

SEPARATION OF LACTOSE FROM MILK

TAVITA MOE III, JOVE AVILA, OSCAR OLIVA II
Saint John Bosco High School Chemistry
July 8, 2015

ABSTRACT

The purpose of this experiment was to separate the sugar from spoiled whole milk. The major outcome that we wanted was to get as much sugar out of spoiled whole milk as possible.

The experiment took about 2-3 days to complete because of how long the sugar formed. Although, with the help of an ice bath, it sped up the reaction of crystallization with the sugars. By the end of the lab, sugar crystals formed at the bottom of the flask.

INTRODUCTION

Lactose is a disaccharide of galactose and glucose units, joined by a *B*-glycoside linkage. For an average serving size of whole milk which is 8 fl oz there is on average 11g of sugar. We believe that if we add 10 ml of acetic acid to our spoiled milk and strain out the casein we will be able to find the amount of sugar in the spoiled whole milk. This is important to study because it is good to know for athletes. For example it is good about protein, calorie intake, etc.

The purpose of this experiment is to separate the lactose from the spoiled milk to receive sugar crystals. We are expecting that out of our 100ml beaker of spoiled milk there will be about 5 grams of sugar left over.

One of the first precautions to take in this lab is to wear goggles so the chemicals don't affect your eyes. When taking beakers or evaporating dishes off the hot plate, make sure to use hot hands or tongs to avoid burns. Do not at all times put any of the liquid or chemicals within your mouth or near your face. When smelling the reaction, remember to waft and not to smell directly from the beaker or flask. When boiling the solution, use a boiling chip to prevent the solution from popping or foaming to the top of the beaker. Clean up and washing of the hands is important after the lab is complete.

MATERIALS / CHEMICAL LIST

250 ml beaker (2-3), Thermometer, Hot plate, Boiling chips, Goggles, Glass stirring rod, Buchner funnel / Filter paper, Rubber stopper, Cheese cloth, Vacuum, Erlenmeyer flask, Graduated Cylinder, Whole milk (spoiled), 10% acetic acid, CaCO₃, Decolorizing carbon, 91% of Isopropyl alcohol

PROCEDURES

1. Record the weight of the 250mL beaker you will use.
2. Pour the spoiled liquid milk about 100 mL into the beaker. Record the weight.
3. Adjust the temperature of the mixture between 40-50°C. Add 10ml of 10% acetic acid and stir to coagulate the casein. Record temperatures, volume of acetic acid, and observations.
4. Remove the casein by gravimetric filtration through cheesecloth. Collect the filtrate in a 250ml beaker. Weigh.
5. Add 2g CaCO₃ to the filtrate. Stir into the solution, and boil for 10min. Record exact boil time.
6. Add decolorizing carbon (about nickel size) and stir into the solution.
7. Vacuum filter using a Buchner funnel and a filter aid.
8. Transfer the filtrate to a 250ml beaker and concentrate solution to about 30ml by boiling. Once reduced to 30ml, turn off the heat and add 125ml 95% ethanol and decolorizing carbon (nickel size).
9. Stir mixture, and vacuum filter through a layer of filter aid.
10. Allow the clear filtrate to crystallize at least 24 hours.
11. Collect lactose crystals by vacuum filtration. Weigh this final solid product. This may be washed with 95% ethanol for clarity. To do this, “crash crystallize” by placing the beaker/flask in an ice bath.

RESULTS

| | Mass w/ beaker | Mass minus beaker |
|----------------|--|--|
| 250 mL Beaker | 105.93 g | 0 g |
| Spoiled Milk | 200.153 g | 94.223 g |
| Solid Proteins | 123.18 g | 17.25 g |
| Lactose | *Mass with evaporating dish 38.40 g | *Mass minus the evaporating dish 38.40-37.40= 1.00 g 1.06% Lactose in the spoiled milk |

OBSERVATION / DISCUSSION



DISCUSSION

In the end of our lab, we thought that we would have more sugar in our evaporating dish than what we actually had. We believe that if we filtered the solution a few more times and have done it more thoroughly we could have gotten more crystals. Another thing that we expected was a clear solution in the Erlenmeyer flask, but instead we had a murky substance instead.

We also felt rushed during the lab so we didn't get to funnel as well as we expected. Our error in the experiment was when boiling the solution, the solution rose up and spilled over the side. Also while boiling the solution the popping of our solution made some spill over and come out of our beaker. Also we think if we were more careful when pouring the solution we would have a way better outcome than what we did. Last if we filtered our solution out more.

If you are given at least an hour and a half or 2 it would help the results of the project tremendously. And when boiling the solution make sure that you keep an eye on it at all time to prevent any rise of it. Also use a boiling chip to

avoid any popping of the solution. And for pouring solution you should commit with it instead of slowly pouring it and making the solution spill down the side of the beaker/ flask.

In conclusion, the experiment overall was successful with our group having 1.06%. This is similar to whole milk having 3.7%-5.1% of lactose in the milk. We successfully collected our grams of lactose and still think that if we had more amount of time we would have more lactose.