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Ethanol from the Field to the Pump

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Ethanol can be made from any plant that contains sugars. These plants are collectively known as feedstocks.

Some plants are easier to grow and make into ethanol. This is why corn and soybeans are the primary crop used for ethanol in the mid-west.

According to the U.S. Energy Information Administration, in 2005 more than 81 million acres of corn and nearly 72 million acres of soybeans were grown.

Ethanol is also referred to as ethyl alcohol and is a colorless, odorless, liquid. It is made up of hydroxyl groups bonded to carbon atoms to form CnH2n+1OH. It has the same structure no matter what plant it is produced from.

Because the available land for farming is limited, researchers are trying to produce corn and soybean plants that produce higher yields.

Other plants used for ethanol include: sugar cane in Brazil, sugar beets in Europe, and forestry wastes.

When the grain comes in from the fields it is held in storage bins until it goes through the hammer mill which grinds it into flour.

The grain is then mixed with water with a slightly acidic pH and an alpha-amylase enzyme. (At this point the mixture is referred to as slurry.) The slurry is heated to reduce the viscosity.

Next the slurry goes through a cooker which has a temperature of 221°F. It is then cooled and held at about 180°F for 4-5 hours to give the alpha enzyme time to break down the starch. A second enzyme glucoamylase is added and the slurry is then sent to the fermentation tanks.

The slurry is then moved to a fermentation tank where it is mixed with yeast to start fermentation. This process produces alcohol and CO2.

The mixture is then sent through the beer column where the alcohol is boiled off. The solid grain is dried and sent off to be used as cattle feed and the alcohol is moved on to the stripper where it goes through a second stage of distillation.

A third stage of distillation by a rectifier column brings the alcohol to 99 proof.

When used in fuels, ethanol is normally mixed with different percentages of gasoline. Most unleaded fuels now contain between 5% and 10% ethanol. These fuels are marked with an E-rating such as E10 which would have 10% ethanol concentration.

The highest blend of ethanol in the U.S. is 85% or E-85. E-85 can only be used in Flex Fuel vehicles. Higher blends such as E-95 and E-100 are produced and used in other countries.

The 95% ethanol is sent through a molecular sieve which filters out the remaining water. The ethanol is now pure and is ready to be sent to the fuel production facilities to be mixed with gasoline.

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