Cheese – Making Mozzarella

Introduction: Say Cheese! But when you say cheese, what type of cheese do you think of? Everyone knows that cheese is a milk-based food product with a wide range of flavors, textures and forms. Cheeses are made around the world as a portable, easy to store food source. Different cheeses are made from the milk of cows, goats, camels, yak, and even water buffalo. The exact origins of cheese making are not known, but it is widely speculated that the first cheeses were made when merchants stored milk in goat stomachs for travel in desert regions of the world. The milk in the stomach came in contact with rennet that was part of the stomach lining and the combination of enzyme action and heat lead to the formation of curds and whey. The foundation for cheese making was established.

Background: The primary components of milk that are essential for cheese making are proteins and fat. The predominant proteins involved in curd formation are the casein proteins. When making cheese, curd formation can be accomplished through acidification, increasing temperature, or adding rennet. It is not uncommon for all three methods to be used simultaneously at different level. Rennet is a family or series of enzyme produces in the stomach of animals called ruminant mammals. The enzyme help the young digest mother's milk. In cheese making, we use rennet to separate milk into solid curds. A description of cheese and cheese making along with the science behind it can be found in Chapter 5: Cheese, Yogurt, and Sour Cream.

LIPASE OPTION: A variety of lipases are available for cheese making. Two common lipases are calf lipase which is considered to make a milder cheese and lamb lipase which makes a sharper cheese. Once again, this exercise can be done by different students or groups of students preparing cheese from different milk products. This should be done on a schedule that allows the students to get together for a cheese tasting. A batch of cheese without lipase should be made as a control for comparison. Whole milk should be used in this exercise.

Pre-Laboratory Concepts:

1. In this exercise you will have options to make both a mozzarella cheese and a ricotta cheese. Describe each and explain their differences.
2. What are curds and whey? What are their roles in cheese making?
3. Why is the amount of fat present in the milk used to make cheese impact the flavor of the cheese?
4. What is a lipase? Describe the chemical reaction that are catalyzed by a lipase.
5. How does the addition of a lipase impact the nature of the cheese produced?
6. What is the food description of a sharp versus a mild cheese?

Procedure:

Milk - The milk that you use in this process makes a difference. We will use homogenized whole milk as our control milk. It is important not to use ultra-pasteurized milk. Most milk you buy in a store is homogenized to limit the separation of milk fat but it is not ultra-pasteurized. The milk container will indicate how the milk was prepared. Low fat milk can be used but the cheese will have a tendency to be dryer and less flavorful. In this exercise we will compare the production of cheese from different milk types.

Water - For cheese making strongly encourage the use of bottled water. The tap water in most towns and cities contain chlorine or chloramine which can inhibit or alter the cheese making process.

Work Area- It is essential that you have a clean work area to prepare your cheese. Bacteria and molds can contribute enzymes that alter the cheese making process. For this reason, we recommend that you do not prepare any other food while you are making cheese. Put all food products not part of the recipe away. Clean you work surfaces with warm soapy water including the counters, sink and stove. Keep all dirty sponges, towels, and wash clothes out of the work area. Finally, use an antibacterial cleaner to wipe down all work areas.

Basic Cheese Making Procedure

1. Prepare rennet
   A. Crush ¼ tablet of rennet and dissolve in ¼ cup of bottles water.
   B. Dissolve rennet in ¼ cup of bottle water
   C. Set rennet solution aside to hydrate
   D. Do not add rennet solution to milk until indicated.
2. *LIPASE OPTION - Add 1/8 teaspoon of lipase powder to ½ cup of cool water 30 minutes prior to use.*
3. In a pot large enough to heat 1 gallon of milk mix 1.5 tsp of citric acid to 1 cup of bottled water. Stir until fully dissolved.
4. Pour 1 gallon of cold milk into the pot with the citric acid and mix well.
5. Heat this milk to 90°F on medium to medium high heat.
   Note 1: Using a cooking thermometer is helpful so that you do not overheat the milk.
   Note 2: As you approach 90°F you may notice your milk beginning to curdle slightly due to acidity and temperature. Remove the pot of milk from HEAT at this time. Don't just shut off the burner.
   LIPASE OPTION: Add the Lipase solution to the milk immediately prior to the addition of rennet is Step 5 of the Basic Cheese Making Procedure.

6. Once the milk has reached 90°F add rennet to the milk and stir in a top to bottom motion for 30-60 seconds then stop.
   Note 3: If you are doing experiments comparing lipase activity, this is the step where lipase will be added.

7. Turn off the heat.
   Note 4: The heat may continue to rise to as much as 105°F

8. Let the milk remain quiet for the next 5-10 minutes during which it will form a curd. A longer set will result in a firmer curd.
   Note 5: A clear whey should separate from the curd. If the whey is not clear or the curds are not set you will not get a clean break of the curd from the pan. Allow the milk set for a few more minutes if this is happening.

9. Only after a good clean break is achieved (or when there is a clearing of the whey) cut the curds into a 1" checkerboard pattern and then scoop with a slotted spoon or spatula onto a double layer of cheesecloth placed in a bowl.
   Note 6: If the curd is too soft at this point let sit for another minute or two.
   Note 7: A dryer cheese can be made by cut a little finer and stirred.

10. Once you have removed the whey, place the pot back onto the stove and heat to 105-110°F while slowly and gently stirring.

11. When the milk reaches the desired temperature, remove from the burner and stir for 2 to 5 minutes.

12. Carefully transfer the curds from Step 8 into a microwave safe bowl lined with cheesecloth (double wrapped).
    Note 8: If the curds are too soft, wait for a few minutes then try again. The longer the curds sit in this step the more firm the final cheese.

