Dynamic changes of acidity in dairy production

Teacheesy

Farmhouse and Artisan Cheese & Dairy Producers European Network

Erasmus+

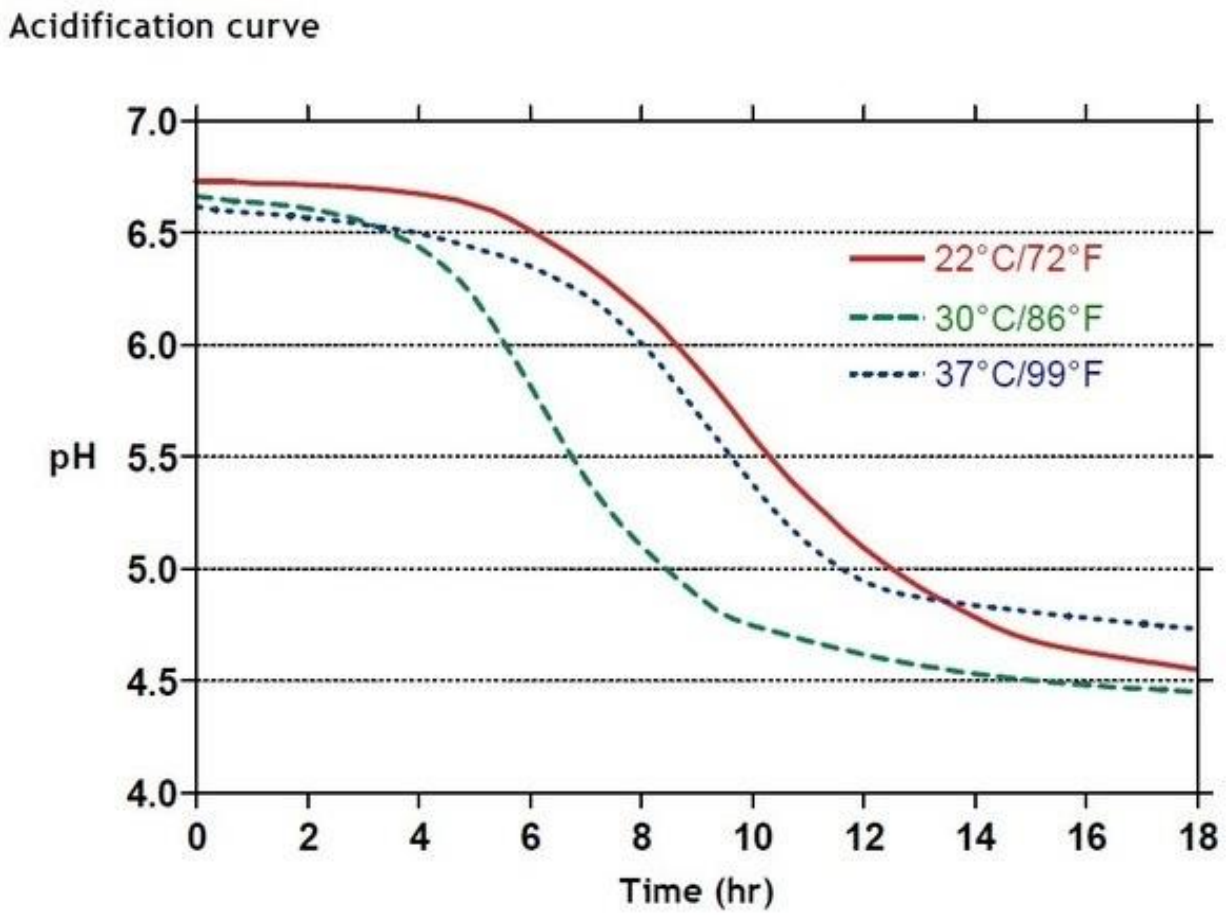
Dynamic changes of acidity in dairy production

- Most products processed by farmhouse and artisan producers are subject to fermentation
- To manage the process properly, the business operator must carefully control acidity at many levels.
- Appropriate changes of acidity over time strongly influence quality and safety of final products.
- In the farm production scale measurement of process and product acidity is the most important and effective tool for ensuring food quality and safety

The importance of acidity measurements

- The acidity level informs the business operator if their process is running correctly in the expected time.
- If acidity decrease is lower than expected it may suggest that the starter cultures bacteria are not working properly.
- This can negatively influence the properties of products and may be dangerous from safety point of view
- Slow development of lactic acid bacteria can allow harmful microorganisms to grow.
- Generally, many harmful microorganisms are strongly inhibited at the pH level ≤ 5,5.

