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MATRIC NO: 19/MHS11/050

DATE: 06-04-2020

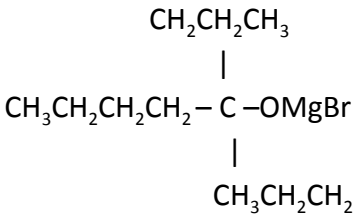
CHM 102 ASSIGNMENT

1. **Major classification of Alcohols and examples**
   a) Classification based on the number of hydrogen atoms attached to the carbon atom containing the hydroxyl 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 (1^0). If it is one hydrogen atom, it is secondary alcohol (2^0) and if there is no hydrogen atom, it is tertiary alcohol (3^0). Examples are; CH_3OH-methanol (1^0), $(CH_3)_3C$-OH 2-Methylpropan-2-ol (3^0).
   b) Classification based on the number of hydroxyl group they possess. Monohydric alcohols have one hydroxyl group present. Dihydric alcohols or glycols have two hydroxyl groups present in the alcohol structure while trihydric alcohols or triols have three hydroxyl groups present in the alcohol structure. Polyhydric alcohols or polyols have more than three hydroxyl groups present. Examples are; $CH_3CH_2CH_2OH$ Propanol (monohydric alcohol), $HOCH_2CH_2OH$ Ethane-1, 2-diol (Dihydric alcohol).

2. **Grignard synthesis of alcohol.**

$CH_3CH_2CH_2MgBr + CH_3CH_2CH_2CH_2C{=}OCH_2CH_2CH_3$ □

(Grignard reagent;
Propyl magnesium bromide)



React with water (H^+OH^-) and dilute acid ?

Mg (OH) Br + $CH_2CH_2CH_3$

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$CH_3CH_2CH_2CH_2$ — C — OH

|

$CH_3CH_2CH_2$

4-propyl octan-4-ol.

3. Industrial manufacture of ethanol

i) Carbohydrate such as starch is used to yield ethanol by the biological process of fermentation. The starch is broken down by enzyme diastase contained in malt at a temperature of 60^0c to give maltose.

Equation: $2(C_6H_{10}O_5)_n + n\ H_2O$ ——————> $n\ C_{12}H_{22}O_{11}$

carbohydrate 60^0c/diastase maltose

ii) The maltose is broken down into glucose on addition of yeast which contains the enzyme maltase and at a temperature of 15^0c.

Equation: $C_{12}H_{22}O_{11} + H_2O$ ——————> $2C_6H_{12}O_6$

Maltose 15^0c/maltase glucose

iii) The glucose at constant temperature of 15^0c is then converted into alcohol by the enzyme Zymase contained also in yeast.

Equation: $C_6H_{12}O_6$ ——————> $2CH_3CH_2OH + 2CO_2$

Glucose 15^0c/zymase Ethanol

4) Reduction of aldehydes and ketones.

Aldehydes and ketones are reduced to primary and secondary alcohols respectively by reaction with hydrogen in the presence of a platinum or nickel catalyst or with complex metal hydride, such as lithium tetrahydridoaluminate (III) ($LiAlH_4$).

RCHO $\underline{H_2(Ni\ or\ Pt)\ cat}$. RCH_2OH

aldehyde or $LiAlH_4$ primary alcohol

R`RCO $\underline{H_2(Ni\ or\ Pt)\ cat.}$ R`RCHOH

Ketone or $LiAlH_4$ secondary alcohol

Specific examples

CH_3CH_2CHO $\underline{H_2(Ni\ or\ Pt)\ cat.}$ CH_3CH_2OH
propanal or $LiAlH_4$ Propanol

$(CH_3)_2CO$ $\underline{H_2(Ni\ or\ Pt)\ cat.}$ $(CH_3)_2CHOH$
propan-2-one or $LiAlH_4$ propan-2-ol