13. Set aside the remaining whey. This will be used in the Ricotta Option.

14. Press the curd wrapped in the cheese cloth with your hand or if too hot to handle, a slotted spoon. Pour off as much of the whey into your reserved pot of whey as possible.

15. Next microwave the curd in the cheesecloth and bowl on High for 1 minute. You will notice more whey has run out of the curd.

16. Drain off all whey with your hand/spoon and by squeezing with the cheesecloth. Quickly work the cheese with a spoon or your hands until it is cool enough to touch.

17. Microwave 2 more times for 35 seconds each and repeat the kneading as in the last step. Drain all of the whey off as you go.

18. Knead quickly now as you would bread dough until it is smooth and shiny. Add a pinch of salt near the finish.
    Note 9: If the cheese doesn't knead or stretch well, it needs to be warmed up. Microwave for 20 to 30 seconds if necessary.

19. At this point the cheese should be soft and pliable enough to stretch like taffy. Do this several times to get a nice cross-linked and chewy cheese.

20. Form the cheese into a ball and drop into enough ice water to cover and cool the cheese. Some will use a salt brine instead of cold water. Refrigerate for 15-30 min.

21. When cold you can wrap in plastic wrap and it will last for several days but is best when eaten fresh. Knead the cheese until it is a smooth and shiny ball.

22. The cheese is ready to eat when it cools.

The Ricotta Option: This section is optional. It includes the production of Ricotta cheese from whey which is more appropriately called ricottone when produced in this manner.

1. Heat the remaining whey to 160°F and add 1.5 cup of milk and 1 to 2 tsp of salt.
2. Continue to heat the whey to 190°F
3. Hold the temperature at 185 to 190°F until the ricotta rises.

4. Mix 1/2 tsp of citric acid in a 1/2 cup of bottled water
5. Quickly add the citric acid solution to the pot while briskly stirring for 30 seconds.
6. At this point the curds form into larger masses.
7. Turn off the heat and leave the pot stand for 10 to15 minutes.
8. Gently ladle the curds into a cheesecloth-layered colander and drain for 15 min to several hours.
9. Store in the refrigerator and eat within 10 days.

Cheese Tasting – The Head Chef will taste a range of different cheeses. Think about the different molecular structure and components that bring about the various textures, flavors and aromas of each cheese.

Cheese Tasting Guide – Gather a variety of cheeses and serve ~2 oz tastings per person. Cheese should stand at room temperature for half an hour before serving. Cover to prevent drying out.

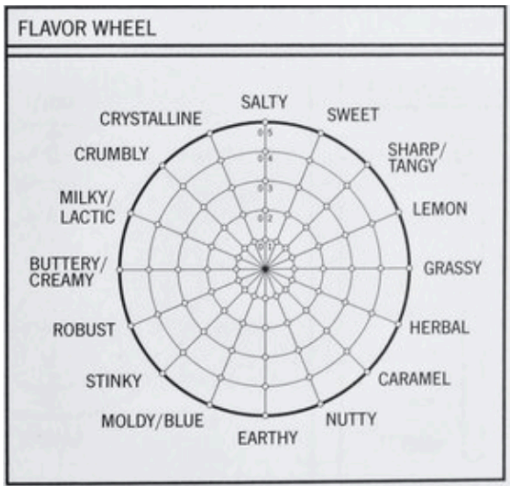
Appearance – This is your first impression of the cheese. Give it a good once over. Observe the color and signs of freshness. Is it creamy, moist, shiny, smooth, crumbly, or uniform? Is it chalky, grainy, dull or inconsistent? Are there bits of nuts, seeds, fruit, herbs, or spices? There are a range of colors: white, ivory, straw, butter, yellow, gold, orange, green-marbled, or blue-marbled (or combinations of thereof).

Aroma – Inhale and take a good whiff of your cheese. What do you smell? See if you can detect any of the following smells: Lactic acid (milk, cream, butter yogurt), Fruity (berry, dried fruits, citric fruits, honey), Roasted (toasted bread, chocolate, nuts, roasted or burnt onion, smoky), Vegetal (artichoke, garlic, grass/hay, leek, mushroom, onion, soil), Animal (bone broth, hardboiled egg, leather, wet wool), Seedy (caraway, cumin, mustard, sesame, sunflower, pumpkin) or Spicy (cloves, mint, nutmeg, pepper, vanilla).

Texture – Gently pinch the cheese between your thumb and index finger. Is your cheese crumbly, dense, creamy, dry, gooey, hard, soft, springy or wet? Does it have a rind? Except for brie and some other soft cheeses, remove the rind before eating.

Flavor – Cheeses range from delicate, fruity and sweet to tangy. Slowly eat the cheese allowing its flavor to permeate your palate. Wait a few seconds to identify any developing flavors. For example, a Gruyere may taste buttery and nutty at first then finish with hints of pears or fruit. Can you taste the flavors of the aromas you just smelled? Is the cheese acidic, buttery, creamy, earthy, herbal, mellow, nutty, peppery, piquant, pungent, rich, salty, sharp, spicy, tangy or tart?

Finish – What are the final flavors that you taste? Do they last a long time or are they short-lived? Is this a cheese you would eat again?



Cheese	Appearance	Aroma	Texture	Flavor	Finish	Notes

You will be provided copies of the tasting table and flavor wheel. Use this to comment on your cheese selections and consider the molecular nature of each component.