

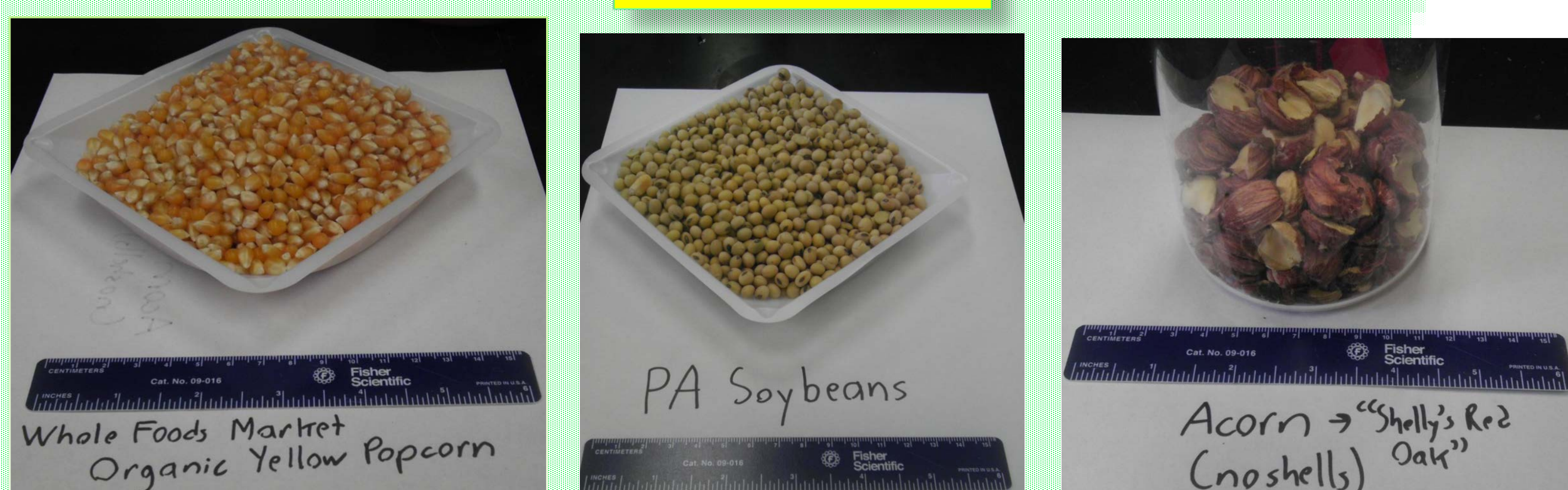
Extracting Oils and Fermenting Carbohydrates from the Same Seed Source to Maximize Biofuel Yields

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Introduction

The demand for alternative energy sources is increasing as the demand for energy and the environmental impacts of fossil fuels have increased. The objective of this project was to both extract the oils (that can be used for biodiesel) and ferment the remaining sugars and starches to form ethanol.

