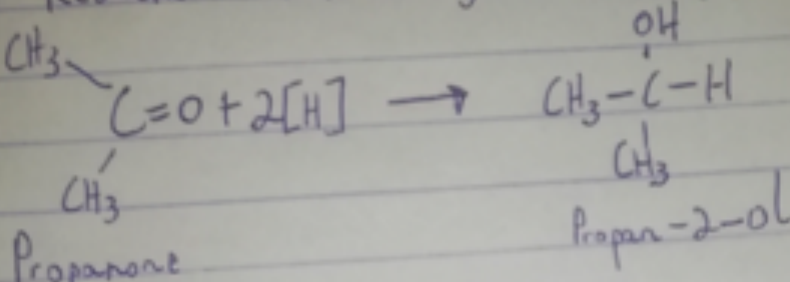
enzyme Zymase contained also in yeast.

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

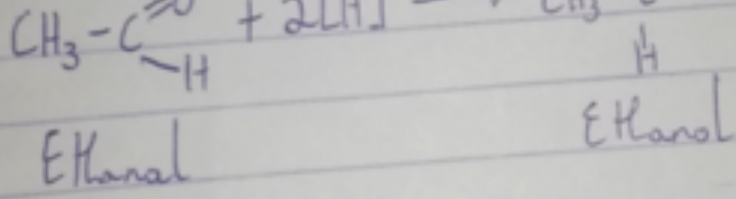
Glucose — Ethanol

4 A - Reduction of Alkanones gives Secondary alcohols



Propanone — Propan-2-ol

B - Reduction of Alkanals gives Primary alcohols



Ethanal — Ethanol

3- Industrial Manufacture of Ethanol

Carbohydrates such as starch are a major group of natural 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 materials include molasses, potatoes, cereals, rice and on warming with malt to 60°C for a specific period of time are converted in maltose by the enzyme diastase contained in the malt

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

carbohydrate → maltose

The maltose is broken down into glucose on addition of yeast which contains the enzyme maltase and 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

The glucose at constant temperature of 15°C is then converted into alcohol by the

1- CLASSIFICATION OF ALCOHOLS

A- This is 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°). If it is one hydrogen atom, it is called secondary alcohol (2°) and if no hydrogen atom is attached to the carbon atom bearing the hydroxyl group, it is called a tertiary alcohol (3°)

Examples are

CH_3OH Methanol (1°), $CH_3CH(OH)CH_3$ Propan-2-ol (2°), $(CH_3)_3C-OH$ 2-Methylpropan-2-ol (3°)

B- This is based on the number of hydroxyl groups they possess. Monohydric alcohols have one hydroxyl group present in the alcohol structure. Dihydric alcohols are also called Glycols have two hydroxyl groups present in the alcohol structure while trihydric alcohols or triols have three hydroxyl groups present in the structure of the alcohol. Polyhydric alcohols or polyols have more than three hydroxyl groups.

Examples are

$CH_3CH_2CH_2OH$ Propanol (Monohydric alcohol)

$HOCH_2CH_2OH$ Ethane-1,2-diol (Dihydric alcohol)

2- $CH_3CH_2CH_2CH_2C{=}OCH_2CH_2CH_3 + NH_4Cl$ (ammonium chloride)

$\longrightarrow CH_3CH_2CH_2CH_2CH_2CH_2CH_2CHO + NH_3Cl$