Pasta Filata Cheese Solutions

Dairy Community Denmark

Factors influencing “pasta filata” structure

Billund, DK – 5th April 2018

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a better world

Factors influencing “pasta filata structure”

With this presentation, based on the long experience of CMT in Pasta Filata market - with more than 3,500 machines installed worldwide - we’d like to share with you some of the factors influencing final products.

Some of the factors are considered marginal but in many cases influence in different ways the quality results.

Performances achieved in one factory may be not achieved in another one .

Stretched curd cheese

Mozzarella has ancient origins in Southern Italy dating back to the Medieval age.

It is a traditional Italian fresh and mild product, developed later on into a hard and more tasty cheese as food ingredient for Pizza

" Pasta Filata " cheese is produced
by stretching the curd using hot water and/or steam.
No other cheeses are produced in this way.

By adding hot water or steam, the protein becomes "plastic" thanks to the demineralization of the curd (calcium minerals) due to the production of acid by biological or chemical acidification.

Pasta filata are cheeses that require maturation during production process **!**

Factors effecting final product structure

- Different type of milk: different composition
  (cow/buffalo/recombined milk)
  quality of raw milk
- Pre-maturation requirement
  milk storage temperature
- Different final products: fresh mozzarella or pizza-cheese
  coagulation process
    - rennet
    - acid
    - mix of rennet and acid
- Structure of fibers hot water/steam stretching along the period

Milk Composition

Composition of milk nutrients of different mammals						
Species	Water %	Dry residual%	Protein %	Fat %	Lactose %	Ashes %
WOMAN	87,6	12,4 - 12,6	1,1 - 2	3,7 - 4,5	6,4 - 6,8	0,2 - 0,3
COW	**87,3**	**12,2 - 12,7**	**3,1 - 3,4**	**3,5 - 3,7**	**4,9 - 4,9**	**0,7 - 0,7**
BUFFALO	**82,3**	**17,7 - 21,5**	**5,1 - 5,9**	**7,5 - 10,4**	**4,3 - 4,4**	**0,7 - 0,8**
SHEEP	83,6	16,3 - 16,4	5,1 - 5,5	4,3 - 6,2	4,2 - 4,6	0,9 - 0,9
GOAT	86,8	12 - 13,2	3,1 - 3,8	3,5 - 4	4,6	0,8 - 0,8
DONKEY	90,1	9,9 - 10,2	1,7 - 1,8	1,2 - 1,4	6,2 - 6,9	0,5 - 0,5
HORSE	90,6	9,4 - 11	2 - 2,7	1,1 - 1,6	5,9 - 6,1	0,4 - 0,5
DOG	75,4	20,7 - 24,6	9,5 - 11,2	8,3 - 9,6	3,1 -3,7	0,7 - 1,2
CAMEL	86,5	13,5 - 14,4	3,7 - 4	3,1 - 4,9	5,1 - 5,6	0,7 - 0,8

Analogue cheese

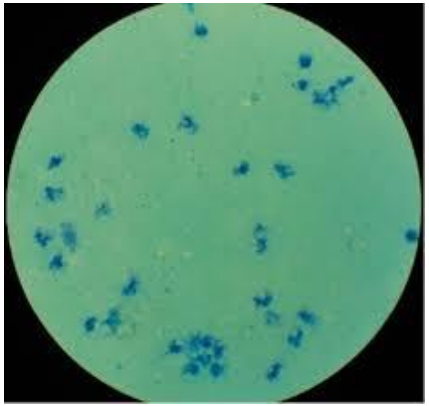
Typical recipe:

- 14 kg of caseine
- 11 kg of butter/oil
- 250 gr of citric acid
- 700 gr of trisodium citrate
- 150 gr polyphosphate
- 7 kg of curd
- Hot water for melting (3 min.)

Microbiological aspects of milk

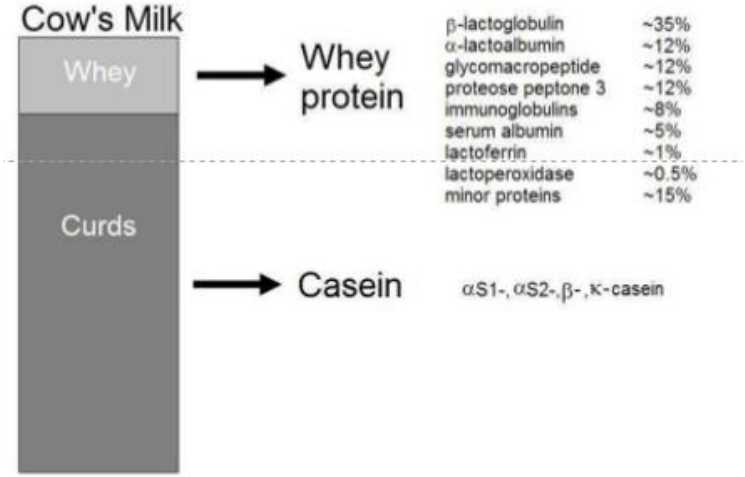
A reduced total bacteria count is, as in all milk products, a pre-requisite for obtaining a quality product.

