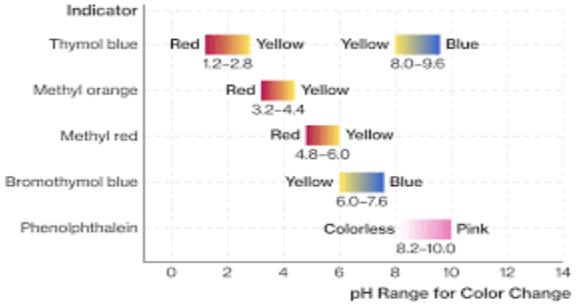
Abu Bekr Belkaid Tlemcen University
Institute of Applied Sciences and Techniques -ISTA
1st year LMD, Specialty: Food industry technologies
Module: Analytical Tools for Chemistry, Biochemistry and Safety

PW N°2: Titrimetric methods
Determination of the acidity of a milk by a volumetric titration

Fresh milk contains very few acids and its pH is close to neutrality.
Lactose, (C12H22O11) is a milk carbohydrate that can be converted into lactic acid by lactic bacilli.
The natural acidity of milk is titrated as follows: acidity due to caseins (2/5), mineral substances and traces of organic acids (2/5) and secondary reactions due to phosphates. The acidity developed is added to the natural acidity during the degradation of lactose into lactic acid by bacteria.
The increase in the acidity of milk is therefore linked to an important development of the lactic flora (Lactic fermentation) influenced by (poor storage conditions, poor hygienic conditions during milking, insufficiently cooled milk after milking, too long shelf life of milk,...
The lactic acid content (therefore the total acidity) of a milk is a good criterion for milk quality.
The titratable acidity of milk can be expressed in several ways :
* Concentration in moles of H+ ion (or H3O+) per liter of milk
• In the dairy industry, Dornic degrees (°D) are most often used.
Definition: a Domnic degree corresponds to the acidity provided by the presence of 0.1 g of lactic acid in one liter of Milk.
A fresh milk has an acidity between 15 and 18 °D.

PRINCIPLE OF AN ACID / BASE DOSAGE:
To dose an acid (compound providing H+ ions), a basic solution can be used (capturing H+ ions), whose concentration is known.
To equivalence, the number of moles of protons (H+) provided by the acids is equal to the number of moles of protons captured by the bases.
Equivalence is generally detected by the turn of a pH indicator; a substance whose color changes according to the pH of the reaction medium.

- ❖ Weak acid + strong base: the pH at equivalence is basic. Phenolphthalein.
- ❖ Strong acid + weak base: the pH at equivalence is acidic. Indicator helianthin (methyl orange).
- ❖ Strong acid + strong base: the pH at equivalence is neutral. Take phenolphthalein or helianthin.



Indicateur	pK_i	pH 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
Hélianthine	3, 6	rouge / orangé / jaune
Rouge de méthyle	5, 1	rouge / orangé / jaune
Bleu de bromothymol	6, 8	jaune / vert / bleu
Phenolphtaléine	9, 0	incolore / rose / rouge violacé

Lactic acid (2-hydroxy-propanoic acid) has the crude formula C3C603, its molar mass is M = 90.08 g.mol-1. It reacts with sodium hydroxide (soda) according to the following scheme:

PREPARATION OF TWO TEST SOCKETS

1) Preparation of the labeled test sample "solution A 1"

Half fill the beaker labeled "MILK"

In the erlenmeyer flask labeled "Al solution", Vo= 20.0 mL of milk taken from the beaker labeled "MILK" using a pipette.

Using a graduated test tube, complete solution A 1 with 100 mL of distilled water.

Add 10 drops of phenolphthalein

The solution A 1 will be used for quick dosing

2) Preparation of the test sample labeled "solution A2"

In the erlenmeyer flask labeled "solution A2", Vo- 20.0 mL of milk taken from the beaker labeled "MILK" using a pipette.

Using a graduated test tube, complete solution A2 with 100 ml. of distilled water.

Add 10 drops of phenophthalein

The A2 solution will be used for the precise dosage

COLORIMETRIC ASSAY

1) Preparation of the rapid dosage

Continue the experimental protocol as follows:

Put the bar of the magnetic stirrer in the erlenmeyer flask.

Fill the burette with sodium hydroxide solution of molar concentration CI = 0.05 mol /L. Adjust the liquid level to the zero level of the burette by draining the excess solution into the labeled erlenmeyer flask *recovery of used products*

Then place the erlenmeyer flask labeled "solution A1" and the magnetic stirrer under the burette.

Adjust the stirrer in order to homogenize the milk-distilled water mixture phenolphthalein.

2) Rapid dosing of milk with the test socket "solution A1"

Pour with a burette, mL by mL, sodium hydroxide into the erlenmeyer flask until the turn to the persistent dose.

Fill in the following table as you go:

Volume V (mL)	0	1	2	3	4	5	6	7	8	9	10
Color											

Indicate between which values the volume of sodium hydroxide V_{eq} is located. This volume corresponding to the persistent pink turning zone :

.....mL< V_{eq}< .....mL

3) Preparation of precise dosage

Complete the level of the burette so as to adjust the liquid level to the zero level of the burette.