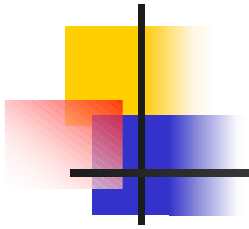


Lecture 6

FOOD QUALITY

(Chapter 6 in POTTER book)

FOOD QUALITY

- People choose foods based on a number of factors which can be summarised as "quality".
- Quality is defined as "degree of excellence" and food quality includes such parameters as taste, appearance, and nutritional content.
- When we eat, we use all of our physical senses, including sight, touch, smell, taste, and even hearing: Snap of a potato chip, crackle of a breakfast cereal, crunch of celery etc.

FOOD QUALITY

Food quality detectable by our senses can be divided into three main categories:

✓1. Appearance factors: size, shape, wholeness, different forms of damage, gloss, transparency, color, consistency.

✓2. Textural factors: handfeel and mouthfeel of firmness, softness, juiciness, chewiness, grittiness.

✓3. Flavor factors: Tounge detects sweet, salty, sour, bitter tastes, and "aromas" are perceived by the nose. The combination is called "flavour".

FOOD QUALITY

APPEARANCE FACTORS

Size and shape are easily measured and are important factors in grade standards. Fruits and vegetables can be graded for size by the openings they will pass through.

Color and gloss: Food color not only help to determine quality. Color is commonly an index of ripeness or spoilage Colorimeters or spectrophotometers can be used for color measurement. The color of an object can be defined in terms of numerical values of three components; value(lightness and darkness), hue (color), chroma (intensity).

Consistency of such foods is measured by their viscosity, higher viscosity products being of higher consistency.

FOOD QUALITY

TEXTURAL FACTORS

✓Qualities of food that we can feel either with the fingers, the tongue, the palate or the teeth.

✓The range of textures in foods is very great and a departure from an expected texture is a quality defect.

✓We expect :

Chewing gum to be chewy

Crackers and potato chips to be crisp

Steak to be compressible and shearable between the teeth

FOOD QUALITY

TEXTURAL FACTORS

- If food is squeezed so that it remains as one piece (as with the squeezing of bread) this is compression.
- If a force is applied so that one part of the food slides past another (as in the chewing of gum) this is shearing.
- A force that goes through the food so as to divide it causes cutting (as in cutting an apple) .

There are instruments to measure each kind of force. Tenderometer, penetrometer, rheometer, Instron texture analyzer, etc.

FOOD QUALITY

TEXTURAL FACTORS

✓The texture of foods does not remain constant. Water changes play a major role. Foods also change texture on ageing.

✓Bread staling- lose of water

✓Crackers, cookies must be protected against moisture pick up

✓Starch and numerous gums are thickeners , they increase viscosity

✓Lipids are softeners and lubricants when blended into a cake formula to tenderize cake.

✓Food manufacturers use countless approved ingredients and chemicals to help modify texture

FOOD QUALITY

FLAVOR FACTORS

- ✓Flavor is a combination of both taste and smell and is largely subjective and therefore hard to measure.
- ✓People differ in their sensitivity to detect different tastes and odors and also differ in the preference.
- ✓The flavor of a given food is determined by both the mixture of salt, sour, bitter and sweet tastes and by the number of compounds which give characteristic aromas.
- ✓Judgements about flavor often are influenced by color and texture. We associate orange flavor with orange color.

FOOD QUALITY

FLAVOR FACTORS

We can measure flavor in various ways depending on our purpose.

- Use of gas chromatography- to measure specific volatile compounds
- Conductivity measurement – for salt concentration
- Refractive index (refractometer) –for sugar concentration
- Titration – for acid measurement or by pH-meter

All of these are largely research or quality control tools.

FOOD QUALITY

FLAVOR FACTORS

When it comes to consumer quality acceptance, we may use trained individuals or groups by applying taste panels to them.

Taste panels are used in:

Research,

Product development

Evaluating new and competitive products

FOOD QUALITY

ADDITIONAL QUALITY FACTORS

Nutritional quality – can be assessed by chemical or instrumental analyses for specific nutrients

Sanitary quality- Measured by counts of bacteria, yeast, mold and insect fragments as well as by sediment levels.