Specific attention should be given to somatic cells count that are affecting negatively the coagulation process



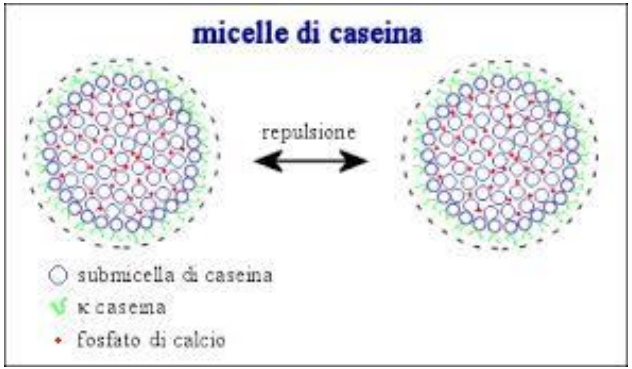
Dedicated attention to cows health and a properly bactofugal treatment will reduce the content at the recommended value of 25,000-30,000 som.cell/ml

Milk Maturation in storage 4°C/ 8°C



Milk pre-maturation is required in order to obtain a higher process yield.

When Milk is stored at a temperature of 4°C the β casein tends to solubilize.



When milk is stored at 8°C for some hours (4/6 hrs), we obtain a more substantial clot in cheese making vat.

