Cheese Short Course 1

Cal Poly SLO
Dairy Products Technology Center

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Courses

- Cheese Short Course 1
  - The class I took
- Dairy Science and Tech for Farmstead/Artisan Cheesemakers

Short Course

- **Topics addressed included:**
  - Basics of Dairy Chemistry & Microbiology
  - Starter Cultures and Coagulants
  - Basic Steps of Cheese Manufacture
  - Cheese Yield and Yield Calculations
  - Sensory Evaluation of Cheese
  - Titratable Acidity and pH
  - Plant Cleaning, Sanitation & Food Safety
  - Full Day of Hands-on pilot scale Cheese making Instruction (Participants are encouraged to bring appropriate attire)
  - Introduction to manufacture of various cheese varieties
  - Worldwide cheese tasting

Farmstead Course

- **Course Description**
- Approximately 2.5 days of classroom-style instruction & discussion, and 1.5 days of hands-on cheese manufacture and cheese sampling.
- Visit to working Farmstead Cheese operation.
- Overview of the world of cheese
- Basic chemistry, microbiology and other scientific concepts
- Milk composition and milk quality and their importance in cheese manufacture
- Other ingredients and their function in cheese manufacture
- Key underlying principles in cheese manufacture
- Unit operations in conversion of milk to cheese
- Equipment, plant layout, and sanitation considerations in cheese making
- Modifications in basic cheese manufacture to make other cheese varieties
- September 11-14, 2012 : $725

What is Cheese?

- Basically the extraction of the solids from mammalian milk. Fat and Protein
- "Average" milk composition (1 G = 8.6#):
  - 87.6% water (7.5#)
  - 12.4% solids (1.1#)
    - 3.7% Lipid (milkfat)
    - 8.7% Non-fat milk solids
      - 3.3% Proteins
      - 4.7% Carbohydrate (Lactose)
      - 0.7% Ash

Milkfat

- 98% Triglycerides
  - Glycerol backbone
  - 3 fatty acids
    - Long chain fatty acid
      - What the animal eats
    - 75 different triglyceride combinations
- This is what creates the flavor
- Creaming ability

Proteins

- 80% Casein Micelles
- 20% Whey Proteins

	Whey Protein	Caseins
pH 4.6	Soluble	Insoluble
Chymosin (rennet)	Soluble	Insoluble
Heat (boiled)	Insoluble	Soluble

Caseins

- Micelles, particles
- Like a Kush ball
  - They have protruding branches like hair
    - These are called k-Caseins
- With the k-Caseins intact the caseins will not stick together
- This is why milk doesn’t clump together

Whey Proteins

- Become soluble in lower pH
- In some business models they whey protein is the main product. Cheese is secondary.
- Also soluble in the presence of chymosin.

How is a gel formed?

- A gel is the same as the curd.
- Forms when the casein micelles stick together to form a matrix trapping the larger milkfat globules.
- The casein micelles will stick together when the k-Casein bonds are snipped.
- Chymosin is the enzyme that breaks the k-Casein bond.

Things that interfere with curd formation

- Homogenization
  - This process forces the milkfat globules to be much smaller.
  - The milk doesn’t separate with the cream floating
  - This makes it easier for the milkfat to move in the curd thus making a softer curd.

Things that interfere with curd formation

- Pasteurization
  - Milk is heated to kill dangerous microbes
  - The heating process denatures some of the whey proteins, breaks them apart.
  - These enzymes from the denatured whey will attach themselves to the k-Casein bond.
  - This will interfere with the Chymosins' ability to break the k-Casein bond.
  - A softer curd will be formed.
  - If to high a heat, like in ultra-pasteurized milk, all the whey protein is broken down and no curd can form.

Things that aid curd formation

- Ionic Ca is necessary to help hold the curd formation.
  - Some Ca is destroyed in the pasteurization process.
  - To much Ca and you can't stretch the curd as in mozzarella
  - To little and the curd will crumble, as in feta
  - This is why we sometimes add CaCl to the milk.
    - It depends upon what type of cheese you're making

More things that aid curd formation

- Heat helps the milk coagulation
- Acidity
  - lower pH makes the whey proteins soluble while the casein proteins remain insoluble
    - A result of culture addition
    - Direct acidification (fresh non-aged cheeses only)
- Cultures
  - The bacteria converts the lactose into lactic acid
  - The lower pH aids in the curd formation
  - The enzymes help in the curd shrinkage and flavor

Summary

- In order to get the best curd formation:
  - Use non-homogenized milk
  - Add CaCl depending upon the cheese type
  - Use low temp pasteurization (or none if aged)
  - Add culture or direct acid
  - Set to correct temperature
  - Check pH and do not add chymosin until pH has dropped. This indicates that the culture is working.
  - Add chymosin, mix gently and let sit.