PRODUCING MIXED ALCOHOLS FROM BIOMASS

Jen Swenton & Matt Behring

Executive Summary

Record CO_2 emissions and an ever increasing demand for energy are pushing our environment to the brink. Extensive research is being done to provide clean and sustainable energy sources that can meet the worlds need. Dr. Mark T. Holtzapple has developed a MixAlco process that converts biomass to a mixture of short chain alcohols. These mixed alcohols burn cleaner with less CO_2 emissions as compared to petroleum based fuels. Also these mixed alcohols have favorable characteristics for the current fuel industry. Mixed alcohols can be blended to current petroleum based fuels to improve their emissions and efficiency. As an additive, mixed alcohols are more favorable than current additives because of their low vapor pressure, high energy content, and environmentally friendly properties.

The MixAlco process is capable of using numerous feedstocks of biomass. The best yields are obtained using a mixture of agricultural foliage and livestock waste. Sorghum and cattle manure are used as the feedstock of this project. For this reason the plant location was selected in western Kansas. Kansas has connections to current petroleum infrastructure that can be used for transport. With a large agricultural community and connections to infrastructure, Kansas is the ideal location. A plant capacity of 40 metric tons of biomass per hour was chosen. This plant size has economic benefits and an initially small impact on local markets. This plant capacity chosen will produce 45 million gallons of mixed alcohol per year.

During the economic analysis several capacity options were examined ranging from 2 metric tons of biomass per hour to 800 metric tons of biomass per hour. It was determined that increasing capacities yielded lower product costs on a per gallon basis. However, the two largest options were not considered viable because their complete impact on local markets has not yet been studied. Theoretically, mixed alcohols can be sold at current market prices for gasoline because it can entirely replace them. Thus, 2 dollars per gallon was chosen as the sales price for all plant size options. When considering uncertainty in prices, it was found that this sales price is profitable. For the 40 metric ton of biomass per hour plant, the total capital investment was $23.1 million with a net present worth after ten years of $260 million.