

Alkenes and Ethanol

Alkenes Have a C=C Double Bond

- Alkenes are hydrocarbons which have a double bond between two of the carbon atoms in their chain.
- They are known as unsaturated because they can make more bonds — the double bond can open up, allowing the two carbon atoms to bond with other atoms.
- The first three alkenes are ethene (with two carbon atoms) propene (three Cs) and butene (four Cs).
- All alkenes have the general formula – C_nH_{2n} — they have twice as many hydrogens as carbons.
- **Test for alkenes (unsaturation)** – Bromine water is a dilute solution of bromine, normally orange-brown in colour. It turns colourless when shaken with an alkene, but its colour remains the same when it is shaken with alkanes.

Ethene	C_2H_4	<pre> H H C=C H H</pre>
Propene	C_3H_6	<pre> H H H H-C-C=C H H</pre>

Ethene Can Be Reacted with Steam to Produce Ethanol

- Ethene (C_2H_4) will react with steam (H_2O) to make ethanol.
- The reaction needs a temperature of 300 °C and a pressure of 70 atmospheres.
- Phosphoric acid is used as a catalyst.
- **Advantage** - At the moment this is a cheap process, because ethene's fairly cheap and not much of it is wasted.
- **Disadvantage** - The trouble is that ethene's produced from crude oil, which is a non-renewable resource and which will start running out fairly soon. This means using ethene to make ethanol will become very expensive.

Ethanol Can Also Be Produced from Renewable Resources

The alcohol in beer and wine etc. isn't made from ethene — it's made by fermentation.

- The raw material for fermentation is sugar. This is converted into ethanol using yeast.
- This process needs a lower temperature (30-40 °C) and simpler equipment than when using ethene.
- Another **advantage** is that the raw materials are all renewable resources. Sugar is grown as a major crop in several parts of the world, including many poorer countries. Yeast is also easy to grow.
- The ethanol produced this way can also be used as quite a cheap fuel in countries which don't have oil reserves for making petrol.
- There are **disadvantages** though. The ethanol you get from this process isn't very concentrated, so it needs to be distilled to purify it.