

### **Experiment #7: Fermentation and Production of Ethanol**

Take your time during the distillation process, don't just crank up the heat and let it go. Also consider doing another distillation of your distillate. This provides a much purer sample and makes the product easier to lite. CA

Make sure that you let the solution cool before adding yeast and enzymes. Otherwise, the yeasts will die and the enzyme will denature. LM

To produce high ethanol yield, you should monitor the temperature during distillation and prevent it from getting too high. LM

Also it is important to weigh the beaker with fermented MASH the following week, as this data is needed for the calculations of %yield. KB

It is important to weigh possibly everything in this lab, as in mass of starch source like corn, rice, potatoes, etc, mass of beaker, mass of beaker+ fermentation solution, final mass of beaker +mash after fermentation, distillate flask, distillate flask +distillate. The reason being is that all of these are important for calculations you will need to provide in your lab report! AG

During the distillation process, make sure to distillate very slowly. The slower and the smaller amount of distillate seemed to produce the highest proofs in the class. DD

his should go without saying but I did it so chances are it will happen to some one else. Make sure that the fermented mash you distill is your own and not another beaker that was also sitting in the hood.

P.S. If you work in hood 2R and I am really sorry that I distilled the wrong mash. If you distilled mine I would be very interested to know what your refractive index and percent alcohol was. NL

When lighting the alcohol on fire, do it outside the fume hood and on the lab tables. If you do it in the fume hood the ventilation may prevent the reaction. When lighting it on fire outside of the fume hood make sure that no papers or matches are located near the watch plate and fire. JS

When your crude product is analyzed, you will be told how much ethanol is in your product by a percentage, but you should also record the refractive index. This can then be compared to the refractive index of pure ethanol.

Also, if you choose to do potatoes for this lab, after boiling them in water, mash them so that there are no big chunks left. By doing this you are ensuring that you will get as much ethanol as you can from your total mass of potatoes, because you will have to filter out the chunks later. RR

In the chromic test don't worry if you get a different color for your test from your partner. The colors and texture may vary from dark green to even dark teal. The colors depend on the type of starch source you choose. PO

When you are boiling your starch source make sure it does not stick to the bottom, if it does add more water to the beaker. LC

Do not forget to weigh the mass of your mush at the beginning of the second part of the experiment. JV  
If you want to get a high refractive index percentage for thiis lab, it is best to use the rice. People who did that seemed to get up to 60%. I used potatoes Make sure and take the weight of the mash before the distillation process otherwise, you will not know how much you distilled. also, the smaller scales will not be able to weigh the mash and your starch sample because they are very heavy. You are going to want to use a different scale. NT

## Student Comments Spring 2009 Dominican University

People also seemed to get higher refractive indexes when they stopped distillation and then continued. Their yields seem higher than people who distilled once and even twice. AJ

A couple of tips for this lab:

- Rice seemed to yield the product with the highest percentage of alcohol.
- Pre-heat the hot plate at the start of lab.
- Stir your solution so that the starch source does not get burned on the bottom of the beaker.
- You must allow the beaker to cool to room temperature before adding the enzymes.
- Pre-heat the thermwell so that you save some time during distillation.
- Additional distillations will increase your alcohol content. BL

Distilling at a lower temperature also yields a higher percentage of alcohol. If you rush through the distillation and distill at 100 degrees you might have a lower percentage of alcohol than someone who distill at a lower temperature but spends a longer time distilling. MZ

Use the corn it is more easier to filter out than potatoes. MJ

The rice seemed to turn out a fairly high yield of ethanol. I also thought that distilling a little longer would increase the yield. It did but not as much as I expected, I guess overall efficiency is a little better than trying to make up for sloppiness at the end. DF

When lighting the product on fire, be sure to wash the watch glass thoroughly before attempting to light it on fire b/c any residual contaminants found adhered to the glass can interfere with being able to successfully light the product on fire. SF

this is a tip that most science people should know, but i saw it happen several times to my peers and to myself during this lab. Please do not place a hot beaker into a beaker of ice. It is VERY important to cool your beakers to room temperature before you put it in the ice bath..otherwise it will crack TM

Treat the corn, potatoes, or rice with hot water before starting the experiment. The literature seems to suggest that this technique increases the amount of ethanol extracted from corn so maybe it will work with potatoes and rice too. CA

A secondary distillation almost doubles the content of alcohol in your product. BL

When distilling, slowly boiled the mixture. This may increase the amount alcohol that is distill out. BMB

he cheese cloth was still a bit slow. Maybe a different way to vaccum filter the product. MJ

One of the most interesting things about organic chemistry is the fact that humans have been conducting experiments in organic chemistry for many years (although maybe they didn't know it!). I think a great improvement to this lab would be to research the people and cultures that fermented the chosen starch. Learn how they grew the starch, how they fermented it, how they purified it and what they did with the alcohol. It's a great real-world historical application to the lab experiment. JW