Pasta Filata Cheese products

HIGH MOISTURE

Fresh Mozzarella

Bocconcini

Cherries

MEDIUM-LOW MOISTURE

Pizza cheese

Provolone

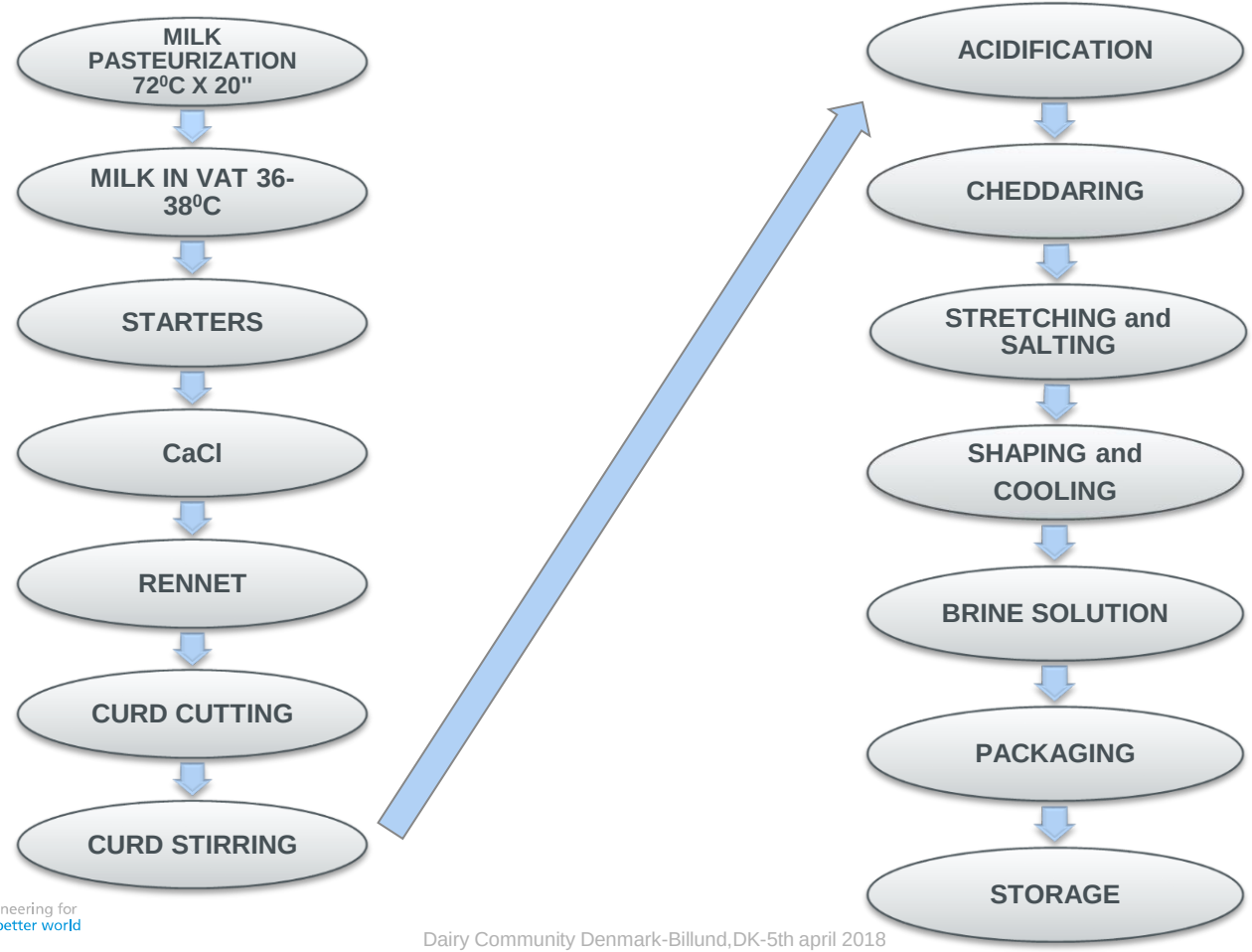
Stick

Pasta filata composition (cow milk)

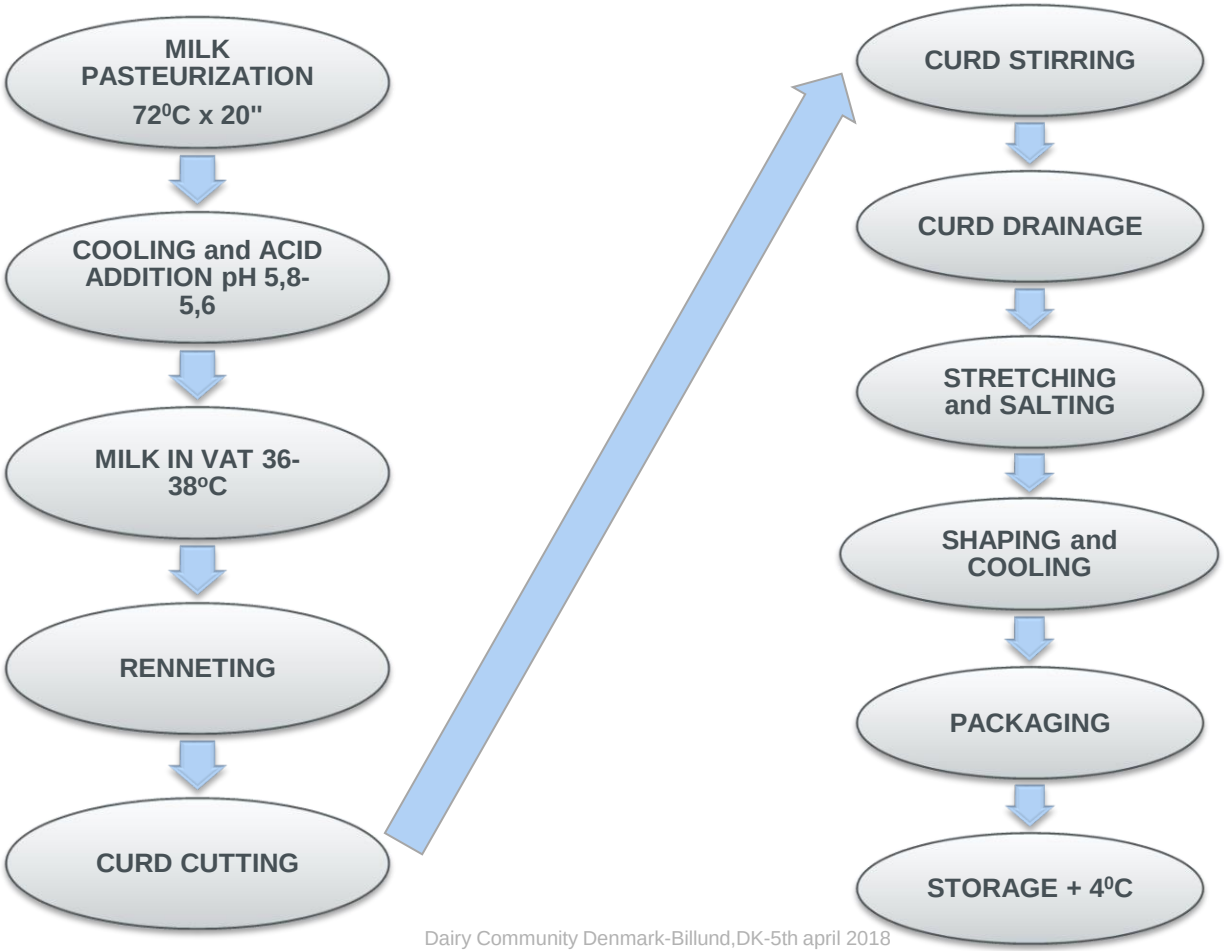
PASTA FILATA COMPOSITION (x 100 g)

