8/4/20

CHM 102

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19/mhs01/1168
MBBS

(1) Discuss the two major classification of alkanols, two examples each

(i) Based on: the number of hydrogen atoms attached to the carbon atom containing the hydroxy group (-OH).
In this classification, alkanols can be grouped into three (3) namely:

(a) Primary alcohol (1°): if the number of hydrogen atoms are 2 or 3

(b) Secondary alcohol (2°): if the number of hydrogen connected is 1.

(c) Tertiary alcohol (3°): if the number of hydrogen atoms is 0.

(d) Examples under this classification.

(i) Methanol (1°) - CH_3OH
(ii) propan-2-ol (2°) - $CH_3CH(OH)CH_3$

(ii) Based on: the number of hydroxyl groups they possess.
There are 4 groups in this classification.

(a) Monohydric alcohol: only one hydroxyl group (1-OH)
(b) Dihydric alcohols (Glycol) - 2 hydroxyl groups (2-OH present)
(c) Trihydric alcohols (triol) - 3 hydroxyl groups present (3-OH)
(d) polyhydric alcohols (polyol) - More than 3 hydroxyl groups present (>3 -OH)

(a) Examples of alcohols in the classification

(i) Propanol - $CH_3CH_2CH_2OH$ (Monohydric alcohol)

(ii) ~~Pentane - 1,2,3-triol~~

Propane - 1,2,3 - triol - $CH_2(OH)CH(OH)CH_2(OH)$ - (Trihydric)

(2) Grignard Synthesis of $CH_3CH_2CH_2CH_2C(=O)CH_2CH_2CH_3$

CH_3CH_2MgCl + $CH_3CH_2CH_2CH_2-C(=O)-CH_2CH_2CH_3$

ethyl magnesium chloride (Grignard reagent)

Octan - 4 - One

$CH_3CH_2^{\delta-}MgCl^{\delta+}$ + $CH_3CH_2CH_2CH_2-C(=O^{\delta-})-CH_2CH_2CH_3$

~~Octyl~~ Decyl magnesium chloride $CH_3CH_2CH_2CH_2-C(CH_2CH_2CH_3)(CH_2CH_2CH_3)-OMgCl$

H^+ OH^-

Acid and Hydrolysis

$CH_3CH_2CH_2CH_2-C(CH_2CH_2CH_3)(CH_3CH_2)-OH$ + $Mg(OH)Cl$

- magnesium hydroxychloride.

4 - ethyl Octan - 4 - ol

(3) Industrial preparation of Ethanol

The Starch containing materials like molasses, potatoes cereals and rice can be used to produce ethanol through the process of Fermentation. The biological catalyst in yeast (enzymes) can be used to break down carbohydrate molecules into ethanol to give a yield of 95%

(i) The starch containing materials are warmed with malt at 60°C for a specific time and are converted to maltose by the enzyme diastase contained in malt.

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

carbohydrate → maltose

(ii) The Maltose is broken down into glucose on addition of yeast which contains the enzyme maltase at a temperature of 15°C

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

Maltose → glucose

(iii) Finally, the glucose at constant temperature of 15°C is then converted into alcohol by the enzyme, zymase. Found in yeast

$$C_6H_{12}O_6 \xrightarrow[15°C]{\text{Zymase}} 2CH_3CH_2OH + 2CO_2$$

Glucose → Ethanol

(e) Determine the product obtained in the reduction of Alkanone and Alkanal with examples.

(i) Reduction of Alkanal gives primary Alcohol

$CH_3CH_2CHO \xrightarrow[[H]]{Li AlH_4 / (C_2H_5)_2O} CH_3CH_2CH_2OH$

Propanal — Propanol (1°)

(ii) Reduction of Alkanone gives Secondary Alcohol

$CH_3CH_2CH_2\underset{\underset{CH_3CH_2}{|}}{C}=O \xrightarrow[[H]]{Li AlH_4 / (C_2H_5)_2O} CH_3CH_2CH_2-\underset{\underset{CH_3CH_2}{|}}{\overset{\overset{H}{|}}{C}}-OH$

Hexan-3-one — Hexan-3-ol (2°)