

Mozzarella Cheese Making

Ricki's 30 Minute Mozzarella
 from
 New England CheeseMaking Supply Company
<http://www.cheesemaking.com/>

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We are making fresh cheese from cow's milk

- Milk is a normal secretion of the mammary glands of female mammals ("milk" usually refers to cow's milk)
 - Milk's purpose is to nourish young of a given species
- Fluid milk for human consumption
 - Pasteurized and homogenized
 - Composition is very close to what is taken from the cow
- Composition: fn(**breed**, age, stage of lactation, season, feed...)
 – But average is...



Approximate Composition of Cow's Milk

Constituents	Percent (%)
Water	87.1
Fat	3.9
Protein	3.3
Lactose (milk sugar)	5.0
Ash (mineral)	0.7
	100.0
Solids – nonfat (MSNF)	9.0
Total solids	12.9

Potter NN, Hotchkiss JH. 1995. Food Science, 5th ed. Table 13.2



Microflora of raw milk

- Milk is an excellent medium for the growth of a variety of microorganisms

– Why?

- High water content
- Suitable pH (6.5-6.7)
- Ample nutrients



Legal Standards



- Milk is most controlled food in U.S. and many other countries
- Federal: U.S. Public Health Service defines milk
 - Minimum of 3.25% fat
 - Minimum of 8.25% milk-solids-not-fat (MSNF)
- Each state in U.S. regulates veterinary inspections on farms and sanitary requirements
 - Sanitary practices employed by dairy industry have been for many years the guide for the entire food industry



Preservation

- Milk is preserved/processed to:
 - fluid milk - whole
 - components (skim, cream, low-fat milk, milkfat, proteins, lactose, "bioactives")
 - conversion products (butter, cheese, yogurt, ice cream, etc.)



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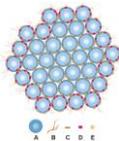
Proteins are large molecules made up of Amino Acids

- Amino Acid (AA): $\text{HOOC}-\underset{\text{R}}{\overset{\text{H}}{\text{C}}}-\text{NH}_2$
- "R" groups can be
 - Various lengths
 - Long
 - Short
 - Charged or uncharged
 - Non-polar (e.g., $-\text{CH}_3$)
 - Uncharged-polar (e.g., $-\text{CONH}_2$)
 - Positively-charged polar (e.g., $-\text{CH}_2\text{NH}_3^+$)
 - Negatively-charged polar (e.g., $-\text{CH}_2\text{COO}^-$)



Cheese making: two most important Milk Protein types

- Caseins (~ 80% of milk protein)
 - Four kinds of caseins
 - Exist in milk as a complex structure called : micelle
 - Casein micelle is insoluble
 - Casein micelles form a stable colloidal suspension
- Whey Proteins (~ 20% of milk protein)
 - Two kinds of whey proteins
 - β -Lactoglobulin (~ 51% of whey proteins) and
 - α -Lactalbumin (~ 19% of whey proteins)
 - Structure is globular

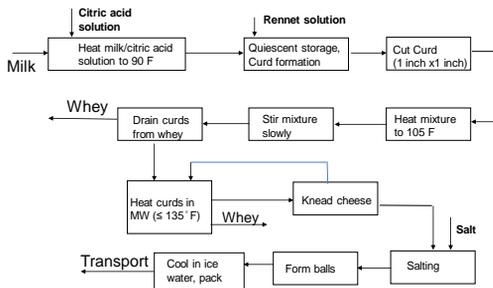


Cheese making – curd formation

- pH (acidity) of foods can be changed by adding acidulants
 - Examples of acidulants: acetic, **citric**, ascorbic, lactic acids
 - Acidulant precipitates the casein proteins, but not the whey proteins
- Rennet is added to milk for curd formation
 - Rennet is an enzyme, which is a protein
 - Rennet cleaves covalent bonds of casein to coagulate casein for curd formation



Mozzarella Cheese Flow Diagram Direct Acidification Technique



Prep for Lab – mozzarella cheese

- Prepare fresh mozzarella cheese made from cow's milk. In this SOP, the milk is made more acidic by adding citric acid. Then rennet is added, which causes the milk to separate into curds and whey.
- This procedure is challenging...
 - success the first time requires keen attention to detail.



Clean and Sanitize

- Milk picks up unwanted flavors and bacteria easily. It's important to prevent cross contamination. Sanitize equipment and surfaces.



- Clean and Sanitize can be done by
 - Dishwasher
 - Steaming utensils in pot with 1" boiling water for 5 min, cover with lid
- Work on paper towel or clean paper



Prepare two solutions

- Prepare citric acid solution
 - Mix 1 ½ t citric acid in 1 cup cool water
 - Stir to ensure that the citric acid is fully dissolved
- Pour citric acid solution into large empty 8 quart pot
- Note:
 - Too much acid- crumbly cheese
 - Too little acid – pasty cheese

- Prepare rennet solution
 - Combine ¼ t liquid rennet and ¼ C cool non-chlorinated water, set aside
 - 1/4 t is about 20 drops
- Note:
 - Rennet is a coagulating enzyme that speed the separation of liquids (whey) and solids (curd)



Milk

- Pour 1 gallon of milk into the 8 quart pot quickly, it will mix with citric acid solution
- Heat milk **slowly** to 90° F. Do not stir
 - Use thermometer to check temperature



Adding the rennet solution ...

- At 90° F, take pot off the burner
 - add rennet solution slowly while stirring slowly top to bottom for approximately 30 s
- Cover pot with lid and leave **undisturbed** for 5-10 minutes
- Check the curd



Check for clean cleave

- The mixture is set
- Clean cleave (wash your hands first)



Cut the curd

Cut the curds in a 1" checkerboard pattern with the long knife.



One wayand then the other way



The curd is cut

Desired result



Sometimes it doesn't work



Too much rennet



Heat the mixture

- Place pot back on the stove and heat to 105° F while stirring slowly and gently
 - Use thermometer to check temperature
- At 105° F, take the pot off the burner and continue stirring slowly for 2-5 minutes
 - More time will make a firmer cheese



Drain

- Transfer the curd to a colander using a slotted spoon.
 - The curd gets firmer as it drains
- Drain the whey from the curd into a pot
 - gently