	PIZZA CHEESE	FRESH MOZARELLA
WATER	48-50	62-66
FAT	22	18
PROTEIN	26	18
SALT	0,7-1,2	0,5

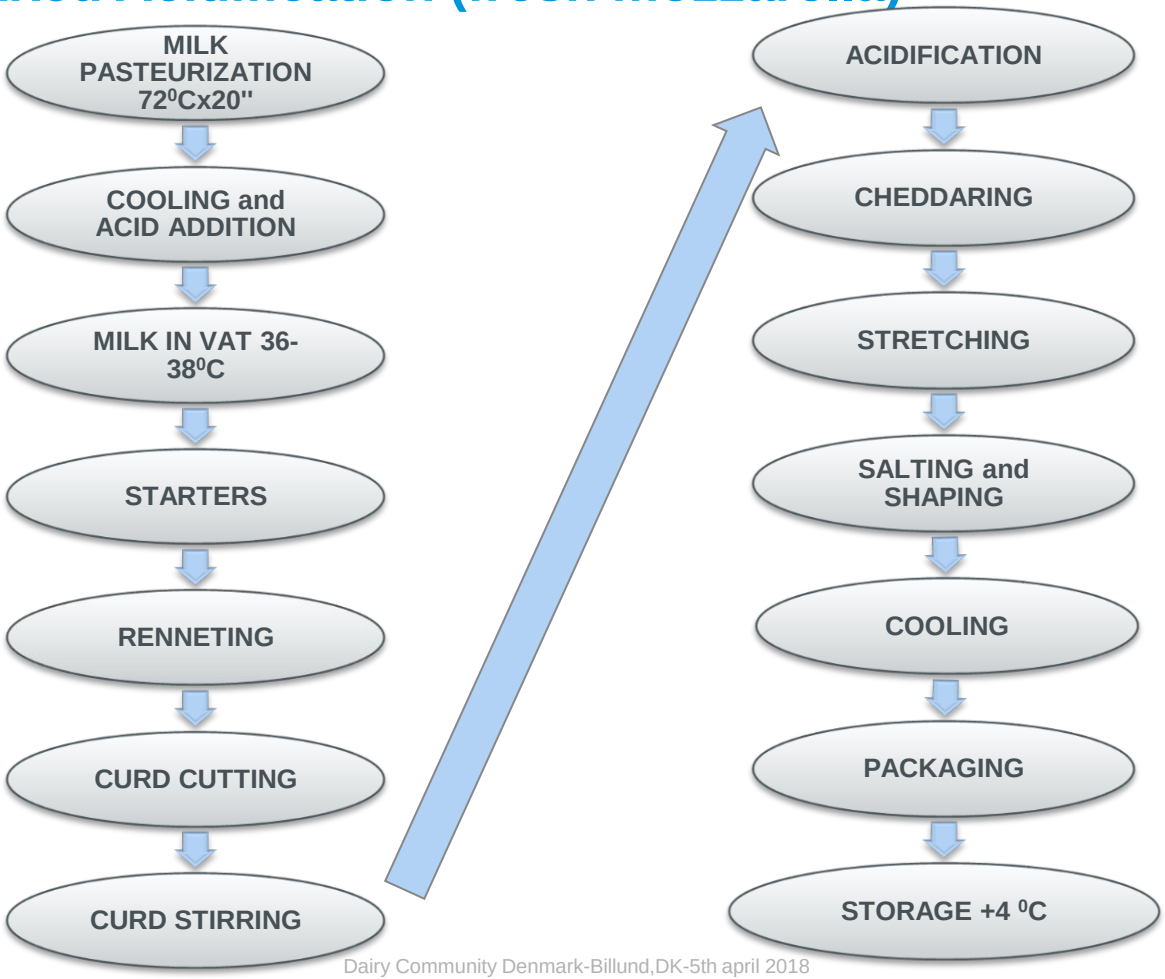
Flowchart:Biological Acidification (fresh mozzarella)



Flowchart:Chemical Acidification (fresh mozzarella)



Flowchart:Mixed Acidification (fresh mozzarella)



Advantages and disadvantages of the Biological Technology

Biological Acidification	
Advantages	**Disadvantages**
Traditional product	Long production time due to the lactic fermentation
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	

Advantages and disadvantages of the Chemical Technology

Chemical Acidification	
Advantages	**Disadvantages**
Reduced production time	Flat Taste
Best adaptation to modern industrial plants	Vulnerability to microbiological re contamination
	Not optimal quality of whey for whey powder production

Stretching process

TRADITIONAL STRECHING ONLY WITH WATER

Continuos recirculation of hot water :

- High losses of fat and protein in streching hot water
- High costs of skimming, cooling and recoverying of streching water
- Hight costs to heat water at around 85/90°C
  (hot water/ curd ratio → 3/1)
- High water consumption (normally 3 times the curd flow rate)

Water temp.:85÷90°C

STRECHING WITH STEAM

The steam added at the curd is completely absorbed into the curd:

- Yield increase from 0,5 to 1,5%
- Energy saving of 30%
- Product microstructure affected
- Reduced loss of protein or fat

Steam pressure.:max. 1,5 bar

Micro structure analysis
(CLSM) Confocal laser scanning microscopy

(Image edge length 319.5 µm)

Evaluation period: 2 weeks, 5 weeks, 8 weeks

- Discovery direct steam stretching machine / dipping arms
- Direct steam stretching Combi Plus machine / paddle-wheel
- Traditional water stretching machine

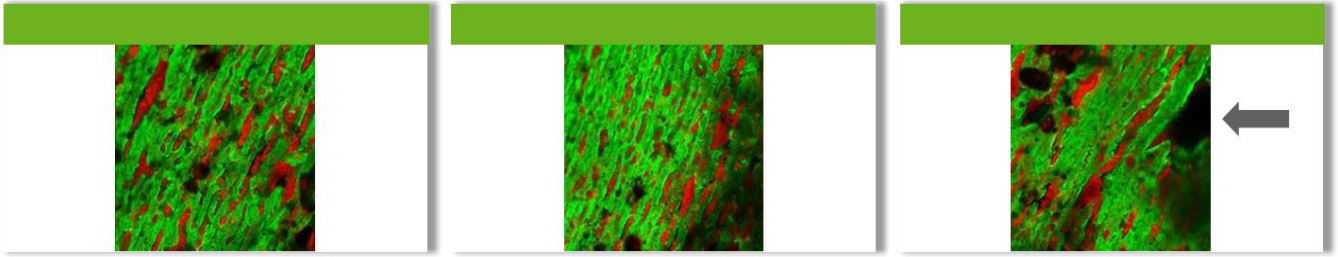
Red = Fat

Green = Protein

Black = Additions (air, fat, water, salt)

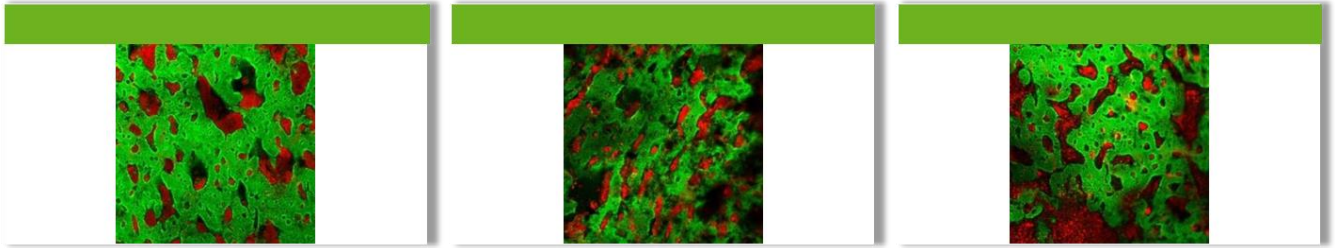
Time = 2 weeks

Good protein matrix with homogeneous fat distribution, air inclusion Pic. 3, Internal – External



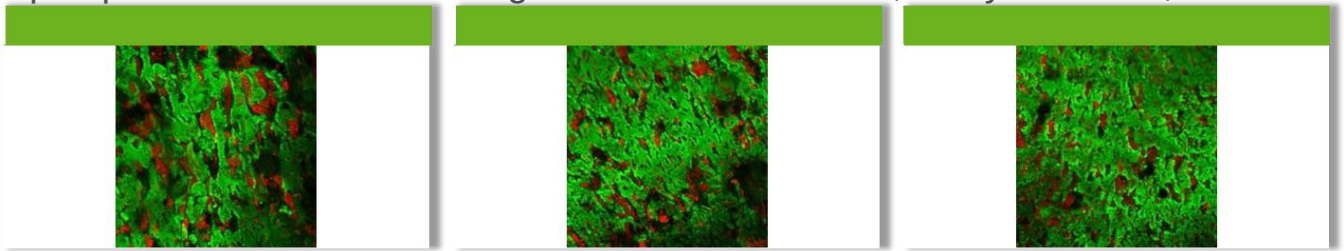
CMT Discovery steam stretching machine dipping arms

Good protein matrix with homogeneous fat distribution, chicken structure visible



CMT Combi Plus steam stretching machine paddle-wheel

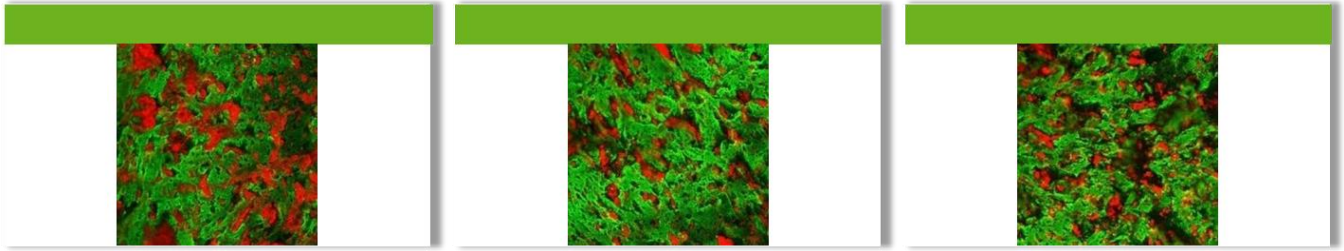
Open protein matrix with homogeneous fat distribution, many additions, Internal=External



Traditional Water stretching machine

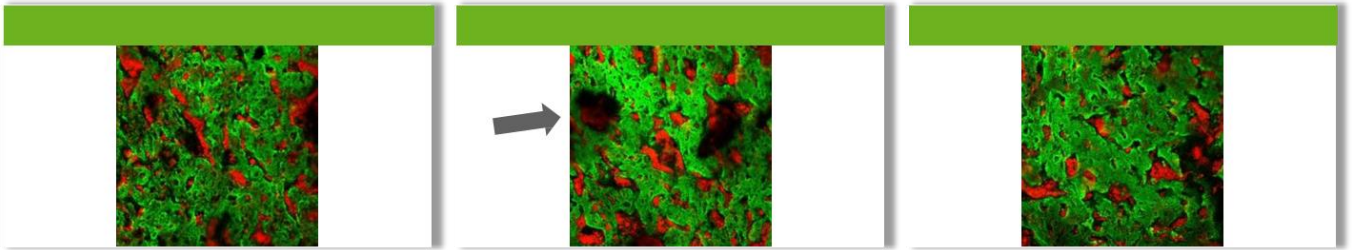
Time = 5 weeks

Good protein matrix with homogeneous fat distribution, size of fat ratios increases



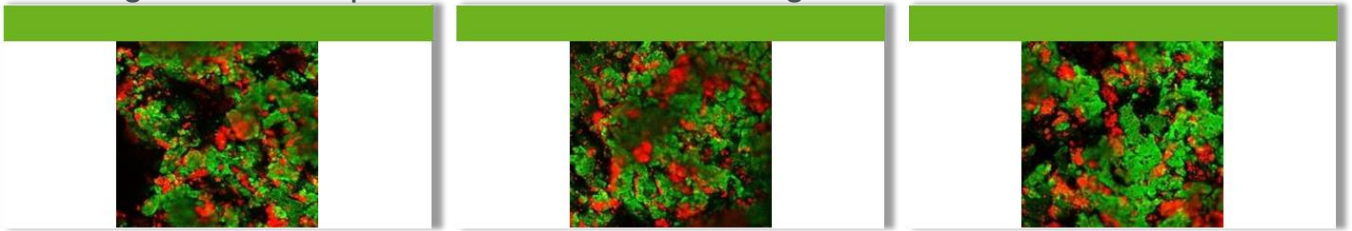
CMT Discovery steam stretching machine dipping arms

