Current Biofuels

Bioethanol

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SEM image Yeast cells budding

Background

Bioethanol is produced by fermentation of simple monosaccharide and disaccharide sugars by yeast such as *Saccharomyces cerevisiae* (seen on the right) or *Escherichia coli*. The bacterium *Zymomonas mobilis* is a promising alternative to yeast due to its greater sugar uptake, yields and resistance to ethanol concentrations. Currently sugar beet (15%), sugar cane (27%), maize (22%) and wheat (25%) are the main sources of sugar for bioethanol production using current methods, though rice is also a popular feedstock. Sugar cane is produced on a large scale in Brazil and sugar beet is cultivated in the UK. There are currently a number of bioethanol plants in the UK, using wheat or sugar beet as feedstocks.

Bioethanol is currently produced and used more than any other biofuel. It is widely used in the USA and Brazil as a replacement for petrol. There are many advantages to the use of bioethanol as a transport fuel which has led to a rapid increase in production in the USA and Brazil. Currently common crops familiar to farmers can be grown on a large scale to produce bioethanol, with Brazil producing over half the ethanol traded globally. The processes involved in production, such as distillation, are well-established technologies with existing infrastructure for industrial levels of throughput and distribution. The final product is also compatible with existing vehicle engines and can be mixed with fossil fuels. Up to 10% blends with petrol can be used without modifying vehicle engines. In some parts of the USA this is now mandatory and in Brazil legally required blends are 25%. With further development, engines designed to accommodate greater proportions of bioethanol will be more efficient and produce less emissions. In comparison to petrol, life-cycle assessment of Brazilian bioethanol production leads to emission of 80% less greenhouse gases.

Bioethanol is not an ideal fuel as it is corrosive and attracts water (hygroscopic). This causes problems with existing vehicle engines and presents difficulties in storing and distributing the fuel through the current transport infrastructure. Vehicle engines require more modifications if using bioethanol than biodiesel. Bioethanol is also less efficient as it only yields about 70% of the energy content of petrol.