Keeping quality or storage stability – is measured under storage and handling conditions that are set up to simulate normal conditions and use. It is common to design accelerated storage tests.

The major quality factors of appearance, texture and flavor are referred to as organoleptic or sensory properties since they are perceived by the senses.

Other specific quality attributes:

- The foam or head on a glass of beer is a quality factor and its size, bubble structure, stability are all important quality attributes.
- A slight cloudiness or turbidity is desirable in orange juice whereas in apple juice it is undesirable. A part of food science called sensory science is dedicated to finding ways to use humans to accurately describe the flavors and other sensory properties of foods.

QUALITY STANDARDS

To help ensure food quality, many types of quality standards have come into existence.

✓Research standards – internal standards set up by a company to help ensure the excellence of its products in a highly competitive market

✓Trade standards – set up by members of an industry on a voluntary basis to assure at least minimum acceptable quality and to prevent the lowering of standards of the quality for the products of this industry.

✓Government standards – mandatory standards to protect health and prevent deception of the consumer.

PLANNED QUALITY CONTROL

A systematic quality control is essential.

- This program begins with customer specifications and market demand.

What level of quality is demanded and can be produced for the price the customer can afford to pay?

What legal requirements must be met?

- With these specifications agreed upon, appropriate testing methods and control stations can be setup.

Nearly all food manufacturing facilities have a formal **quality control or quality assurance departments.**

PLANNED QUALITY CONTROL

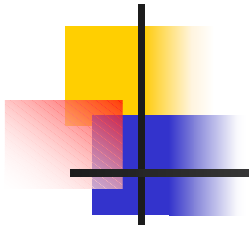
The functions of quality control departments:

Inspection (incoming materials, in-plant inspection)

Laboratory (organoleptic, chemical, physical evaluation)

Sanitation and Microbiology (in-plant and outside inspection, microbiological evaluation, water and waste)

Research and development (new product development, process and product improvements, nutritive and shelf-life evaluations)



PLANNED QUALITY CONTROL

Two newer concepts in product quality and safety have been developed and widely adopted in recent years:

Total Quality Management (TQM)

Hazard Analysis and Critical Control Point (HACCP)

Are quality and management systems designed to assure the highest quality and safest foods possible.

PLANNED QUALITY CONTROL

- Total Quality Management (TQM): is a management system which strives to continuously improve the quality of products by making small but incremental changes in a product's ingredients, manufacture, handling, or storage which results in overall improvement.

All workers in plants which employ TQM techniques have joint responsibility for product quality and routinely meet in "quality circles" or similar groups to discuss potential improvements.

PLANNED QUALITY CONTROL

- HACCP: is a preventative food safety system in which a process for manufacturing, storing and distributing a food product is carefully analyzed step by step .

Points at which tight control of the process will result in elimination of a **potential hazard** are identified and appropriate control measures taken **before** a problem occurs.

MILK AND MILK PRODUCTS

(Ch. 13 in Potter book)

MILK AND MILK PRODUCTS

(Ch. 13 in Potter)

Milk is a unique substance in that it is both consumed :

- As fluid milk with minimal processing
- As raw material for manufacturing a wide variety of products

Also has unique nutritional properties that make it an especially important food particularly for the young (good source of protein, essential elements like calcium and vitamins A,D and B complex).

MILK AND MILK PRODUCTS

Milk consumption:

Finland-Iceland : 200 kg/year/person

UK: 125 kg/year/person

USA: 97 kg/year/person

Turkey: 22 kg/year/person

Productivity of cows:

EC countries: ~4000 lt/cow/year

Turkey: ~1000 lt /cow/year

MILK AND MILK PRODUCTS

Milk can be separated into its principal components:

Cream and skim milk

↓ may be separated into

Butterfat, casein, other milk proteins, lactose

↓ may be processed into

Butter, cheese, ice cream, other dairy products

MILK AND MILK PRODUCTS

- Milk may be modified by condensing, drying, flavoring, fortifying, demineralizing, and other treatments.
- Whole milk or its components may be combined in various proportions into manufactured food products, such as milk chocolate, bread, cakes, sausage, confectionery items, soups, etc.

MILK AND MILK PRODUCTS

FLUID MILK

- Milk is the normal secretion of the mammary glands of all mammals to nourish the the young of the species.
- The nutritional needs of species vary so that the milk from different mammals differ in composition.

