



Salahaddin University- Erbil



College of Agricultural Engineering Sciences

Department of Animal Resources

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“Dairy Science and Technology”

Cheese Manufacturing

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Definition

- **Cheese** is a gel network formed from the protein and lipid fraction of milk. The casein and milk fat fractions are concentrated (removal of moisture and whey proteins) And solidified through the presence of acid (gel network) or enzymes (bacterial, or rennet).
- Cheese is the fresh or ripened product obtained after coagulation and whey separation of milk, cream or partly skimmed milk, buttermilk or a mixture of these products.

CHEESE- Introduction

- Cheese is one of the oldest foods of mankind.
- Cheese continues to be a popular addition to every day diet, due to the high amount of protein, calcium, minerals and vitamins.
- The word 'cheese' is derived from the old english 'cese' which in turn was derived from the Latin 'caseus' which means correct or perfect thing.
- There are about 2000 names of cheeses.....

Cheese process

Cheese process: Milk proteins, caesin are coagulated with the addition of an enzyme, usually rennet found in cows stomachs.

- Milk coagulates, separates into solid curds and liquid whey.
- Drain the whey curds = fresh cheese to make ricotta or cottage cheese.
- Kneaded and cooked cheeses are packed into molds and drained.
- Salt or bacteria is added to give it flavor and allowed to ripen.



BASIC PROCESS OF CHEESE MANUFACTURE:

1. MILK



2. ACIDIFICATION



3. RENNETING



4. CUTTING



5. SALTING



6. RIPENING

Clotting



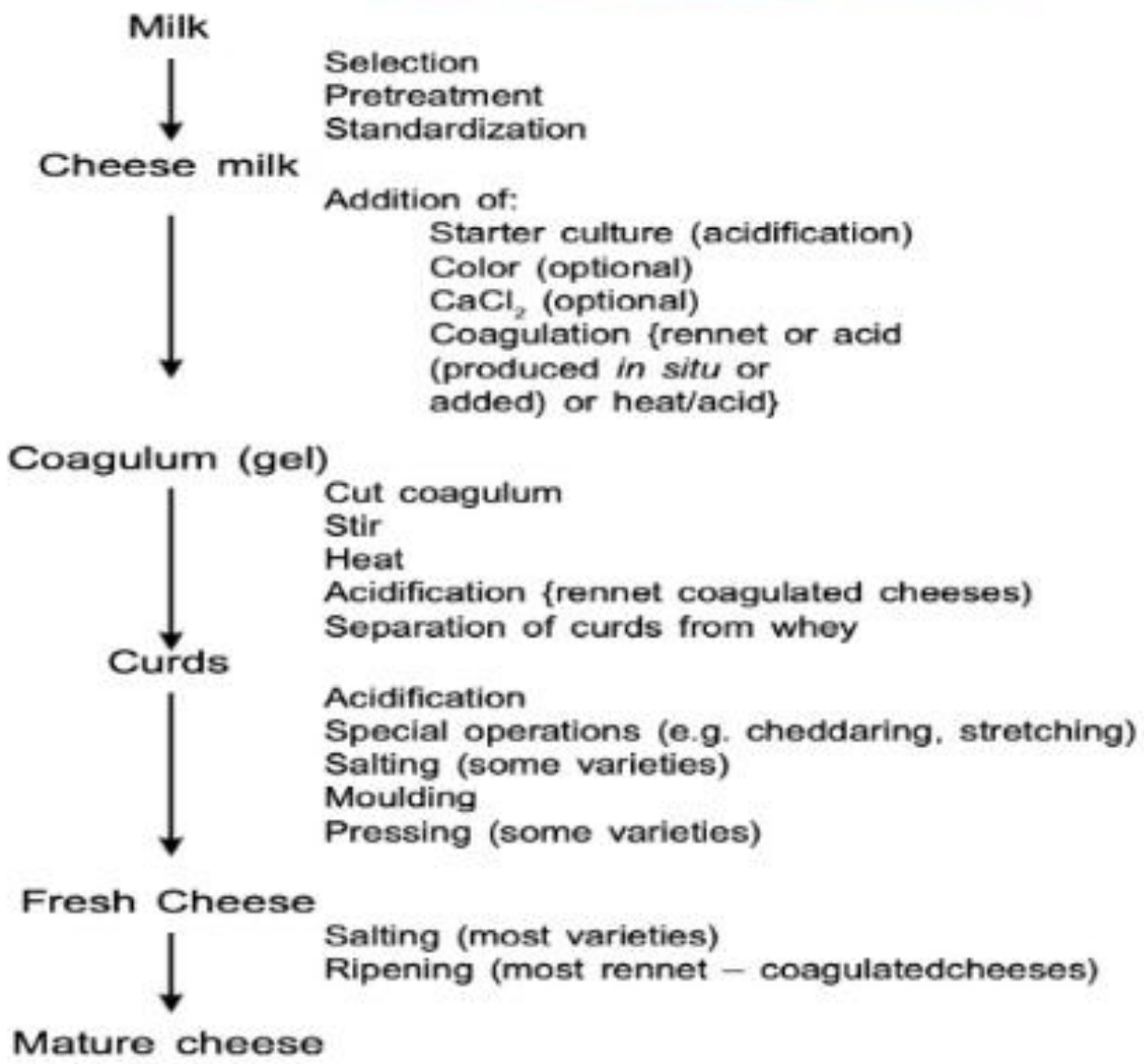
Curd Making

Separation

Shaping



Flow diagram for cheese manufacture



INGREDIENTS FOR CHEESE MAKING

- INGREDIENTS:

- 1- Raw or pasteurized milk

- 2- Starter Culture: Mixed; Lactobacillus

- Milk: The most important ingredient in cheese is milk.
- The milk of many mammals can be used but the milk of ruminants is the best.
- This is because it contains high levels of the milk protein, casein, which is required to provide an adequate coagulum.

