

Perfect Soft Mozzarella



Andrea Pelati
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INTRODUCTION

Worldwide, there are many recipes and various types of Mozzarella produced in response to market demands and consumers.

This webinar does not aim to provide an ideal recipe for the production of a good Mozzarella. Rather it will provide guidance to a broader vision, for those who want to know and produce this wonderful cheese.

The dairy technologist needs to know how to produce the best product based in context of the raw material and market demands they operate in.

Perfect Soft Mozzarella

Mozzarella is the most important and well-known representative of "Pasta Filata" cheese.

- **Mozzarella dates back to the Medieval age.**
- **Originated in Southern Italy**
- **Primitive conditions of transport meant that the milk from buffaloes and cows arrived at the processing sites already containing acid. This ensured that the curd produced was stretchy and elastic.**
- **Now in Italy, Mozzarella represents 20% of the national dairy production.**
- **Various types of Mozzarella are produced, differing in shape, moisture and taste.**



PASTA FILATA CHEESE

- **Pasta Filata cheese is distinguished by how it is made: stretching with hot water.**
- **No other cheeses are made this way.**
- **When added to hot water, the protein properties in milk become "plastic" thanks to the demineralization of the curd (calcium minerals) due to the acids produced by natural fermentation or chemical.**
- **Includes fresh cheeses such as Mozzarella, semi-mature or seasoned cheese as Caciocavallo, Provolone and Kashkaval.**



SOFT MOZZARELLA



Soft mozzarella, often called "Fior di latte" or "Bocconcino" is probably the most well-known and important type of Mozzarella.

- The classic soft Italian Mozzarella is in the form of egg
- Weight varying from 100 to about 300 grams
- White color
- Very soft, milky
- Mild flavor of milk, slightly acid
- The skin must not be slippery, but thin and soft

Mozzarella can be produced from:

- Buffalo milk
- Cow milk
- Sheep milk (rarely, only for small traditional production)

CHEMICAL COMPOSITION AND ENERGY of MOZZARELLA (x 100 g)

	Buffalo	Cow
Water (g)	55-60	55-65
Protein (g)	19-20	18-22
Fat (g)	22-27	16-24
Salt (g)	0-1	0-1
Energy (kcal)	280	265

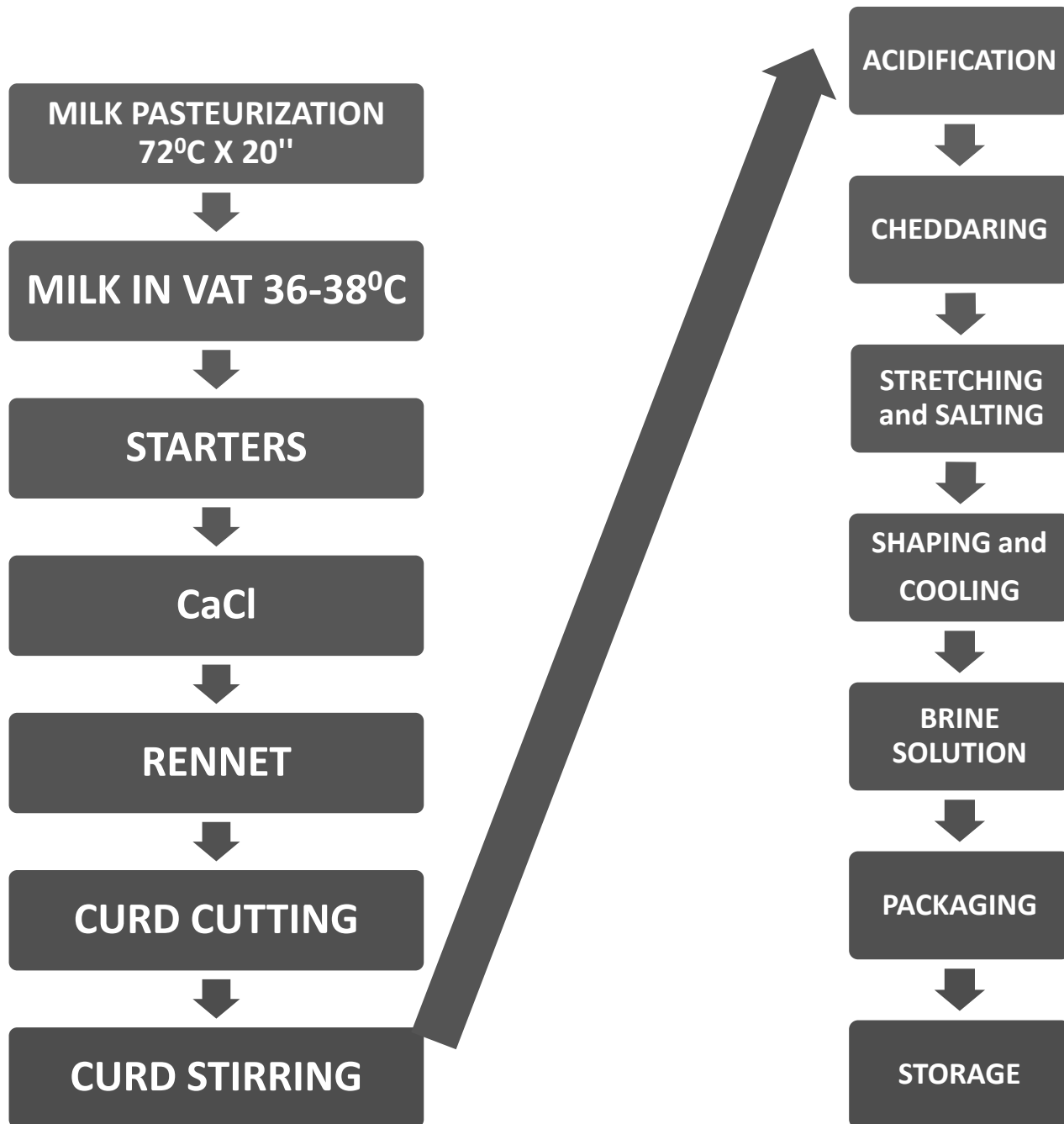
PRODUCTION MOZZARELLA TECHNOLOGIES:

- **Because Mozzarella is a fresh cheese, the milk must be pasteurized.**
- **The typical process of spinning with hot water (75-95 °C) DOES NOT substitute pasteurization.**
- **The process of milk pasteurization must NOT be greater than 75°C (interaction casein-whey proteins, disulphide bridges) or it will impair substantially the spinning phase.**
- **Production can be made with different qualities of milk, usually slightly acidic (pH 6.7 to 6.4), also known as “mature” milk.**
- **Milk with high somatic cell counts significantly affects the quality and shelf life of Mozzarella (most somatic cells are destroyed during pasteurization, but not the highly proteolytic enzymes)**
 - **BIOLOGICAL ACIDIFICATION**
 - **CHEMICAL ACIDIFICATION**
 - **MIXED ACIDIFICATION**

BIOLOGICAL ACIDIFICATION

- Occurs with natural or selected cultures, usually *S.Thermophilus* and sometimes *L.Bulgaricus* or rarely mesophilic cultures.
- Addition of natural or microbial rennet in quantities such as to obtain coagulation times between 10 and 20 minutes.
- Acidification time of the curd between 3 and 6 hours.
- pH of the curd between 5.20 and 4.80 for the phase of spinning.
- Stretching with hot water between 75 to 95 °C.
- Shelf life from a few days to 1 month.

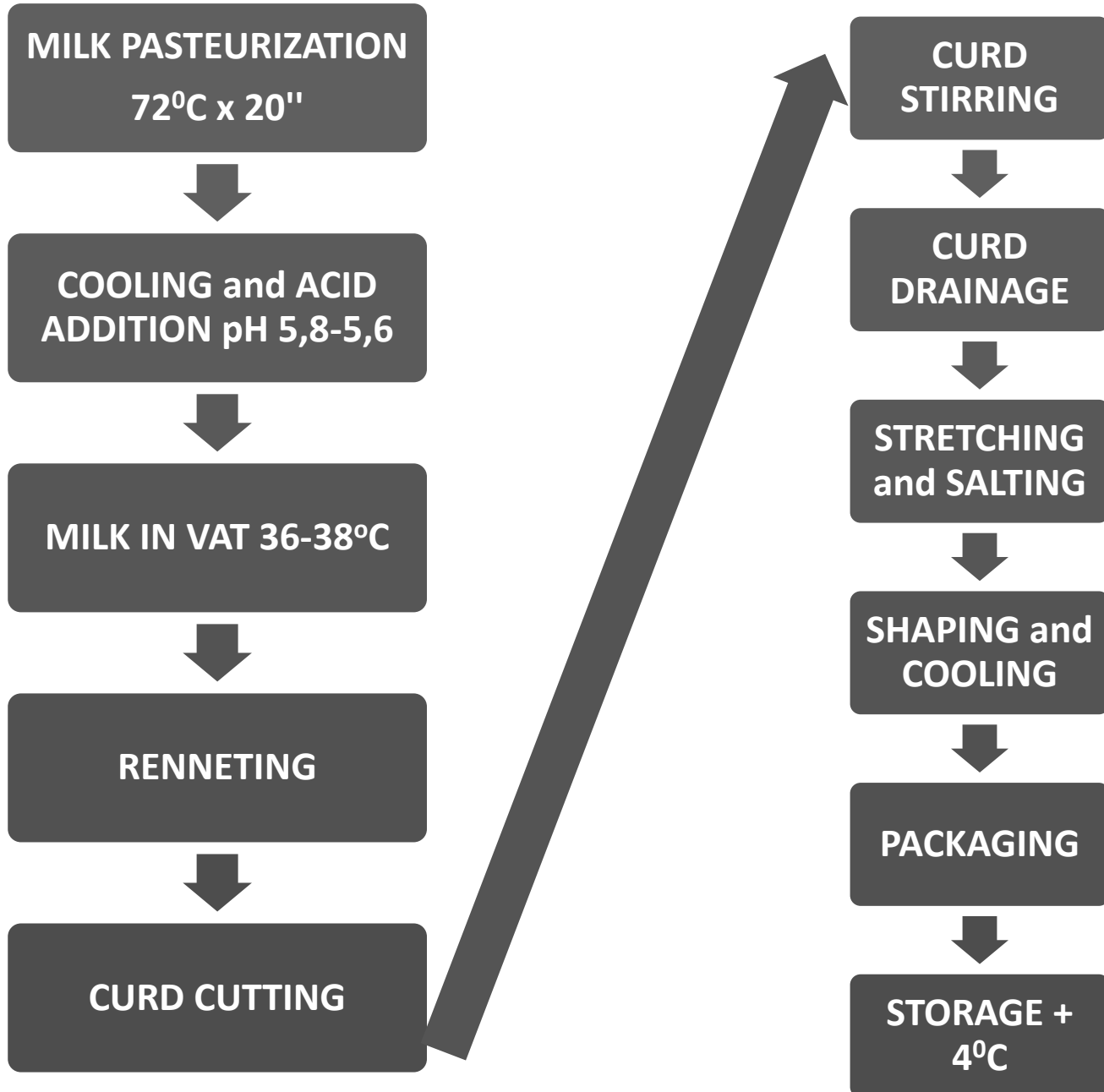
BIOLOGICAL ACIDIFICATION FLOWCHART



CHEMICAL ACIDIFICATION

- Includes the replacement of natural fermentation with addition of mineral or organic acids (citric acid, lactic acid, malic acid, acetic acid) into cold milk.
- Syneresis of the curd exclusively by mechanical action (cutting and stirring in vat).
- Separation of the curd from the whey and immediate stretching process.
- Stretching pH 5.6 to 5.9, depending on acid used (nr. of carboxylic acid groups COOH).
- Salting during the stretching process.
- Cooling and packaging in water or brine solution.

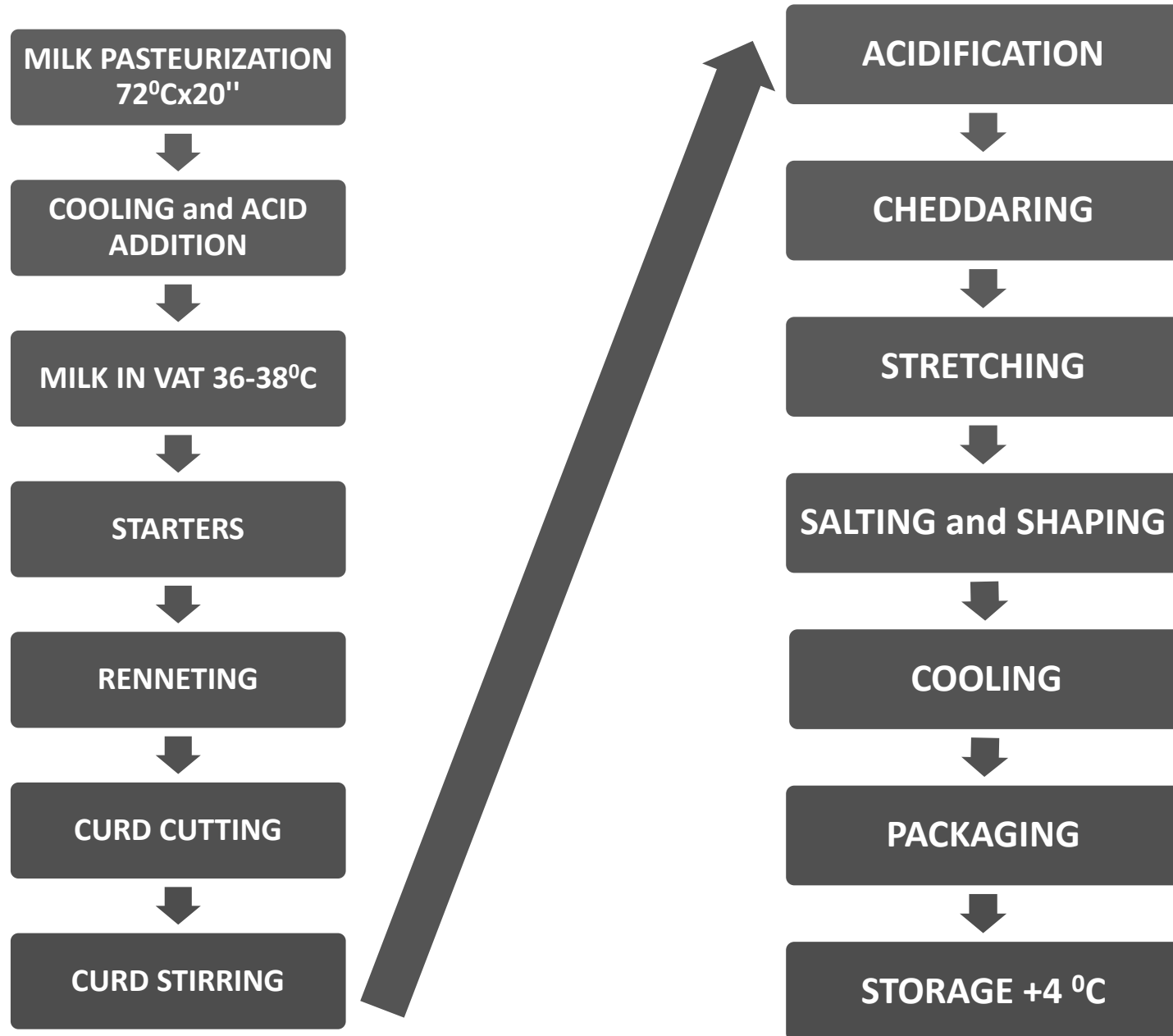
CHEMICAL ACIDIFICATION FLOWCHART



MIXED ACIDIFICATION

- **This technology provides a partial acidification of the milk with organic acids to a pH of 6.00 to 5.8 and then addition of starter.**
- **It reduces working times.**
- **Spinning at pH 5,40-5,20**
- **Final product with more taste than a Mozzarella with chemical acidification.**

MIXED ACIDIFICATION FLOWCHART



ADVANTAGES AND DISADVANTAGES OF THE BIOLOGICAL AND ACIDIFICATION TECHNOLOGIES

Biological Acidification

Advantages

Traditional product.

Superior organoleptic quality.

Protection against microorganisms, so a longer shelf life .

Good knowledge of microbiology for a correct control and managing of the production process.

Disadvantages

Long production time due to the lactic fermentation.

ADVANTAGES AND DISADVANTAGES OF THE BIOLOGICAL AND ACIDIFICATION TECHNOLOGIES

Chemical Acidification	
Advantages	Disadvantages
Reduced production time	Flat taste
Best adaptation to modern industrial plants	Vulnerability to microbiological contamination
	Reduced shelf life
	Quality of the whey not optimal for the production of Ricotta

BRINE SOLUTION

The preparation of a suitable brine solution is of great importance. It controls the osmotic processes between the product and the solution and influencing the outer surface, the presentation, taste and shelf life.