MILK AND MILK PRODUCTS

FLUID MILK

Table 1. Percentage composition of milks used for human food

	Total solids	Fat	Crude protein	Casein	Lactose	Ash
Cow	12,6	3,80	3,35	2,78	4,75	0,70
Goat	13,18	4,24	3,70	2,80	4,51	0,78
Sheep	17,00	5,30	6,30	4,60	4,60	0,80
Woman	12,57	3,75	1,63	-	6,98	0,21

MILK AND MILK PRODUCTS

FLUID MILK

The principal constituents of milk :

- ✓Fat
- ✓Protein (primarily casein)
- ✓Milk sugar or lactose
- ✓Minerals of milk (ash)

Vary not only in amounts among the different animal species but also somewhat in chemical, physical, and biological properties.

The high degree of variability among the milks of different animals becomes especially important in processing operations.

MILK AND MILK PRODUCTS

FLUID MILK

Even the milk from cows vary in composition depending on:

- The breed
- Animal to animal variability
- Age
- Stage of lactation
- Season of the year
- The feed
- Time of milking
- Period of time between milkings
- Physiological condition of cow (calm or excited, receiving drug)

FLUID MILK

All of these factors also affect the quality of milk.

Table 2. The approximate composition of milk

Constituents	%
Water	87,1
Fat	3,9
Protein	3,3
Lactose	5,0
Ash (mineral)	0,7
	100,0
Solids-nonfat	9,0
Total solids	12,9

The term solids-nonfat refer to total solids minus the fat.

FLUID MILK

- The market price of milk purchased in bulk generally is based on its fat content and to a lesser extent on its solids-nonfat content.
- These solids of milk further determine the approximate yields of other dairy products.

MILK PRODUCTION PRACTICES

The **udder** of the cow produces milk from components withdrawn from the animal's bloodstream.

Milking operation stimulates release of hormones, which act on muscles in the udder causing let down of milk into the four teat canals.

Hand milking

Milking machines: working on a vacuum principle squeeze and suck milk from the teat canals into receiving vessels or drawn under vacuum from the milking machine cups through pipes to a bulk holding container tank.

MILK PRODUCTION PRACTICES

- Tank should be refrigerated quickly to cool the milk to 4.4°C or lower to control the growth of bacteria.
- Milk secreted by a healthy udder is sterile. Quickly contaminated with microorganisms from:

The external body of the cow

Milk handling equipment.

- Milk should not be held in the cold tank more than 2 days before it is transported to the milk receiving station or plant.

