**Cellulosic Ethanol**

Cellulosic ethanol, a second-generation biofuel, is created from biomass sources such as wood, organic waste, food waste and specific biomass crops. Fast growing trees, such as poplar trees, need to undergo a series of chemical reactions that break down lignin, the “glue” that holds plants together, in order to make the fuel. This pretreatment step involves thermochemical or biochemical reactions that unlock the sugars embedded in fibers of the plant. After this step, the process to generate plant ethanol resembles that of corn ethanol. Additionally, straw and other forest residues can go through a thermochemical step that produces syngas (a mixture of carbon monoxide, hydrogen and other hydrocarbons). Hydrogen can be used as a fuel and the other hydrocarbons can be used as additives to gas oil. Currently, there is not a large commercial cellulosic ethanol market in the United States, which makes widespread production and distribution difficult.

Second-generation biofuels address many issues associated with first-generation biofuels like corn ethanol. They don’t compete between fuels and food crops since they come from distinct, non-food crop biomass. Second generation biofuels also generate higher energy yields per acre than first-generation fuels. They allow for use of poorer quality land where food crops may not be able to grow. The technology is fairly immature, so it still has potential of cost reductions and increased production efficiency as scientific advances occur.

However, some biomasses for second-generation biofuels still compete with farmland use since some of the biomass grows in the same climate as food crops. This leaves farmers and policy makers with the hard decision of which crop to grow. Cellulosic sources that grow alongside food crops could be used for biomass, such as corn stover (leaves, stalk, and stem of corn). However, this would take away too many nutrients from the soil and would need to be replenished through fertilizer. In addition, the process to produce second-generation fuels is more elaborate than first-generation biofuels because it requires pretreating the biomass to release the trapped sugars. This requires more energy and materials.





