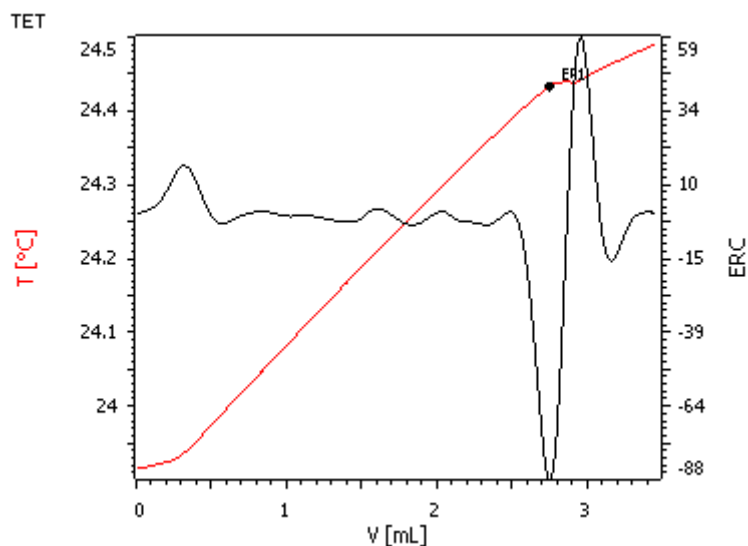# Determination of sodium in soy milk

This Application Note describes the determination of the total sodium content in soy milk products. The methodology may also be applied to the determination of sodium in milk from cows, goats, and sheep.

A standard addition technique is employed to permit the accurate and precise determination of sodium at relatively low levels.

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Method description

Principle

Sodium ion reacts exothermically with aluminium ions in the presence of potassium and fluoride ions to form insoluble NaK_2AlF_6 («elpasolite»). Aluminium must be in the $Al^{3.}$ ionic form.

The reaction may be used for the quantitative determination of total sodium in milk products.
For accurate and precise analysis, it is necessary to remove protein and lipids from the food. Trichloroacetic acid is used to denature the protein. The resultant curd is separated by filtration or centrifugation, and the whey or «serum» titrated for the sodium content.
To enable the analysis of products with lower sodium contents, a fixed volume of standard sodium chloride solution is added. Subtraction of the titration volume of the standard sodium chloride solution alone allows determination of the sodium content.

Samples

Two soy milk products were purchased from a supermarket – «Vitasoy» and «Nature's Soy».

Sample preparation

The products were well shaken before sampling.

Configuration

Basic equipment list for automated titration

814 USB Sample Processor	2.814.0030
859 Titrotherm	2.859.0010
Sample rack 24 × 75 mL	6.2041.340
Thermoprobe HF resistant	6.9011.040
Sample beaker 75 mL	6.1459.400
802 Rod Stirrer	2.802.0010
Stirring propeller 104 mm	6.1909.020
3 × 800 Dosino	2.800.0010
1 × Dosing unit 10 mL	6.3032.210
1 × ETFE cylinder unit 10 mL 1 × Dosing unit 5 mL	6.1566.150 6.3032.150
tiamo™	6.6056.222

* Acidified solutions of fluoride ion are used in this determination

Solutions

Titrant	$c(Al(NO_3)_3)$ = 0.5 mol/L aluminium nitrate solution prepared in a solution of $c(KNO_3)$ = 1.1 mol/L potassium nitrate
	$c(NH_4F)$ = 40% (w/v) ammonium fluoride in deionized water.
	CCl_3COOH trichloroacetic acid A.R.
	$c(NaCl)$ = 0.25 mol/L sodium chloride, for standardization of the
	$c(Al(NO_3)_3)$ = 0.5 mol/L aluminium nitrate solution and use as a standard addition

Analysis of samples

100 mL of milk is pipetted into a 250 mL Erlenmeyer flask containing 12.0 g trichloroacetic acid and a magnetic spin bar. The flask contents are then stirred for five minutes. The curdled milk is then filtered through a fast filtering paper or centrifuged.
A 25 mL aliquot of the filtrate or centrifugate is then titrated with standardized $c(Al(NO_3)_3)$ = 0.5 mol/L solution after automated addition of 3 mL $c(NaCl)$ = 0.25 mol/L and 5 mL $c(NH_4F)$ = 40% (w/v) solution.
Note that since the aliquot is taken from a solution whose original volume has been enhanced by the addition of the trichloroacetic acid; this volume increase has to be taken into account when calculating the effective volume of original milk actually titrated.
It has been found experimentally that the dissolution of 12 g trichloroacetic acid in 100 mL water increases the volume of solution to 106 mL. Therefore, for example, a 25 mL aliquot of filtrate or centrifugate is equivalent to 25 × 100/106 = 23.58 mL of milk.

Initial determination of NaCl blank

The blank determination is required when either a new standard solution of $c(NaCl)$ = 0.25 mol/L is prepared, or when a new batch of $c(Al(NO_3)_3)$ = 0.5 mol/L titrant is prepared.
Weigh 3.0 g trichloroacetic acid into a titration vessel and add 25 mL deionized water. Titrate with mixed $c(Al(NO_3)_3)$ = 0.5 mol/L, $c(KNO_3)$ = 1.1 mol/L solution after automated addition of 3 mL $c(NaCl)$ = 0.25 mol/L and 5 mL $c(NH_4F)$ = 40% (w/v) solution. Perform this analysis in triplicate, and calculate the mean of the volume of titrant required to reach the endpoint. Save this value as a Common Variable CV.

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Method description

Standardization of titrant

Prepare five titration vessels, each containing 25 mL deionized water and 3 g trichloroacetic acid. Aliquots of 2, 4, 6, 8, and 9 mL of c(NaCl) = 0.25 mol/L are dispensed by a Dosino as part of an automated *tiamo*™ standardization program, which also adds 5 mL c(NH₄F) = 40% (w/v) solution before the commencement of titration with mixed $c(Al(NO_3)_3) = 0.5$ mol/L, $c(KNO_3) = 1.1$ mol/L solution.

A regression analysis is performed automatically by *tiamo*™ to compute the strength of the Al solution.

Parameters

Basic experimental parameters

Titrant dose rate (mL/min)	2
ERC EP1 (exothermic)	-40
Data smoothing («filter factor»)	47
Stirring speed (802 Stirrer)	15
Evaluation start (mL)	1
Damping until (mL)	1

Titration plot

Results

Blank determination

(titration of 3.0 mL c(NaCl) = 0.2502 mol/L) :
1.5000, 1.5033, 1.5000, 1.4967 mL
Mean = 1.5000 mL

Analysis of soy milks

| Soy milk | Na mg/100 mL | |
	Nutrition information average value	TET analysis
Nature's Soy	25	24.9 ± 0.2 (n = 7)
Vitasoy	44	65.1 ± 0.1 (n = 8)

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