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MATRIC NO: 19/MHS01/179

06/04/2020

CHM 102 ASSIGNMENT

1. The two major classifications of alkanol are:

a. It is based on the number of hydrogen atoms attached to the carbon atom containing the hydroxyl group. In this classification, alkanols are grouped into three namely: primary, secondary & tertiary alcohols. Primary alcohol (1°) contains two or three hydrogen atoms which is attached to the carbon atom bearing the hydroxyl group- Secondary alcohol (2°) contains only one hydrogen atom. While, tertiary alcohol contains no hydrogen atom.

Examples:

Primary alcohol – CH_3CH_2OH Ethanol (1°), CH_3OH Methanol (1°)

Secondary alcohol – $CH_3CH(OH)CH_3$ Propan-2-ol (2°) $CH_3CH_2CH(OH)CH_2CH_2CH_3$ hexan-3-ol (2°)

Tertiary alcohol – $(CH_3)_2C-OH$ 2-Methylpropan-2-ol (3°)

b. This classification is based on the number of hydroxyl group they possess. It can be grouped into 4: mono-, di-, tri- & poly hydric alcohol. Monohydric alcohol has only one hydroxyl group present in the alcohols structure. Dihydric alcohol has two hydroxyl groups present. Trihydric alcohols have three hydroxyl groups present. While, polyhydric alcohols/polyols have four or more hydroxyl groups.

Eg: $CH_3CH_2CH_2CH_2OH$ Butan-1-ol, $HOCH_2CH_2OH$ Ethane-1,2-diol

monohydric alcohol — dihydric alcohol

2. Grignard reagents: ethylmagnesium chloride (CH_3CH_2MgCl)

$$CH_3\overset{\delta^-}{C}H_2\overset{\delta^+}{Mg}Cl + CH_3CH_2CH_2CH_2\overset{\delta^+}{C}=\overset{\delta^-}{O}CH_2CH_2CH_3 \longrightarrow CH_3CH_2CH_2CH_2-\underset{CH_3CH_2}{\overset{CH_2CH_2CH_3}{\overset{|}{\underset{|}{C}}}}-OMgCl$$

$$-OMgCl \xrightarrow[OH^-]{H^+} CH_3CH_2CH_2CH_2-\underset{CH_3CH_2}{\overset{CH_2CH_2CH_3}{\overset{|}{\underset{|}{C}}}}-OH + Mg(OH)Cl$$

3. Ethanol can be produced through the following process:
Starchy food materials such as potatoes, yam, rice, cereals, etc are warmed with malt to 60°C for a specific period of time. During this heating, it is 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 when yeast is added which contains the enzyme maltase at a temperature of 15°C

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

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

$C_6H_{12}O_6 \xrightarrow{15^\circ C / \text{zymase}} 2CH_3CH_2OH + 2CO_2$
glucose ethanol

4. Alkanone – ketones
Alkanal – aldehyde

$CH_3CHO \xrightarrow{LiAlH_4/(C_2H_5)_2O}$ CH_3CH_2OH ethanol (1°)
ethanal

$CH_3CH_2C{=}O \xrightarrow{LiAlH_4/(C_2H_5)_2O}$ CH_3CH_2CHOH propanal (2°)
propanone