Good protein matrix with homogeneous fat distribution, salt additions



CMT Combi Plus steam stretching machine paddle-wheel

Disintegration of the protein matrix with inhomogeneous fat distribution, more additions (greasy water)

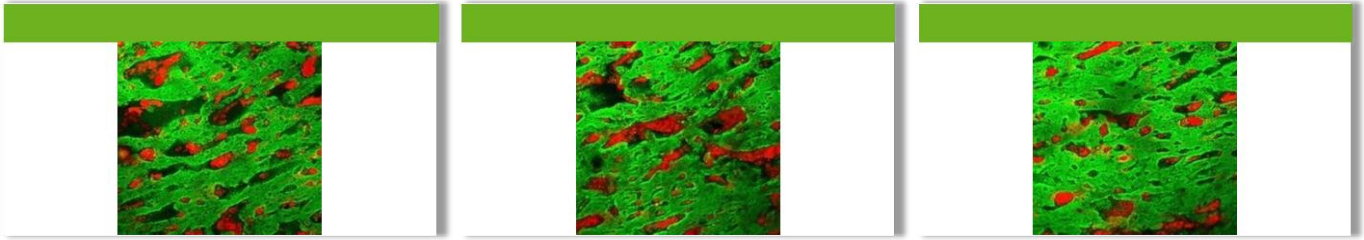


Traditional Water stretching machine

Red = Fat Green = Protein Black = Additions (air, fat, water, salt)

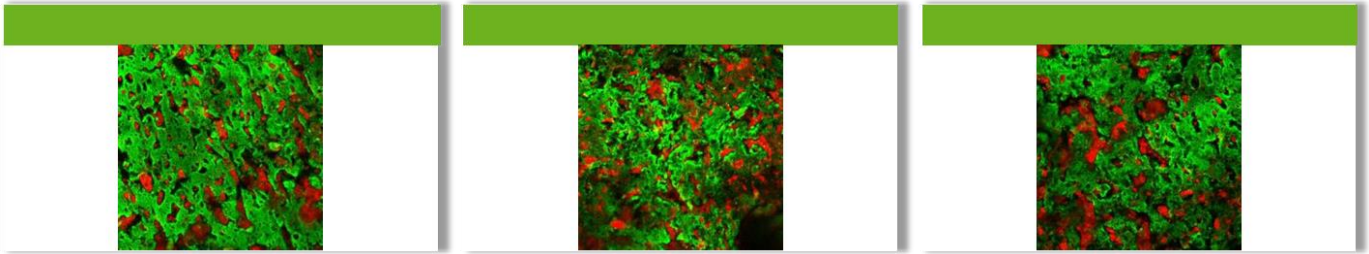
Time = 8 weeks

Good protein matrix with homogeneous fat distribution, Internal = External



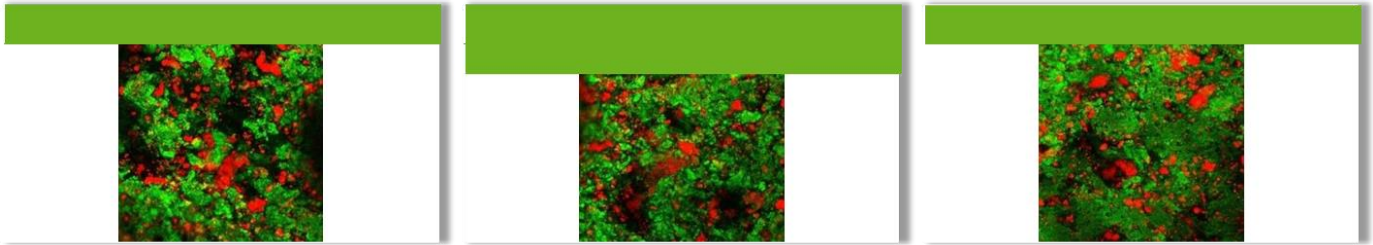
CMT Discovery steam stretching machine dipping arms

Slight disintegration of the protein matrix with homogeneous fat distribution, Internal = External



CMT Combi Plus steam stretching machine paddle-wheel

Disintegration of the protein matrix with inhomogeneous fat distribution, more additions (greasy water)