Example of acidification curve



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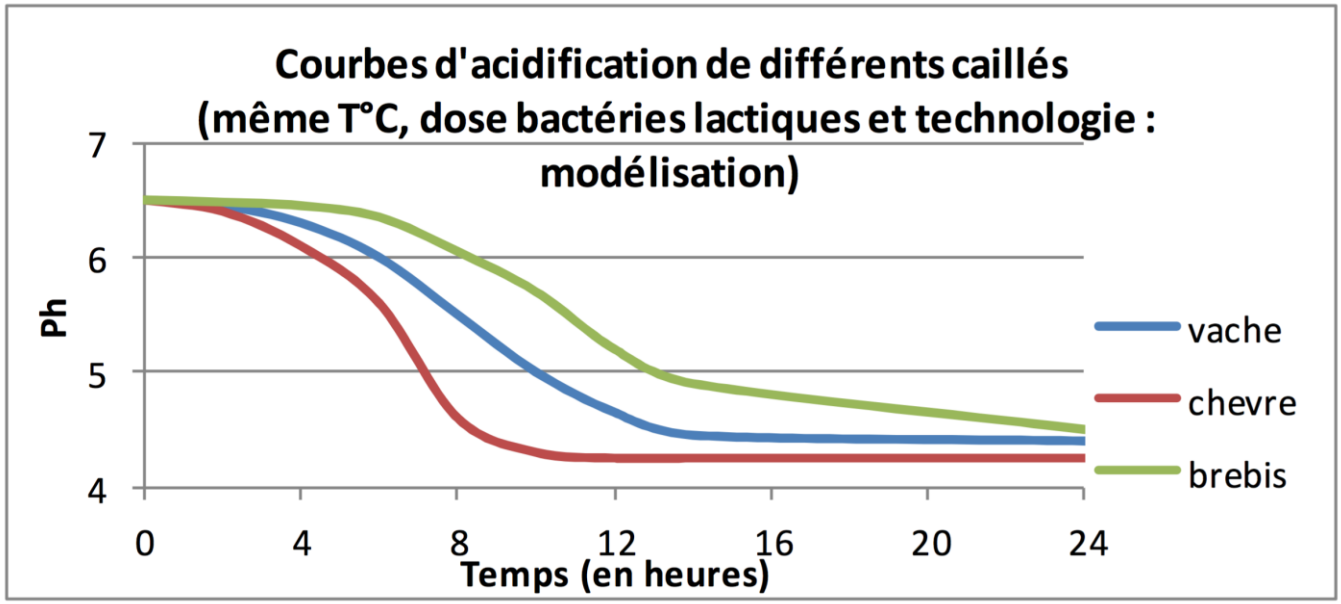

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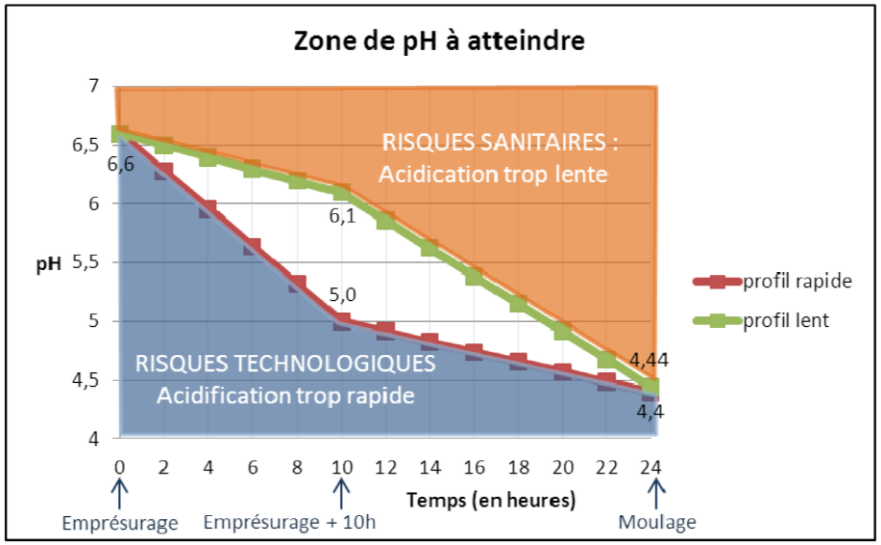