INGREDIENTS (for 100 liters of solution)

- Pasteurized water
- 0.6-1% NaCl
- 1-1.2% CaCl
- 1ppm chlorine

Brine solution is always adjusted and depends on the water in the place of production.

A mineral compound for specific use of the brine solution is available.

FUNDAMENTAL PRODUCTION STEPS

STARTERS

- The "quality" of acidification influences the final curd and the finished product.
- The species and strains of starter influence quality and shelf life of the product:
 - Post acidification
 - Proteolysis
 - Production of aromatic compounds
- A good starter must have a medium-high acidification power, low post acidification and act without proteolytic activity.
- Acidification time for the production of a good Mozzarella should be 4 to 6 hours (from the addition of starters).

RENNET



- The **quality** of rennet influences shelf life of product.
- The **quantity** of rennet influences the finished product.
- Fast coagulation times give hard products, long coagulations give moist products.
- A good coagulation should be between 10- 20 minutes.

CHEDDARING

- The grains of curd during acidification (hence their demineralization) gradually change their structure from round to elongated shapes to produce filaments similar to chicken meat.
- This may be amplified by the technique of cheddaring, overlapping and periodically turning blocks of curd.
- A curd treated with cheddaring, to parity of pH, has better performance during the stretching phase than a curd not treated this way.



STRETCHING TEST



- **pH control, then acidification is important, but does not replace manual testing:**
- **To test the "plasticity" of the product: 200-300 grams of chopped curd is immersed in water at 80 °C for 10 sec, then manually stretched.**
- **The milk protein content influences the right pH for stretching phase.**

STRETCHING PHASE



- **This process is immersing the curd previously triturerated in hot water (75-95 °C).**
- **The amount of water required is double or triple the amount of curd.**
- **The stretching allows the curd to be washed, to absorb the necessary water and to receive the salt.**
- **The product is shaped manually or by machinery and placed in cold water for the cooling phase.**



- **The cooling step must be gradual to achieve a finished product temperature of $<10^{\circ}\text{C}$ in a couple of hours.**
- **It is then packaged with brining liquid and stored at 4°C .**

BUFFALO MOZZARELLA



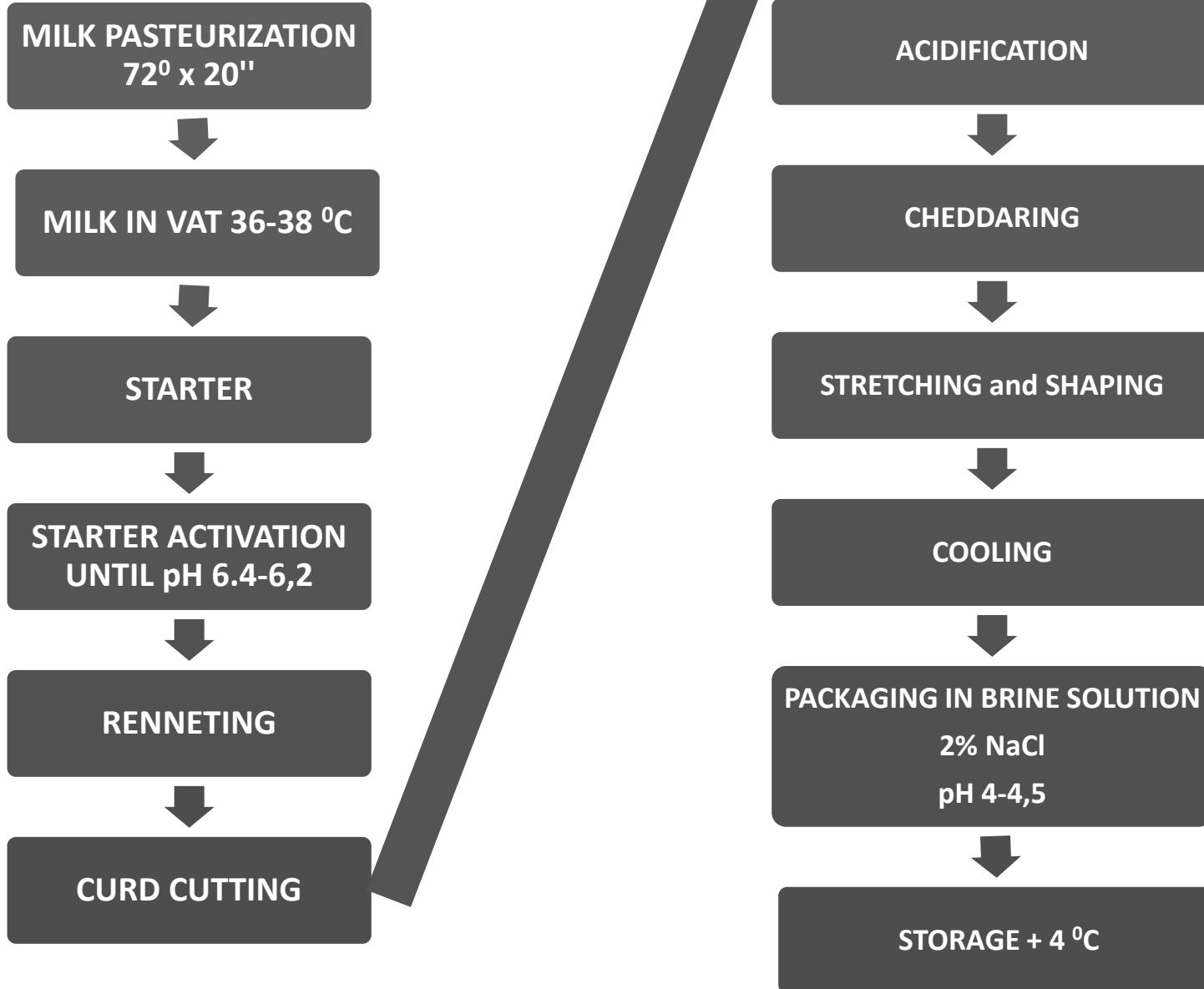
- “The Queen” of Mozzarella.
- Buffalo milk has double the protein and fat of cow milk, therefore the amount of starter used must be doubled.

