

What are biofuels?

Biofuels are produced from biological carbon sources such as sugar cane, corn, switchgrass, and cellulosic plant material. They differ from fossil fuels because they are produced from recently dead organic material, whereas fossil fuels come from long dead (millions of years!) sources. The two most common types of biofuels are biodiesel and ethanol. Biodiesel is made from recycled cooking grease or a variety of plant oils. Ethanol is an alcohol made from sugar using a process similar to brewing beer or fermenting wine. Ethanol can be made from many feedstocks – corn grain in the US and sugarcane in Brazil are currently the most common, but other substances like cellulosic materials have potential to be used in the future. The biggest challenge in creating useful feedstocks is efficiently converting biomass into sugars to be fermented into ethanol.

What are sugar, ground corn, corn meal, and stover, and what are their uses in biofuels?

Table sugar, or sucrose, is one of the easiest substrates for yeast to convert into ethanol. Through fermentation, yeast breaks down sugar into carbon dioxide and ethanol. Sucrose ($C_{12}H_{22}O_{11}$) is a disaccharide made of fructose and glucose.

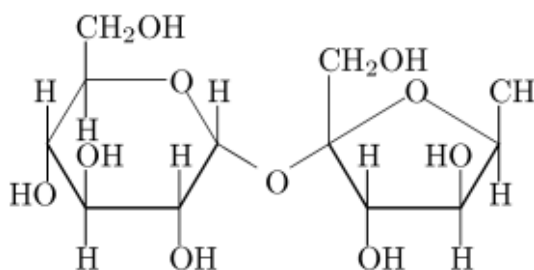


Figure 1. Sucrose is a disacchride made from the monosaccharides fructose and glucose.

Both ground corn and corn meal contain high quantities of starch, which can be broken down into simple sugars with use of enzymes or heat treatment. Ground corn and corn meal are similar products, but depending on processing and added ingredients, corn meal may be chemically different than ground corn, and may produce different results. Grain corn is genetically different from sweet corn, which contains more sugar than starch in the ear and is consumed as a vegetable.

Stover is the stalks, leaves, cobs, and husks of the corn plant, which is often discarded as waste. Stover contains a large amount of cellulose, which is the most abundant organic compound on earth. Breaking down this cellulose into usable sugars requires chemical treatments, enzymes, or heat. Figuring out how to efficiently convert cellulosic material into ethanol would unlock an enormous source of renewable energy. The main difference between stover (cellulose) and corn (starch) are the types of bonds that hold the chains together.