OH)CH_2OH$), Butan-1,2,4-triol ($HOCH_2CH(OH)CH_2CH_2OH$)

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2 Grignard's Reagent - CH_3CH_2MgBr (ethylmagnesium bromide)

$$CH_3CH_2MgBr + \underset{\text{octan-4-one}}{CH_3CH_2CH_2CH_2C{=}OCH_2CH_2CH_3} \longrightarrow CH_3CH_2-\underset{\underset{CH_3CH_2CH_2}{|}}{\overset{\overset{CH_3CH_2CH_2CH_2}{|}}{C}}-OMgBr$$

$$CH_3CH_2-\underset{\underset{CH_3CH_2CH_2}{|}}{\overset{\overset{CH_3CH_2CH_2CH_2}{|}}{C}}-OMgBr \xrightarrow[\text{dil. acid}]{H^+\ OH^-} CH_3CH_2-\underset{\underset{CH_3CH_2CH_2}{|}}{\overset{\overset{CH_3CH_2CH_2CH_2}{|}}{C}}-OH + \underset{\text{basic bromide}}{Mg(OH)Br}$$

~~4-ethyloctan-4-ol~~
4-ethyloctan-4-ol

3 Industrial Manufacture of Ethanol:

Carbohydrates such as starch are a major group of natural ~~compoun~~ compounds that can be made to yield ethanol by the biological process of fermentation. The biological catalysts, enzymes, found in yeast break down the carbohydrate molecules into ethanol to give a yield of 95%.

The starch-containing substance is warmed with malt to 60°C for a specific period of time and is converted into maltose by the enzyme DIASTASE contained in malt.

$$\underset{\text{carbohydrate}}{2(C_6H_{10}O_5)_n} + nH_2O \xrightarrow[60°C]{\text{Diastase}} \underset{\text{maltose}}{nC_{12}H_{22}O_{11}}$$

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

$$\underset{\text{maltose}}{C_{12}H_{22}O_{11}} + H_2O \xrightarrow[15°C]{\text{Maltase}} \underset{\text{glucose}}{2C_6H_{12}O_6}$$

The glucose, at constant temperature of 15°C is then converted into ethanol by the enzyme ZYMASE, also contained in yeast

$$\underset{\text{glucose}}{C_6H_{12}O_6} \xrightarrow[15°C]{\text{Zymase}} \underset{\text{ethanol (95\% yield)}}{2CH_3CH_2OH} + 2CO_2$$

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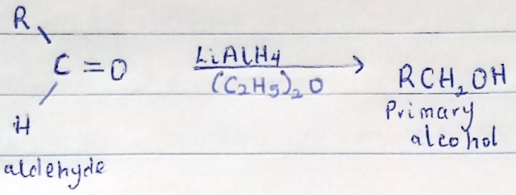
4a Reduction of ~~Alkanone~~ Alkanal:

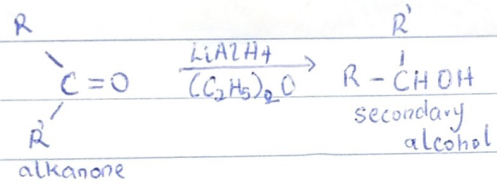


Example

$$CH_3CHO \xrightarrow[(C_2H_5)_2O]{LiAlH_4} CH_3CH_2OH$$

methanal → ethanol

b Reduction of Alkanone:



Example: