



Lab01: Curdled Milk

Lesson Objectives:

- Student will learn basic lab procedures.
- Student will learn to follow procedures exactly.
- Student will learn to collect data.
- Student will learn to analyze data.
- Student will learn about hydrophobic action.
- Student will learn how to make ricotta cheese.

PLEASE READ THIS ENTIRE PAGE BEFORE BEGINNING THIS ASSIGNMENT

In this lesson you will perform experiments, develop conclusions, and write a report of your procedure and findings.

If you work from any outside sources, you will be responsible for citing **all** sources of your information. If you do not cite your sources, you will not get full credit for the project.

Introduction:

Ricotta cheese is usually made from the whey left over when making other cheeses. We can make an inauthentic version of ricotta cheese by using whole milk instead of whey, and see a few principles of hydrophobic reactions in the process.

Milk is actually made up of several different biomolecules. Milk usually contains about 87% water, 3.5-4% fat, 3.5% protein, and 5% sugar. (You always need to leave a little wiggle room, the break down won't be precise.) As we've learned, fats are usually hydrophobic. In milk, not only are the fats themselves hydrophobic, but the proteins have hydrophobic and hydrophilic ends. In unhomogenized milk, some of the fat will separate and float on the top of milk as cream. However most store-bought milk is homogenized, which means the fat globules have been broken up into tiny pieces that stay suspended throughout the milk. Because of the way the proteins, sugars, and fats bond together (possible because the proteins are both hydrophobic and hydrophilic depending on which way they turn), the milk does not clump, even though it has some hydrophobic components.

In this lab we are going to disrupt the pH balance of milk, which will destabilize the protein and allow the milk to clump.



Materials:

- thermometer
- one half gallon of pasteurized whole milk
- 1/4 cup of vinegar
- a half teaspoon of salt
- metal pot for cooking (with some kind of lid)
- cheesecloth, or clean wide weave cloth, and a colander for draining the cheese (if no cheesecloth is available you can try just using the colander, but results may be a little messier)
- bowl for catching the liquid you drain off

Procedure:

Follow these instructions and keep a written record of precisely what you do and do not do. The record should be detailed enough that someone else could perform the same procedure just using what you have written.

1. Heat the milk in a pot until it reaches 185 degrees Fahrenheit. You will need to stir the milk often to make sure it does not scald. If you don't have a thermometer, be sure to turn off the heat if the milk begins to bubble--we don't want to let the milk boil. Remove from heat.
2. Add the vinegar and salt, and stir them gently into the milk. Cover the mixture and let it sit for at least an hour, you may even wait two.
3. Put two layers of cheesecloth into the colander, and pour the now curdled mixture into the colander to drain off the liquid. Make sure to catch the liquid that drains off in another bowl so you can examine it. Some recipes will tell you to drain the cheese overnight, though only an hour is necessary. Make some space to drain it in the refrigerator if you plan to let it sit for more than an hour.
4. The solids can be eaten, though plain they may not be very tasty. They can be used in any recipe that calls for ricotta cheese or cottage cheese, and will keep about a week in the refrigerator. (It is used in many Italian dishes, main dishes like lasagna and gnocchi, and even desserts. Adding sugar or honey to sweeten the curds, with an optional teaspoon of lemon juice for flavor, and mixing in fruit can make an interesting dessert. Some people eat the curds plain with salt and pepper. Don't try this if you are lactose intolerant however.)
5. There are no substances in this experiment that are too hazardous for sink or garbage disposal.

Safety Procedures:

- *Hot liquids and steam can cause burns. Use caution when stirring and measuring temperature. Wait a full hour before pouring the hot liquid through the colander, and use caution when pouring as steam or splashed liquid could still burn.*



Analysis Questions:

1. How big are the curds? What color are they? Since the protein carries the white color in milk, how much of these curds do you suspect are protein? Are the curds pretty solid or do they seem soft?
2. Examine the liquid you drained from the curds. What color does it appear to be? Would you be surprised to learn that milk without the white protein is really greenish yellow in appearance? Why or why not?
3. What happened to the proteins here? What causes do you suspect made them collapse? We learned some terms for this in the lesson on enzymes, refer back to it for the proper terminology. Do you think this process is reversible? Why or why not?

What to Submit:

All of the following should be submitted at one time--DO NOT submit partial reports, they will not be accepted.

- Submit to your teacher a report of your procedure and the data you collected. Use paragraphs with complete sentences and proper English grammar.
- Submit your data analysis to your teacher. Be sure that your analysis addresses the questions and directions listed in the instructions above. Also record any other conclusions you have reached. Use paragraphs with complete sentences and proper English grammar.
- Part of the challenge of a lab is figuring out how best to organize your information and submit your findings. Remember this is a report, not just a listing of what happened.

Grading Rubric:

To get a 10: You can have no factual, grammatical or structural errors, within the second revision of the report. Paragraphs are clear and focused; the report addresses the approved topic; all references are cited in the report; all requirements have been met. All answers are in complete sentences.

To get a 9: You can have 1 or 2 errors (factual, spelling, punctuation, capitalization, wrong word, etc.) on the second revision of the report or you can have no errors on the third revision. Paragraphs are clear and focused; the report addresses the approved topic; all references are cited in the report; all requirements have been met. All answers are in complete sentences.

To get an 8: You can have 1 or 2 errors on the third revision of the report or you can have no errors on the fourth revision. Paragraphs are clear and focused; the report addresses the approved topic; all references are cited in the report; all requirements have been met. All answers are in complete sentences.



To get a 7: You can have up to 5 errors. Paragraphs are clear and focused; the report addresses the approved topic; all references are cited in the report; all requirements have been met. All answers are in complete sentences.

To get a 6: You can have up to 8 errors. Paragraphs are clear and focused; the report addresses the approved topic; all references are cited in the report; all requirements have been met. All answers are in complete sentences.

To get a 5: Plagiarism - purposely or mistaken which will lower your final grade for the course (so be very careful when posting your work!); lack of effort, disrespect, or attitude (we are here to communicate with you if you don't understand something)

Also be aware that you will have a chance to revise your work. More than 2 revisions will result in a lower grade, so read the directions carefully and make sure you meet the requirements. No lesson is complete without the approval of the instructor, and all revisions must be completed before a grade is assigned. **No grade will be given for incomplete work.**

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