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CHEM214: Organic Chemistry II
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01/27/2021

Lab Report: Recycle Waste from Diesel Production

The purpose of the experiment was to separate a solution by distillation and obtaining a purified solution of alcohol for later use in the synthesis of biofuel. Distillation is a process in which through the different volatility points of different compounds, the separation of them is obtained. Compounds in solution contain different boiling points, so heating the solution to a temperature that exceeds the boiling point of one compound, without exceeding the boiling point of the other compound, will result in the conversion to vapor of the compound with the boiling point that has been exceeded. The resulting vapor will travel to the sidearm of the distillation apparatus, and then to the condenser. The condenser has its own insulated tube. In the condenser, there are two different tracks, one for the input of cold water and the other for the outflow of cold water. The one closest to the distilling flask is the outflow hose of cold and the one closest to the collecting flask is the input hose of cold water. The purpose of the cold water flow is to "condense" the vapor to a liquid state.

In this experiment, two distillations have been carried out. The first one consisting of the distillation of water and glycerol, and the second experiment consisting of distillation to separate water from methanol.

1. First Experiment: Simple Distillation of Water and Glycerol

Materials needed

Distillation Apparatus
Condenser
Heating mantle
250ml Distillation Erlenmeyer flask
3 x 100ml collecting flask for the 3 drops
Heating mantle
Thermometer: positioned just below sidearm

This solution contained 4 moles of water (bp=100°C) and 1 mole of glycerol(bp=290°C). Therefore, the mole percent of the compounds were 80 mole percent and 20 mole percent respectively.

*bp= boiling point

SAFETY REMINDER: Goggles, laboratory, gloves, because some compounds are highly flammable.

1. Set up the heating mantle in the distillation apparatus
2. Install the flask containing water and glycerol in solution to the distillation apparatus
3. Install collection in the distillation apparatus. This will ensure that your sample is collected.
4. Install thermometer in the distillation flask. Notice that the data wanted is the temperature of the vapor, so the thermometer must be installed below the sidearm

5. Turn on the heating mantle so the temperature can rise and begin the boiling process of the solution. This temperature will be 110°C
6. Once it has reached the desired temperature, the first sample will be collected in the collecting flask.
7. Turn of the heating mantle to avoid safety issues
8. Collect the first sample by removing the collecting flask. This sample will contain water because it has a boiling point of 100°C, therefore the mole percent of water in this first sample will be 100
9. Install a second collecting flask in the distillation apparatus
10. Turn of the heating mantle to avoid safety issues
11. Collect the first sample by removing the collecting flask
12. Install a third collecting flask in the distillation apparatus

Notice: As the reaction continues and the different samples are collected, the mole percent of water in the distillation flask is decreasing. When a compound boils, the temperature remains constant. Since water boils at 100°C it can be seen water being distilled from the mixture as a flat line at that temperature.

2. Second Experiment: Distillation of methanol and water

Materials needed

Distillation Apparatus

Condenser

Heating mantle

250ml Distillation Erlenmeyer flask

250ml collecting flask

Heating mantle

Thermometer: positioned just below sidearm

This solution contained 3 moles of methanol (bp=65°C) and 2 moles of water (bp=100°C). Therefore, the mole percent of the compounds were 60 mole percent and 40 mole percent, respectively.

SAFETY REMINDER: Goggles, laboratory, gloves, because some compounds are highly flammable.

1. Install the distillation flask containing 2 moles of water and 3 moles of methanol in the distillation apparatus
2. Turn on the heating mantle, so the temperature can rise and begin the boiling process of the solution. This temperature will be around 70°C
3. Turn of the heating mantle to avoid safety issues
4. Collect the first sample by removing the collecting flask

Result: This separation does not work because there is a difference of less than 70°C in the boiling points of the two compounds

The sample collected from methanol would be 83 mole percent because the methanol is not hundred percent pure. As the mole percent of methanol decreases in the distillation flask, the mole percent of methanol also decreases in the collection flask

I do not have a significant amount of experience performing chemical experiments. In Spain, unlike in the United States, students do not usually do experiments until they get to university. With this distillation experiment, I have learned that there are

two types, simple and fractional distillation. As seen in the first experiment, the difference between the boiling points of water compared to that of glycerol is almost 200°C . This large difference makes it possible to distinguish clearly when each compound begins to vaporize (Figure 1). The distillation of water and methanol, on the other hand, cannot be carried out because the difference between boiling points is very small. Therefore, it is not possible to see a clear distillation of one compound as opposed to the other (Figure 2). Another detail learned after this experiment is that to have a more exhaustive control of the temperature, it is ideal that the thermometer is positioned slightly below the sidearm, since what there must be controlled is the temperature of the vapor and not of the liquid. Another knowledge acquired is that, as the pressure decreases, the boiling point of the compound of a certain compound also decreases. This has been the first experience I have had with Labster. It is quite dynamic and helps the student to think about how the reaction will progress. Perhaps one of the things I would incorporate would be to know how long it would take for the experiment to bring to completion in real life. Another improvement on my part in the case of this experiment would be to be able to check the samples of each flask obtained in the first experiment, to see more visually as well, the change of concentration in the distillation flask. Overall, I think the app is well designed to make the student feel comfortable to perform the required experiments.

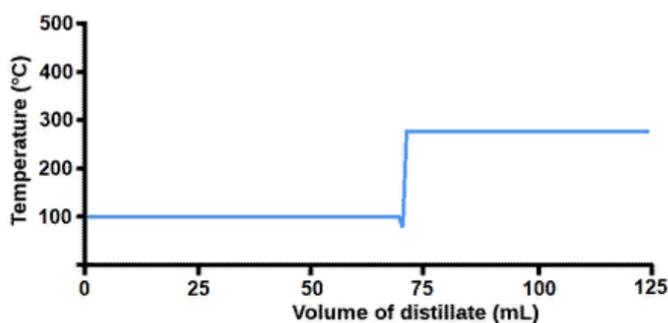


Figure 1: Water/glycerol temperature vs volume plot

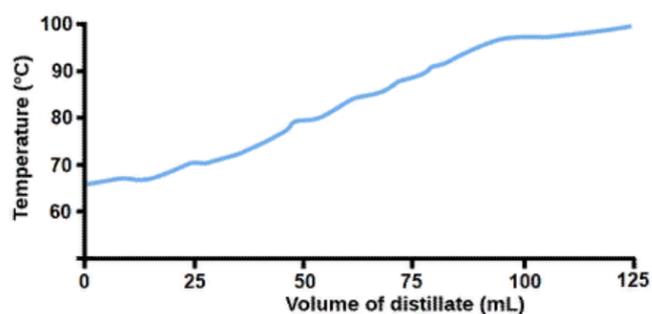


Figure 2: Water/methanol temperature vs volume plot