MILK PRODUCTION PRACTICES

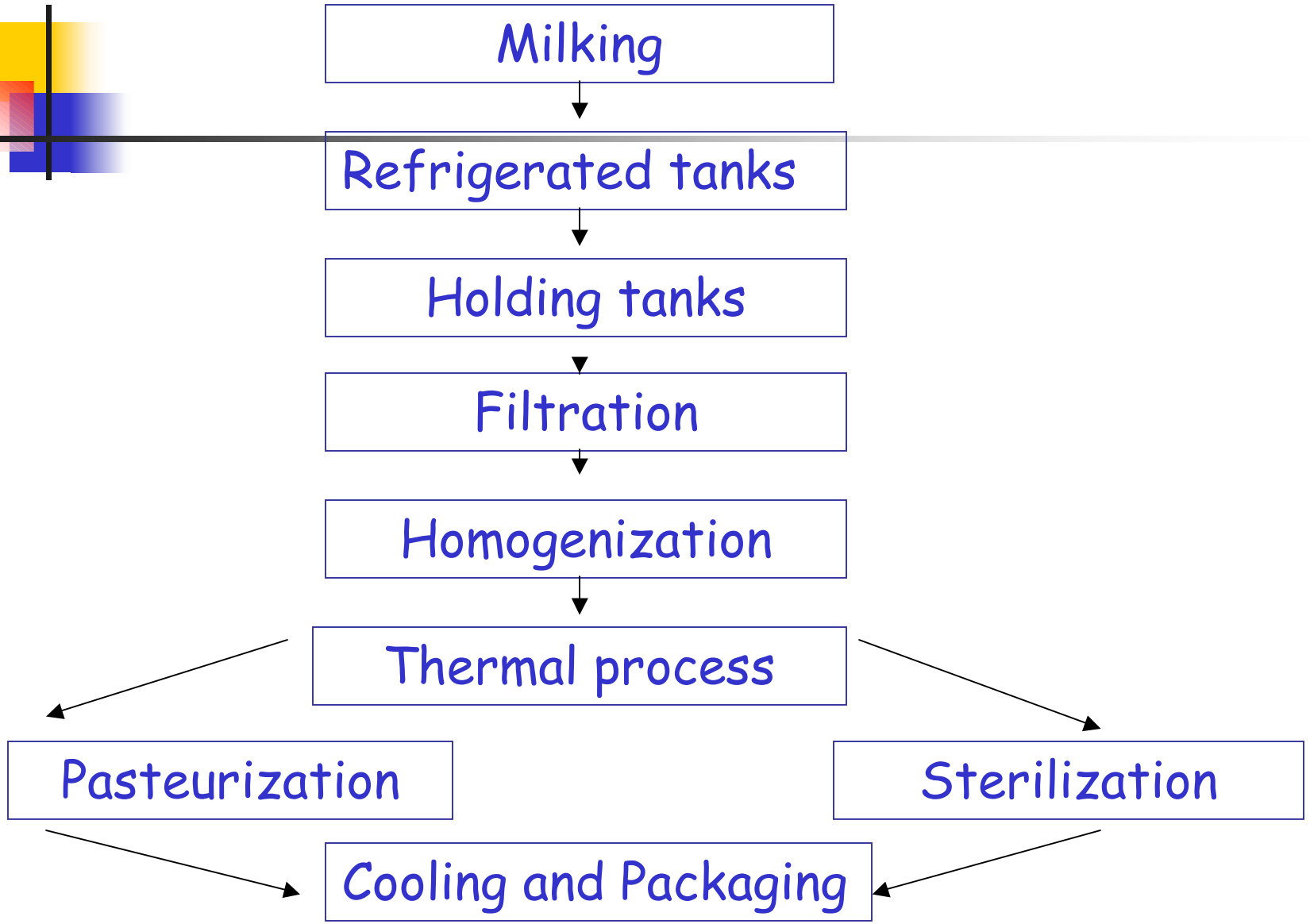
- Transported in bulk tank trucks from the farm to the processing plant.
- Pumped into insulated stainless steel tanks
- A small sample is removed for later analysis of fat and total solids on which to base price to the farmer and for microbiological tests.

QUALITY CONTROL TESTS

At a processing plant, several inspections and tests may be run to control the quality of the incoming product.

- Determination of fat and total solids by chemical or physical analyses
- Estimation of sediment by forcing milk through filter pads and noting the residue left on the pad.
- Determination of bacterial counts, total counts, coliform count, yeast and mold count(sanitary quality)
- Determination of freezing point as index to possible water pickup.
- Evaluation of flavor
- Detection of antibiotic residues, pesticide residues.

MILK PROCESSING SEQUENCE



MILK PROCESSING SEQUENCE

- First step in processing milk may be blending of different batches to specified fat content All the while the milk should be held cold at 4.4°C.

CLARIFICATION

Aim: To remove sediment, body cells from the udder, and some bacteria.

Equipment: Centrifugal clarifier

Removal of the impurities is facilitated by distributing the milk in thin layers over conical disks which revolve at high speed. Separated according to differences in the density .

PASTEURIZATION

Aim: To rid the milk of any disease-producing organisms it may contain and to reduce the total bacterial count for improved keeping quality. Also destroys lipase and other natural milk enzymes

✓Pasteurization temperatures and times for many years were selected to ensure destruction of *Mycobacterium tuberculosis* , the highly resistant non-spore forming bacteria that can transmit tuberculosis to humans.

A treatment of 62°C for 30 min or its equivalent was employed.

PASTEURIZATION

✓In more recent years it was discovered that the organism causing Q fever, *Coxiella burnetti*, was slightly more resistant than the tuberculosis organism and required a heat treatment of 63°C for 30 min or its equivalent.

The two accepted methods for milk pasteurization:

✓Batch holding method: Heating every particle of milk to not less than 63°C and holding at this temperature for not less than 30 min.

