# Synthesis and Combustion of Biofuels

Christopher Churley and Alexandria Prox

## ABSTRACT

Fossil Fuels can be extremely expensive and can harm the environment in many different ways. The resources that are currently used will not be around forever and are becoming more and more limited. Renewable resources will need to be more widely used for future use of energy to continue. In this experiment biofuels were made from from corn, seaweed(algae), and sorghum. he ability of the combustion reaction in order to determine the best source.

## INTRODUCTION

Since the Industrial Revolution fossil fuels have been the primary fuel source for most humans. Over the last several hundred years fossil fuels and human progress have gone hand in hand, as these non-renewable resources power not only our machines but also our innovation. It is only recently that the more dangerous side effects of fossil fuels are being realized, and now the use of these resources is leading humanity towards a path of destruction rather than one of progress. Humans must begin to explore renewable resources as a fuel for the future, an one of the most promising candidates is all around us: Biofuels.

## OBJECTIVES

To find an alternate source of energy to start replacing fossil fuels. To find burning temperatures and rates of each material to see if it is combustible. To work with distilling rates and see if it is reasonable to use in the real world.

Figure 1: The start of the heating of the corn “mash”

Figure 2: The final products after distillation

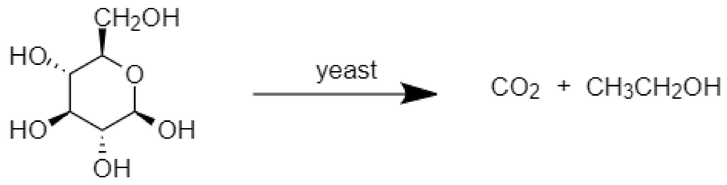


Figure 3: The process of fermentation produces ethanol and carbon dioxide from glucose

## METHODS

1. Start by making the mixture
   - Add ½ cup of sugar , ½ cup of water and 1 cup of the main material used
   - Mix well for 5 minutes to make sure everything is blended
   - Add 1 table spoon of yeast and mix again for a minute to make sure the yeast starts to react
2. Place in sealed container and let sit for 1 week
3. After 1 week separate the liquid product from the solid mash
4. Distill the liquid product using either the vapor condenser method or the pressure cooker method

   For pressure cooker method:

Add ice to a bucket and run the pipes through it. Heat the mixture to 80 ℃ . Collect the ethanol that is cooled back to liquid in the pipes

   For vapor Condenser method:

Run cold water through the vapor condenser. Heat the liquid to 80℃. Collect the distillate in a flask.

5. Weigh the fuel to test the density and also take a small amount and place it on a fireproof surface and test how fast it burns.

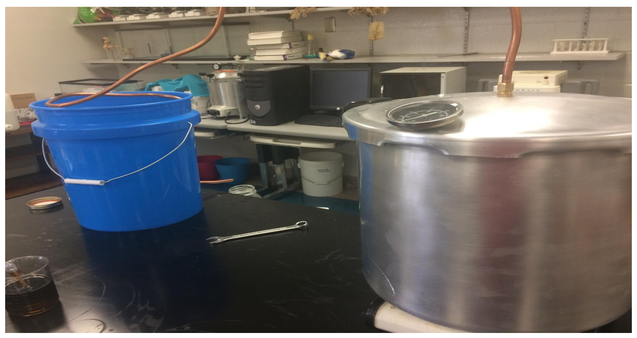

Figure 4: The pressure cooker distilling process

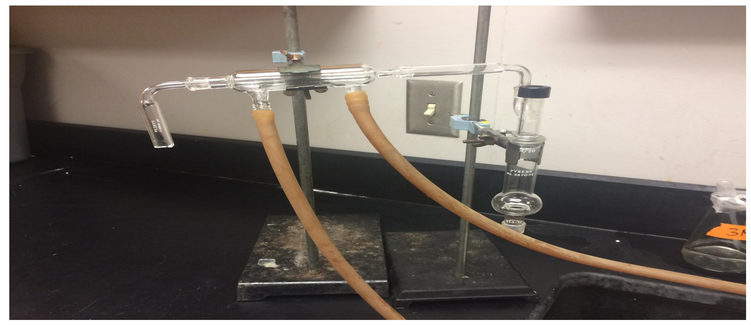

Figure 5: Distillation under reflux in a vapor condenser

## RESULTS

- Ethanol has about 30 percent less energy per unit then gasoline
- Each source started with 16oz of material
- Gasoline density is .700 g/cm^3
- Corn mix density .792 g/cm^3, final mix 5.20 oz
- Seaweed density is .784 g/cm^3 final mix 4.96 oz
- Sorghum mix density .802 g/cm^3 final mix 6.84 oz

This means the best mixture to use was the sorghum because it distilled the most efficiently compared to the other materials

## CONCLUSIONS

The ethanol produced from the sorghum mix was the most pure and efficient in combustion. The corn and seaweed mixes still provided experimentally viable amounts of ethanol, but under the current conditions sorghum is the best choice for a reactant in the ethanol making process

## FUTURE WORK

Due to the multiple steps involved in the process, from fermentation to distillation to combustion, future work could be done to measure the efficiency between each step rather than at the end of all steps. This could be used to help increase the efficiency of the ethanol making process, which would be valuable in helping to make biofuels a viable fuel source in the future.

### REFERENCES

Brandvold, Timothy A., Daniel L. Ellig, and Francis Stephen Lupton. Pretreatment of Fats and Oils in the Production of Biofuels. Patent US 2012/0167454 A1. 5 July 2012. Print.

Perry, Stephen C. Combustion Modifier and Method for Improving Fuel Combustion. Patent US 8323362 B2. 4 Dec. 2012. Print.

Skye, Jared. “Advantages and Disadvantages of Biofuels.” *lovetoknow*. N.p., n.d. Web. 14 Oct. 2015.

### ACKNOWLEDGMENTS

Thanks to Dr. Vania De Paoli and Dr. Anne O’Connor for advice and assistance