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CHM 102

19/ENG05/051 / MECHATRONICS ENGINEERING

① Alcohols are ~~as~~ classified into three groups, based on their '-OH group'

① Primary alcohols: In this group of alcohols, the carbon atom that carries the -OH group is only attached to one alkyl group.
Example is $\text{CH}_3 - \text{CH}_2 - \text{OH}$
ethanol

② Secondary alcohols: In a secondary alcohol group, the carbon atom with the -OH group attached is joined directly to two alkyl groups, which may be the same or different. ~~For~~
Example is
$$\begin{array}{c} \text{OH} \\ | \\ \text{CH}_3 - \text{CH} - \text{CH}_3 \end{array}$$
propan-2-ol

③ Tertiary alcohols: The carbon atom holding the ~~the~~ -OH group, in this classification, ~~is attached~~ ^{is attached} directly to three alkyl groups which may be any ~~different~~ ^{combination} of the same or different groups.
Example:
$$\begin{array}{c} \text{OH} \\ | \\ \text{CH}_3 - \text{CH}_2 - \text{C} - \text{CH}_3 \\ | \\ \text{CH}_3 \end{array}$$
 2-methylbutan-2-ol

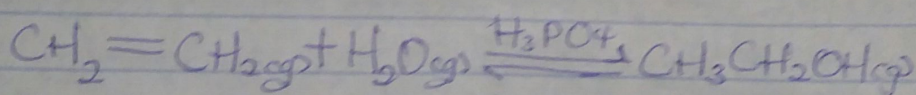
② Smaller alcohols, methanol, ethanol and propanol, dissolve easily in water. This is because the water is able to form hydrogen bonds with the hydroxyl group in these molecules and the combined energy of formation of these water-alcohol hydrogen bonds is more than enough to make up for the energy that is lost when the alcohol hydrogen bonds are broken up.

However, solubility decreases as the length of the hydrocarbon chain in the alcohol increases. At four carbon atoms and beyond

The decrease in solubility is noticeable; a two-layered substance may appear in a test tube when mixed with water. The difference is that the larger alcohols have larger nonpolar, hydrophobic regions in addition to their hydrophilic hydroxyl group. At about four or five carbons, the hydrophobic effect begins to overcome the hydrophilic effect and water solubility is lost.

③ Alcohols are manufactured from alkenes:

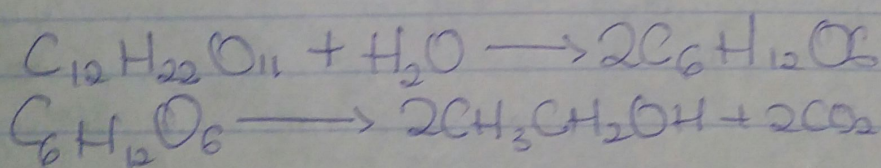
Ethanol is manufactured by reacting ethene with steam. The catalyst used is solid silicon chloride coated with phosphoric(V) acid. The reaction is reversible.



Only 5% of the ethene is converted into ethanol at each pass through the reactor. By removing the ethanol from the equilibrium mixture and recycling the ethene, it is possible to achieve an overall 95% ~~conversion~~ conversion.

~~Alcohol~~ Ethanol can be produced by fermentation of starch:

This is done with substances that contain cellulose, starch or glucose e.g. grapes. ~~It~~ It is done by grinding the starchy material and adding enzymes to break down cellulose and starch into glucose. Enzymes in yeast break down glucose to ethanol and carbon dioxide giving out heat. Fractional distillation is used to get ethanol from the mixture.



⑧ If we have, $\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{OH}$ (propan-1-ol). Heat in the presence of concentrated H_2SO_4 to dehydrate it and form propene ($\text{CH}_2=\text{CH}-\text{CH}_3$)

$\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{OH} \xrightarrow{\text{concentrated } \text{H}_2\text{SO}_4, \text{ heating}} \text{CH}_2=\text{CH}-\text{CH}_3$

Add water to the propene. Mercuric acetate can also be used as it favours Markovnikov addition)