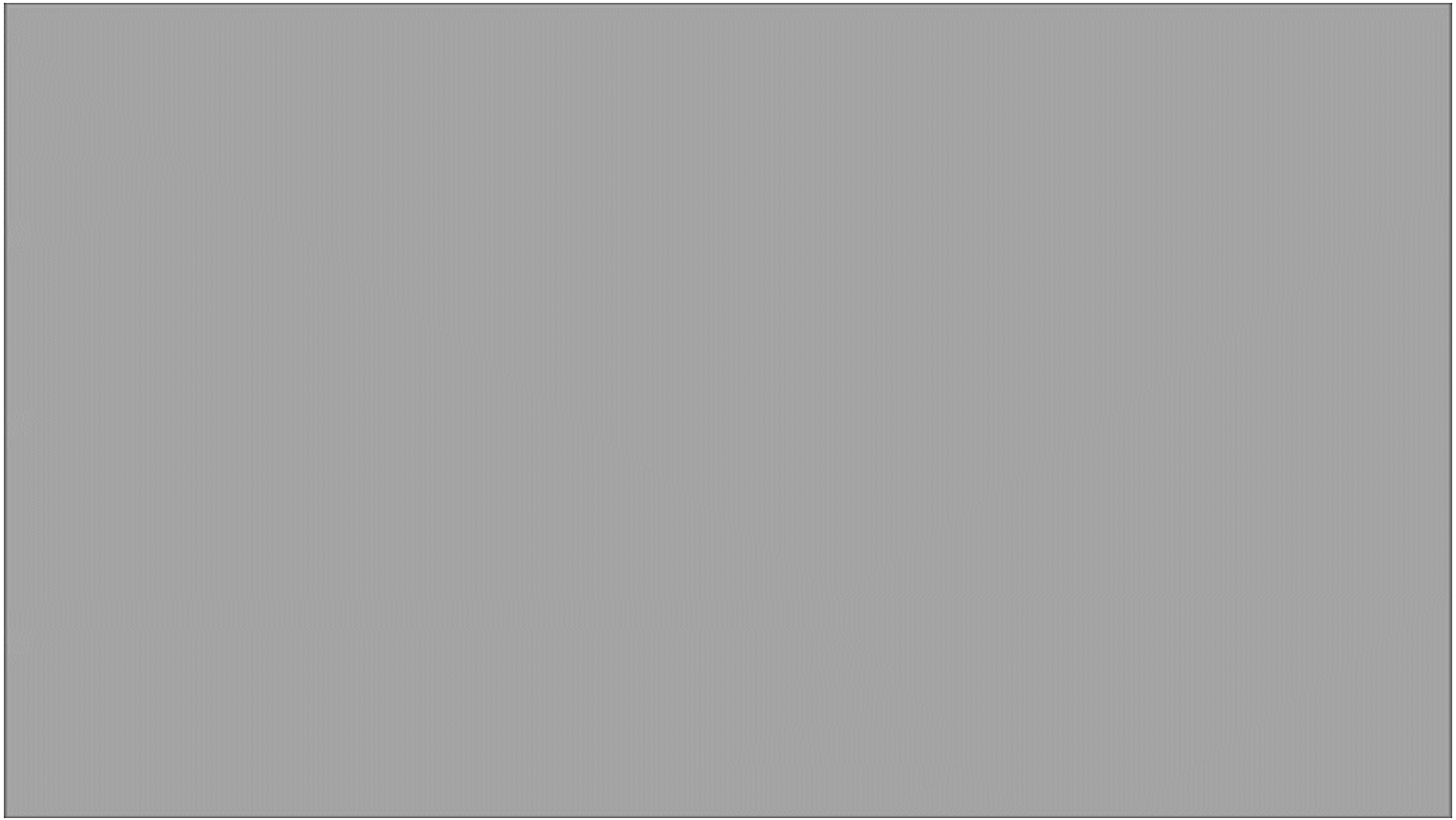
Traditional Water stretching machine

Red = Fat Green = Protein Black = Additions (air, fat, water, salt)

Other factors

- Other factors are also influencing quality of final product :
  - Salting
    - Liquid/solid
    - Doseing:
      - In mixing chambers
      - Between stretching and molding
      - In drum molding
      - In brine vat
  - Packing:
    - Cold (maintenance liquid)
    - Warm (water)
  - Cooling
    - Vats
    - Spiral
    - Storage system

Pasta Filata Cheese Production



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