✓High Temperature Short Time (HTST): Heating every particle of milk to not less than 72°C and holding for not less than 15 sec.

PASTEURIZATION

- Pasteurized milk is not sterile.
- It must be quickly cooled to prevent multiplication of surviving bacteria.
- Does not produce an objectionable cooked flavor in milk
- No important effect on nutritional value

MILK PROCESSING SEQUENCE

STERILIZATION

- A typical heat treatment is : 150°C for 2-3 sec.
- When the temperature is sufficiently high, the time may be very short, preventing cooked flavor and color change.
- Then quickly cooled and aseptically packaged in cans or appropriate cartons. (UHT processed milk).
- Refrigeration not necessary.

HOMOGENIZATION

- After pasteurization milk may be homogenized or homogenization may come just before the pasteurization step if the milk has first been warmed to melt the butterfat.
- Milk and cream have countless fat globules that vary from about 0,1 to 20 μm in diameter. These fat globules have tendency to gather into clumps.
- Aim: To subdivide the fat globules and clumps to such small size that they will no longer rise to the top of the milk as a distinct layer.
- It makes the milk more uniform , richer in taste and white-appearing.

RELATED MILK PRODUCTS

Vitamin D milk

Multivitamin mineral milk

Low-sodium milk

Soft-curd milk

Low-lactose milk

Evaporated milk

Sweetened condensed milk

Dried whole milk

Low-fat milk

ICE CREAM

Composition of ice cream:

Dairy ingredients: whole milk, skim milk, cream, frozen cream, butter, butter oil, condensed milk products, dried milk products.

Ice cream is composed of:

milk fat, milk solids-non-fat (MSNF) derived from these ingredients + sugar + stabilizer + emulsifier + flavoring materials + water + air.

ICE CREAM

Functions of ingredients:

✓Milk fat: Gives rich flavor, smooth texture and body, contibutes heavily to the energy value of ice cream.

✓MSNF: contribute to flavor, give body and desirable texture, higher overruns (increase in volume caused by whipping air into the mix before freeezing) without textural breakdown.

✓Sugar: adds sweetness, lowers the freezing point (prevents freezing solid in the freezer). Sucrose, dextrose, fructose...