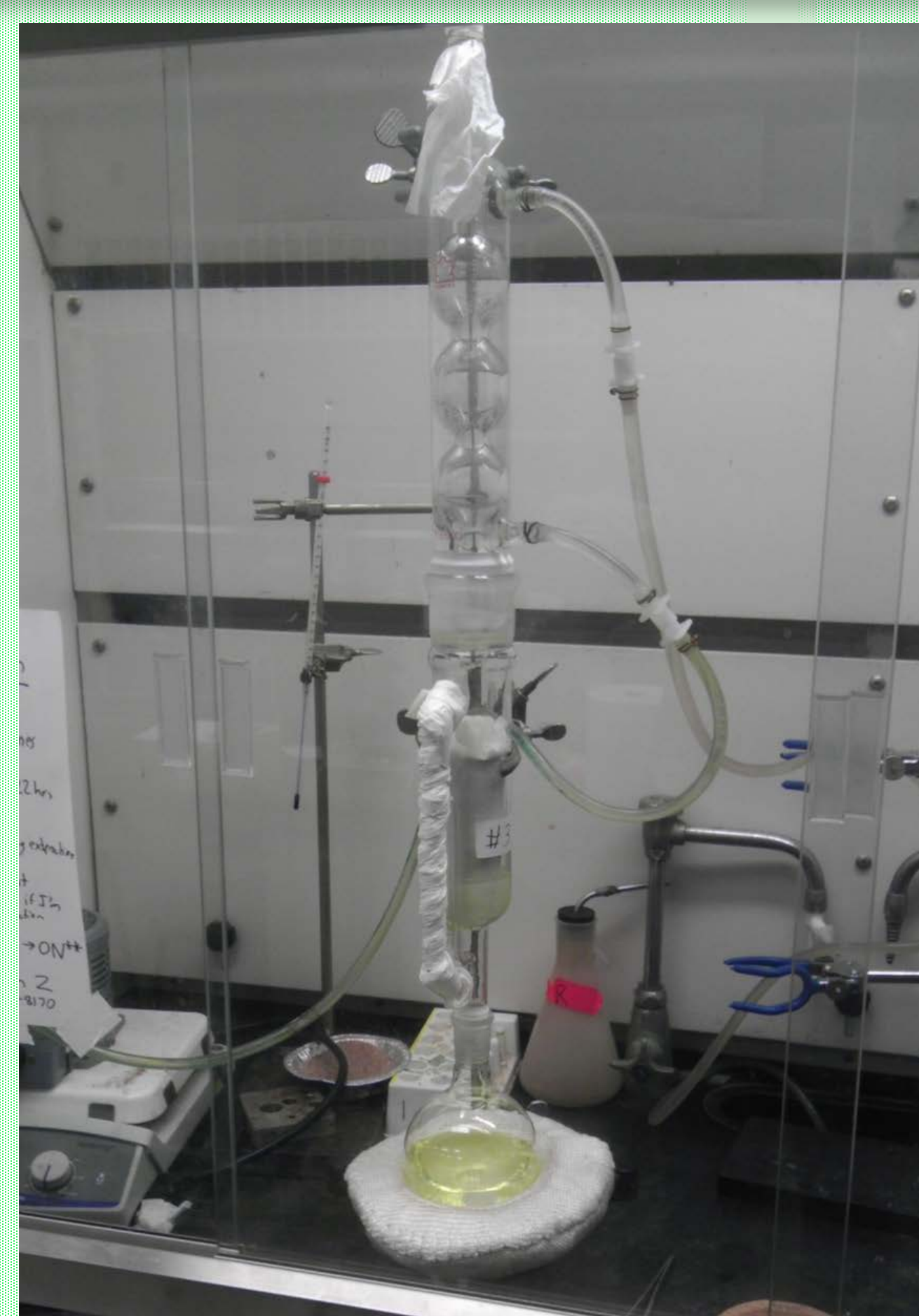
The Samples



Methods

The first step in the process is to turn the seeds into a flour for oil extraction. This involves dissolving the oil in hexanes and capturing the mixture. The hexanes are evaporated and the left over oil is weighed.

Step #1) Soxhlet Oil Extraction



The second step is to then ferment the oil extracted flour. The flour is treated with α -amylase and glucoamylase the break starches into sugars. Next, Ethanol Red[®] yeast was used to convert the sugars into ethanol.

Step #2) Mash Fermentation



The final step is to remove the ethanol from the fermented mash via distillation. The distillate is then analyzed on a gas chromatogram flame ionization detector.

Step #3) Distillation



Experimental Data

	Corn	Soybeans	Acorns (no shells)
Sample Size	111g	92.6g	98.5g
Oil	3.56%	19.22%	18.95%
Alcohol	33.4mL	4.39mL	13.8mL

Results

The oil yields for each of the samples were consistent with the USDA reports taking into account different plant species and growing variables. Both the corn and acorn fermentation was successful and the corn alcohol yield was 75% as efficient as the optimal conditions. The soybeans were less efficient at ethanol fermentation than expected.

Conclusion

The overall experiment was successful and we are able to extract two different types of biofuel from the same seed together. The method requires further optimization, especially concerning fermentation. This experiment could also be improved by testing a larger variety of seed sources as well, such as seeds that do not impact food stocks.

Acknowledgments

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Reference

¹ United States Department of Agriculture. *USDA National Nutrient Database for Standard Reference*²⁶. August 3, 2014.

USDA Nutritional Reference¹

	Corn	Soybeans	Acorns
Fats	4.74%	19.64%	23.86%
Sugars	0.64%	7.33%	--no data--
Starches	74.26%	30.16%	40.75%