- Using the same amount of cow Mozzarella rennet, buffalo milk coagulates faster and syneresis is greater.
- The starters used are usually highly thermophilic acidifying (*S.Thermophilus*, + *L.Bulgaricus*, and / or *L.Helveticus*) and sometimes a small percentage of mesophilic cultures.
- Buffalo mozzarella is usually produced with natural starter from whey of the previous day’s production.

- **The acidification step takes slightly longer and optimum pH for stretching is lower than cow Mozzarella: about 4.8.**
- **Fat has a higher melting point than cow's milk.**
- **The step of stretching is carried out with water at 90-95°C.**
- **Final product is usually salted and packed in brine solution with 2% NaCl and adding lactic acid or citric until pH of 4-4.5.**
- **Yield is almost double that of cow Mozzarella (20-28%).**



BUFFALO MOZZARELLA FLOWCHART



PRODUCTION PROBLEMS AND DEFECTS

(Cow and Buffalo Mozzarella)

ABNORMAL ACIDITY AND WEAVING

Problems of abnormal acidity and weaving are often caused by a wrong acidification during the process. The causes can be found in the quality of the milk or in the performance of the starters.



BITTER FLAVOUR

Bitter flavours are often caused by excessive proteolytic activity of starters.

NON-OPTIMAL APPEARANCE

Non-optimal appearance (blistering, detachment of the skin, stripping of the product) are caused by a not optimal brine solution.

MICROBIOLOGICAL PROBLEMS

Problems of microbiological origin are usually caused by a bad hygiene (coliforms) or contamination by Pseudomonas.

TECHNOLOGICAL INNOVATIONS

Mozzarella and “Pasta Filata” cheeses are traditionally made using the addition of hot water during the process of the stretching.

Hot water has 3 functions:

- It makes the curd “plastic” so that it can be shaped.**
- It gives curd the desired moisture.**
- It “cleans” curd from the whey and from any eventual sources of microbiological contamination.**

The amount of water added to the curd is usually double or triple the curd’s weight. Yet not all the water is absorbed. The remaining water is then drained, along with small amounts of fat and protein, thus decreasing the yield.

- **Technological innovations by Italian Company CMT have replaced the use of water with steam.**
- **Steam added to curd is entirely absorbed without residues, thus increasing the yields and reducing the high water consumption used in big dairies.**
- **Tests carried out have given implemented yield of 9 kg of cheese / 1000 liters of milk.**



- **The curd absorbs steam in a mode more “intricate” (drops of steam/diameter), which allows for an increase in the moisture content in the product, further increasing the yield.**

***Thank you for your
attention....***

QUESTIONS