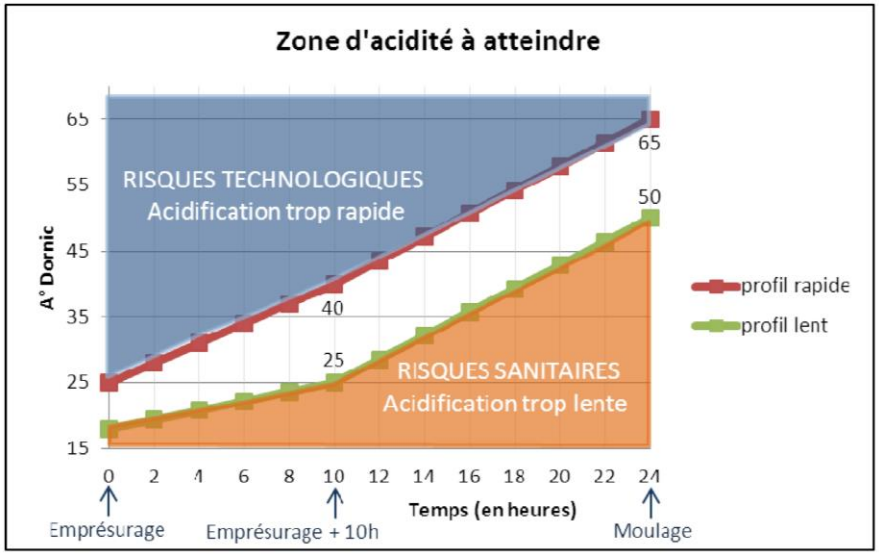

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Source image: PEP Caprin

Types of acidity scales

There are two interrelated concepts in food analysis that deal with acidity:

- ***pH***
- ***titratable acidity***

Each of these methods is analytically determined in separate ways and each has its own particular impact on food quality.

- The pH acidity of a solution is determined as the concentration of hydronium ions (H_3O^+) by using special measuring tool (pH-meter).
- Titratable acidity deals with measurement of the total acid concentration contained within a food (so called total acidity). It is determined by titrating a known volume of milk with standard alkali to the point of an indicator like phenolphthalein.

Different methods of titration

Titratable acidity (TA) methods are not too precise because the accuracy of measurement depends on many factors like:

Cleanless of used tools
Exact concentration of sodium hydroxide
Exact quantity of measured sample
Equal speed of measurement
Correct reading of results
Staff experience

But this method has a big advantage in daily practise: is simple and cheap.
In different countries different TA methods have been applied.

Different methods of titration

The principle of all these methods is the same:

The titrable acidity test measures the amount of alkali which is required to change the pH of milk from its initial value to the pH of the colour change of phenolphthalein (to pinkish colour) added to milk to indicate the end point

1. *Soxlet-Henkel degrees – quantity of 0.25N NaOH used for neutralize 100 ml of milk*
2. *Dornic degrees – quantity of 1/9N NaOH used to neutralize 10 ml of milk*
3. *Dornic-Marshal degrees –quantity of 0.1N NaOH used to neutralize 9 ml of milk*
4. *Thorner degrees – quantity of 0.1 n NaOH used to neutralize 100 ml of milk*

$$^{\circ}\mathrm{SH} = \frac{4}{9} \cdot {}^{\circ}\mathrm{D} = \frac{4}{10} \cdot {}^{\circ}\mathrm{Th}$$

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Procedure	SH	Dornic	Thörner
Pipet milk into Erlenmeyer flask	25 ml milk (if a SH buret graduated in 0.25 ml subdivision is used) 100 ml milk (if a SH buret graduated in 1.0 ml subdivision is used)	10 ml milk	10 ml milk + 30 ml water
Add Phenolphtalein	1 ml of Phenolphtalein (2%)	3-4 drops Phenolphtalein (5%)	5 drops of Phenolphtalein (5%)
Fill buret with Sodium hydroxide solution	1/4 N Sodium hydroxide solution	1/9 N Sodium hydroxide solution	1/10 N Sodium hydroxide solution

Different methods of titration

Characteristic points described with different acidity scales

Method	Alkaline milk	Fresh milk	Coagulates when boiling	Coagulates in ambient temperature
SH	≤ 6	7,0- 7,5	11-12	25-30
D and DM	≤ 14	15-17	26-27	≥70
T	≤ 16	16-19	≥27	≥75

Different methods of titration

Interdependence between different acidity scales and % of LA

	Lactic acid [%]	°Soxhlet-Henkel	°Dornic Marschal	°Thoerner
Lactic acid 1%	1,0	44,44	100,0	111,1
1°Soxhlet-Henkel	0,0225	1,00	2,25	2,5
1°Dornic Marschal	0,01	0,444	1,0	1,11
1°Thoerner	0,009	0,4	0,9	1,0

Different methods of titration

Group exercise to show the difference in pH and titration

Time (h)	0,5	1	1,5	2	2,5	3	3,5	4
Acidity of Yogurt (pH)	6,5							4,7
Acidity of Yogurt (° SH)	7							30
Acidity of Water (°SH) (water should have the same pH as the yogurt above)								

Different methods of titration

More detailed information

5.3 Titratable Acidity – A way of measuring acidity (video + instruction)

5.4 pH measurement – A way of measuring acidity (video + instruction)

5.5 Instruction sheet: Practical training on buffer capacity