- -RAW INGREDIENTS:
 - 1- Raw or pasteurized milk
 - 2- Starter Culture: Mixed; Lactobacillus
- **ACIDIFICATION:** Lactic Acid Initially Limited;
Can continue gradually throughout cheese making
- Effects of acidification:
 1. Coagulant activity
 2. Retention of coagulant in curd
 3. Curd strength
 4. Gel syneresis
 5. Dissolution of Calcium Phosphate

- **Rennet** is An enzyme used to coagulate milk during the cheese making process. Rennet is derived from one of four sources but the most common is from the fourth stomach of young calf:

- **Sources of Rennet:**

- 1- the stomach lining of a young calf (the enzyme rennin is found in the stomach lining of animals because it aids in the digestion of their milk)

- 2- plants (typically thistle)

- 3- microbes in fungus and yeast

- 4- Genetically engineered rennet that imitates animal rennet.



RENNETING

- -RENNETING COAGULATION OCCURS IN TWO PHASES:

1. Direct enzymic action (renneting)
2. Clotting of destabilised casein

- COAGULATION IN MILK:

COAGULATION IN MILK INCREASES WITH:

- A- Increasing Temperature (slow below 15 °C)
- B- CaCl₂ Content
- C- Reduction in pH

- COAGULATION IN MILK DECREASES WITH:

Increasing pasteurisation temperature-

Gel formation

- Gel formation
- As the paracasein micelles aggregate, they form a network. Once this network reaches a critical concentration, a gel is formed.
- The gel is a rubbery elastic material with a high water content. As the gel progresses, the network tightens and syneresis progresses, forcing water out of the structure.

SALTING

- Direct addition of crystals to milled or broken curd e.g. cheddar or cottage
- Immersion of moulded cheese in brine e.g. Edam
- Principle Effects of salting in cheese making:
 - 1. Control of microbial growth
 - 2. Control of various enzyme activities
 - 3. Influence on syneresis
 - 4. Physical changes in cheese proteins
 - 5. Flavour

Types of Cheese

- Fresh Cheeses • Uncooked/Unripened
- Mild, creamy with tart tanginess. • Cream Cheese: 35% • Feta: salt brined • Marcarpone: 70-75% • Mozzarella: 45% • Ricotta: 4-10% fat
- Queso Oaxaca: 45% fat
- Semi soft cheeses • Include mild buttery cheeses, smooth sliceable textures.
- Moisture content of 40-50%. • Aged from a few days to a few months. • Good for melting.
- Cobrales: Spanish • Gorgonzola: Italy
- Gouda: Dutch • Stilton: Great Britain
- Roquefort: France • Port du Salut: France

Types of Cheese

- **Soft-Ripened Cheeses** • Distinguished by their white "bloomy" rinds and creamy interiors • get softer instead of harder as they age.
- The best-known are Brie and Camembert.
- **Firm Cheeses** • Not hard or brittle • Aged from a few month to few years & longer.
- Moisture 30-40% • Cheddars: North America, Australia, Great Britain • Emmenthaler: Swiss.
- Comte: France • Manchego: Spain • Provolone: Italy
- **Hard Cheeses**: Carefully aged for extended periods • Contain 30% moisture • Used for grating, salads or table cheese • Salty sharp taste. • Asiago
 - Parmigiano-Reggiano • Pecorino Romano

Cheese Classification

several classification of cheese include age, type of milk, country of origin, ripening process/agents, important compositional varieties, like moisture and fat, general appearance, texture and rheological qualities.

- **Origin**
 - UK, Hawes, Yorkshire
- **Texture**
 - Coagulation (vegetarian rennet)
 - Rheology (medium [semi-hard], crumbly)
 - 38% - 46% moisture
- **Ripening method**
 - Internal bacterial (white version)
- **Drying method**
 - salting, moulding and pressing
- **Salt content**
 - 500 mg of sodium per 100g cheese



CHEESE CLASSIFICATION - TEXTURE

1) Very hard (grating) - Moisture $< 35\%$ on matured cheese and ripened by bacteria, e.g. Parmesan, romano.

2) Hard - Moisture $< 40\%$

a) ripened by bacteria, without eyes: cheddar

b) ripened by bacteria, with eyes: swiss

3) semi-hard - Moisture 40-47%

a) ripened principally by bacteria: Brick

b) ripened by bacteria and surface microorganisms: Limburger

c) ripened principally by blue mould:

i) external – camembert

ii) internal – gorgonzola, Blue, roquefort.

4) soft - Moisture $> 47\%$

a) Unripened – cottage

b) ripened – neufchatel

Types of cheese



TYPICAL CONCENTRATION OF TOTAL FREE FATTY ACIDS IN SOME CHEESE VARIETIES

FFA (mg/kg)

EDAM

356



CAMEMBERT

681



CHEDDAR



1028

GRUYERE



1486



PARMESAN

4993



ROQUEFORT

32,453

BLUE



32,230

Table 2.5: Legal standards of cheese

Type of cheese	Moisture, maximum	Milk Fat (on dry basis), minimum
Hard pressed cheese	39.0%	48.0%
Semi hard cheese	45.0%	40.0%
Semi soft cheese	52.0%	45.0%
Soft cheese	80.0%	20.0%
Extra hard cheese	36.0%	32.0%
Mozzarella cheese	60.0%	35.0%
Pizza cheese	54.0%	35.0%