ICE CREAM

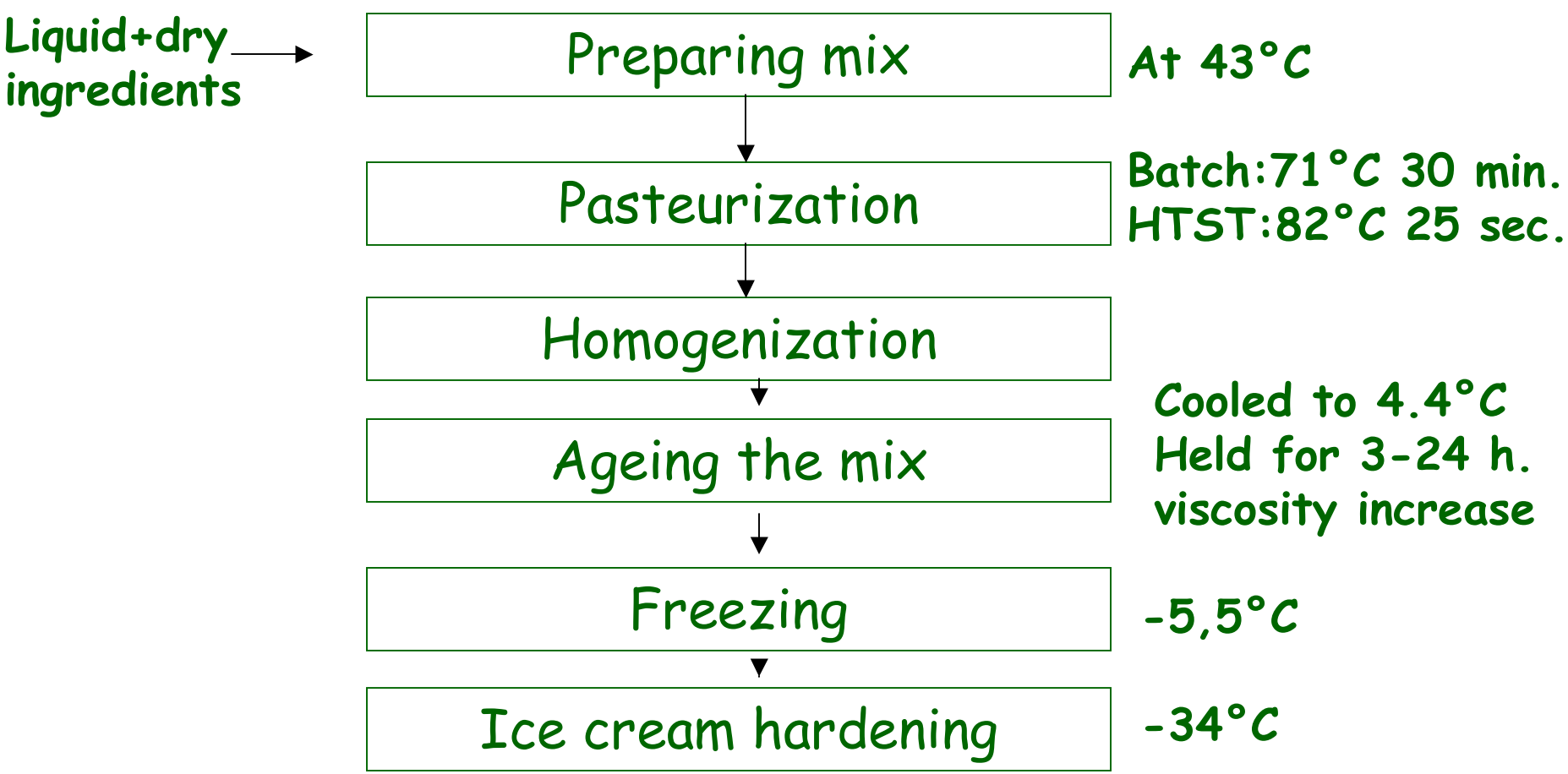
- Stabilizers: Form gels with the water and thereby improve body and texture. Give a drier product which does not melt as rapidly or leak water. By binding water, help to prevent large ice crystals from forming during freezing. Gelatin, Gum guar, Gum karaya, seaweed gums, pectin, carboxymethyl cellulose.

- Egg yolk: is a natural emulsifier (lecithin). Help disperse the fat globules throughout the ice cream mix and prevent them clumping together. Improve whipping properties to reach desired overrun.

- Flavors: Give variety and consumer appeal. Vanilla, chocolate, strawberry, fruit and nut combinations.

ICE CREAM

MANUFACTURING PROCEDURE



ICE CREAM

MANUFACTURING PROCEDURE

FREEZING

- The cold , thoroughly blended mix is pumped to a batch or continuous freezer.
- The purpose of freezing: is to freeze the mix to about -5.5°C and to beat in and subdivide air cells.
- Freezing must be quick to prevent the growth of large ice crystals that would coarsen the texture and iar cells must be small and evenly distributed to give a stable frozen foam.
- The semi-solid ice cream emerging from the freezer goes into packaging cartons or drums.
- Flavors can be pumped to give the common flavor.

CHEESE

- Product made from the curd of the milk of cows and other animals.
- The curd being obtained by the coagulation of milk casein with an enzyme (rennin), an acid (lactic acid)and with or without further treatment of the curd by heat, pressure, salt and ripening (fermentation) with selected microorganisms.

