

Worksheet 11.7

Ethanol production

When chemicals are manufactured, there are always costs involved. The main costs in a chemical factory are:

- ◆ raw materials
- ◆ energy
- ◆ workforce
- ◆ transport.

Ethanol can be manufactured in two ways:

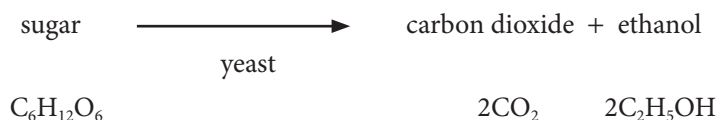
- 1 from sugar by using the enzymes in yeast
- 2 from petroleum by distillation, cracking and reaction of ethene with steam.

These two processes are described below. You must decide which of the two processes is better and give reasons. There are reasons for and against each process and not everyone will reach the same conclusion.

Ethanol from sugar – this process is used in Brazil

Sugar cane grown in large quantities in the hot, wet climate in Brazil is harvested and crushed to obtain the juice. Some of the juice is used to make sugar to be sold, but some has yeast added to it.

Yeast is a microorganism which feeds on the sugar by using this reaction:



The sugar is slowly changed to ethanol and the carbon dioxide steadily bubbles off.

When the solution contains about 12% of ethanol, the yeast dies because ethanol is a poison.

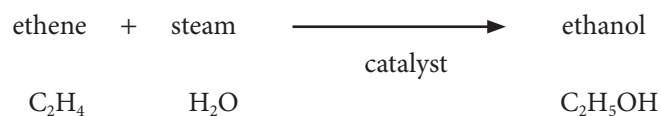
A 12% solution is not sufficiently concentrated to be used so it must now be fractionally distilled to increase the concentration to about 90% ethanol. Distillation requires heat and this is obtained by burning the dried sugar cane, which has been crushed.

The alcohol produced can be used to make rum but most of it is used to power cars. Many of the cars in Brazil are built to run on ethanol because Brazil does not have its own supply of petroleum to distil gasoline from.

Ethanol from petroleum – this process is used in Europe and America

Petroleum from oil wells is distilled to make petrol (gasoline) and other useful substances. In order to get more petrol, some of the denser, oilier fractions are cracked. A lot of ethene is produced as a by-product of this cracking process. Some of the ethene is used to make the plastic poly(ethene), but some is also used to make ethanol.

The ethene is reacted with steam by using a catalyst.



The ethanol produced in this way is almost pure. The reaction happens automatically in the plant and is controlled by computers.

The ethanol produced is used as a solvent and to make other organic chemicals.

Some other useful information

Labour costs are not necessarily the same in all parts of the world.

Petroleum is a fossil fuel and will one day run out. Sugar can always be grown.

Alcohol is more likely than petrol to damage car engines.

Alcohol is a much safer fuel than petrol because it does not ignite as easily.

The price which sugar can be sold for is increasing.

The price of petroleum goes up and down frequently according to the political situation.

Your task is to produce a PowerPoint or poster display presenting your arguments for which of the two methods of ethanol production is more effective. Be prepared to discuss the issues in a group or in a class debate.