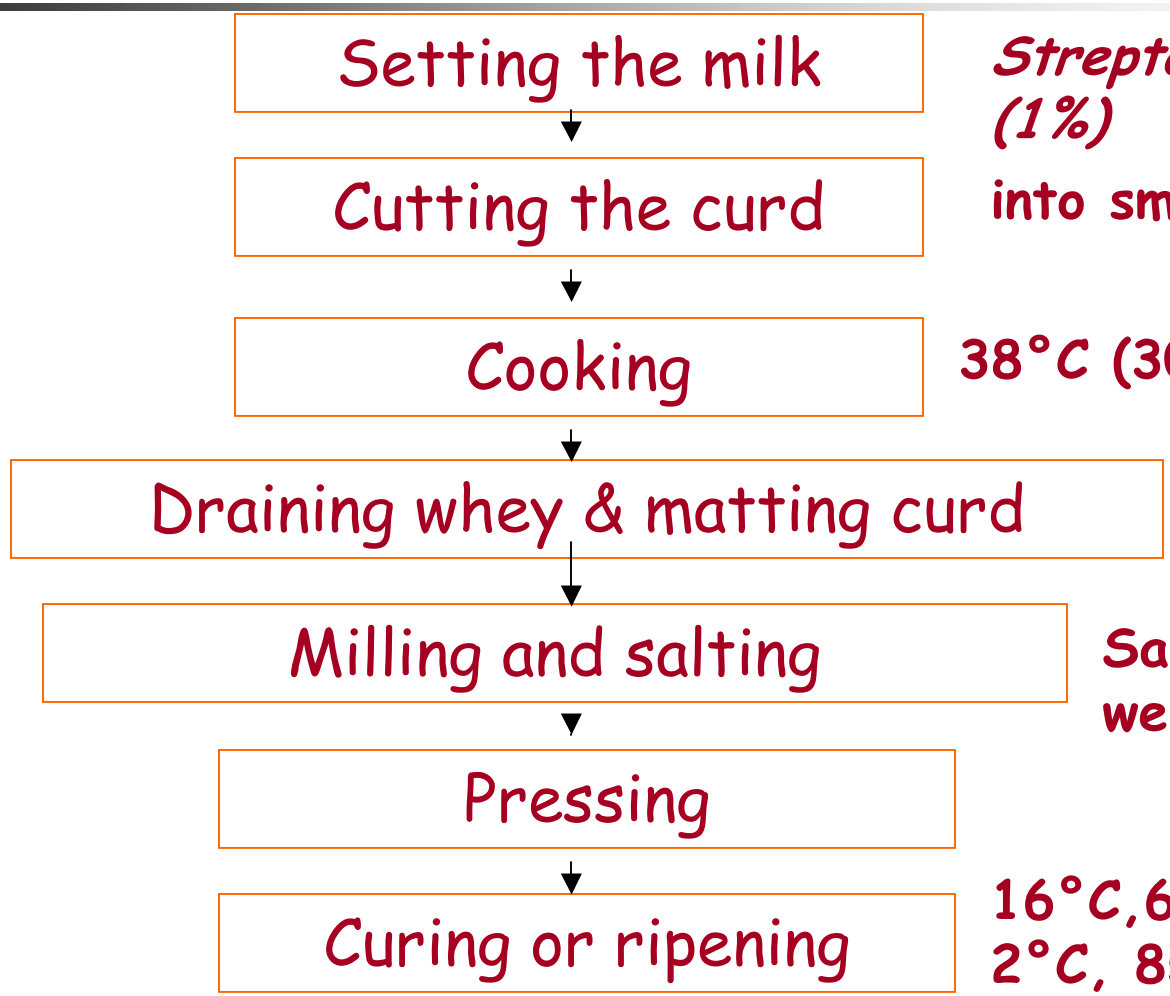
CHEESE

Kinds of cheese:
Soft – unripened – lowfat: cottage, high fat: cream
Semisoft – ripened by bacteria: brick, by bacteria and surface m.o.: Limburger, by blue mold: roquefort, Blue cheese
Hard – ripened by bacteria: Cheddar, Swiss, Emmentaler
Very hard – Parmesan
Process cheeses – pasteurized, cold-pack, related products
Whey cheeses – Mysost, Primost, Ricotta

CHEESE MAKING OPERATIONS

- Milk contains fat, proteins (principally casein, less beta-lactoglobulin and alpha-lactalbumin), lactose, minerals and water.
- When acid and/or enzyme rennin are added to milk, the casein coagulates, trapping much of the fat, some of the lactose, and some of the water and minerals in the coagulant. This is the curd.
- The remaining liquid which contains dissolved lactose, proteins and minerals and other minor constituents is the whey.
- Cheese curd can be made from raw or pasteurized milk.

CHEESE MAKING OPERATIONS



Streptococcus lactis (1%)

into small cubes

38°C (30+45 min)

Salt:2,5% of curd weight

16°C,60% RH,3-4 days
2°C, 85% RH 60 days-12 months

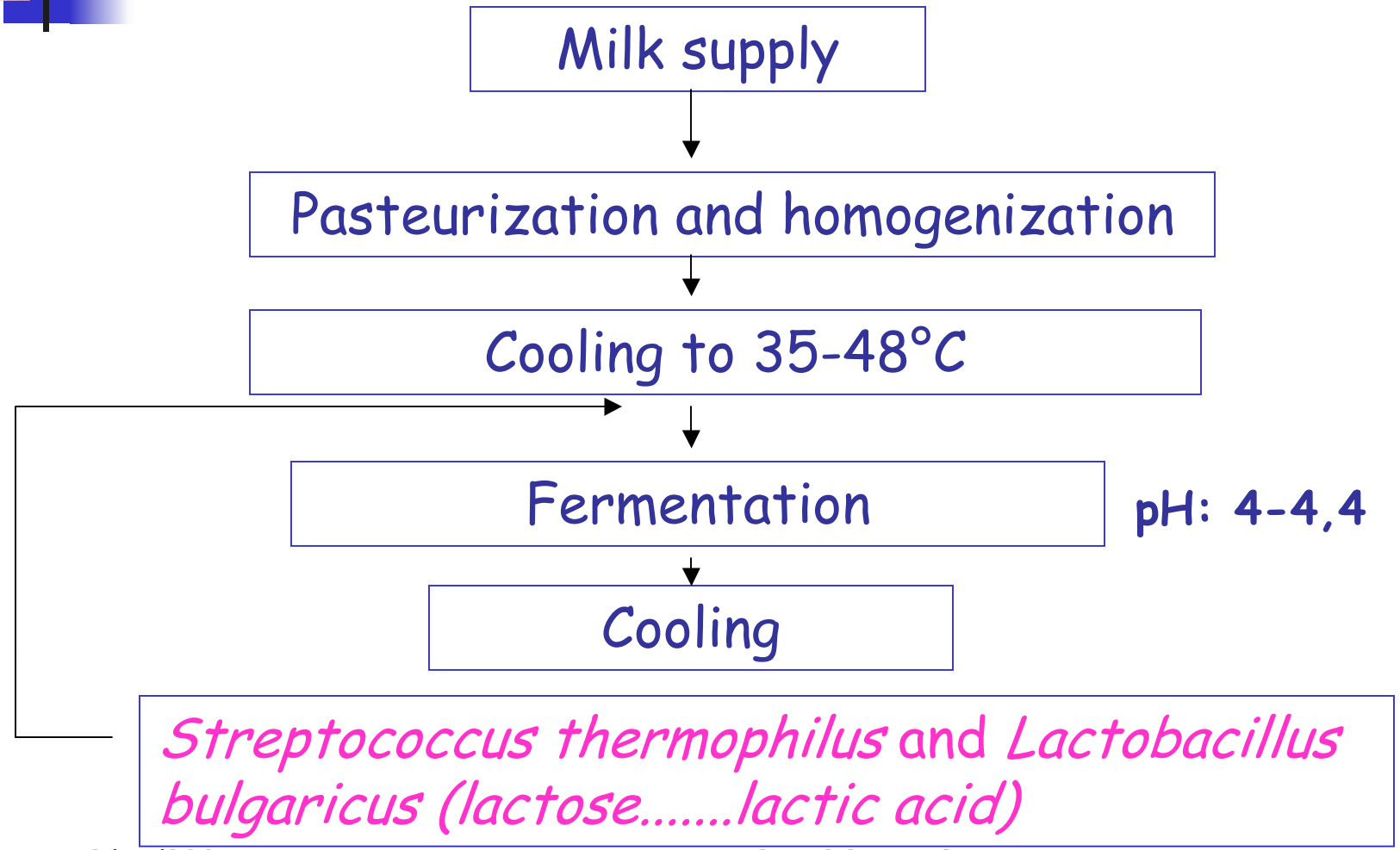
YOGHURT PRODUCTION

- Yoghurt is pasteurized milk or low-fat milk coagulated to a custard-like consistency witha mixed lactic acid culture containing *Streptococcus thermophilus* and *Lactobacillus bulgaricus*. It is also flavored with fruit preserves.

Types of yoghurt production :

- ✓Set type: Process in the package
- ✓Stirred type: Packaging after process

YOGHURT PRODUCTION



END OF Lecture