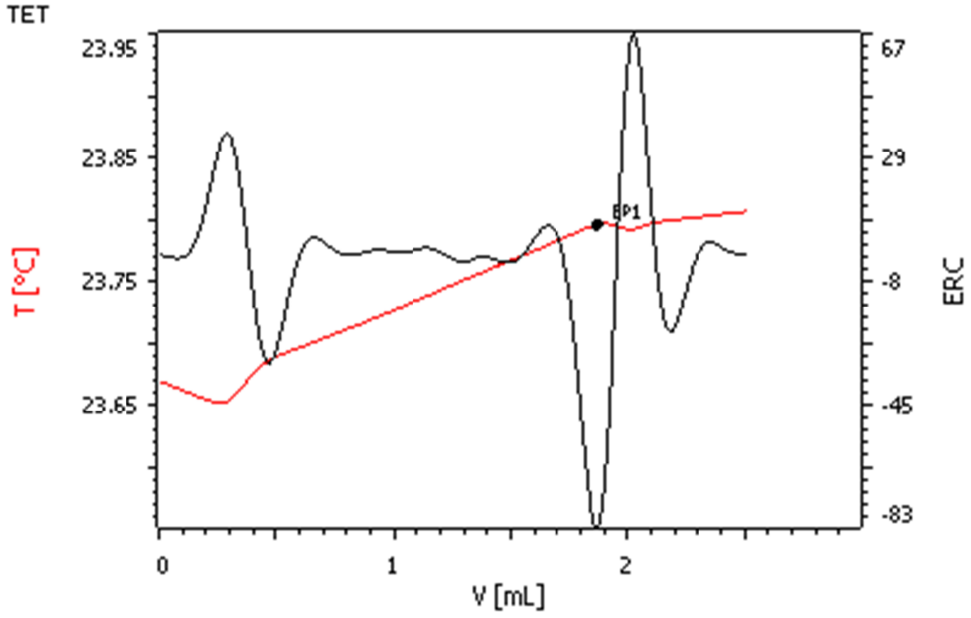
Titration Application Note H–122

Determination of sodium in canned fish products



This application note describes the determination of the total sodium content of canned fish products using thermometric titration.

Metrohm

Method description

Principle

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

The reaction may be used for the quantitative determination of total sodium in various foodstuffs. A necessary precondition for accurate analysis is that all sodium must be released for the food matrix. In the case of foods with a high protein content, trichloroacetic acid CCl_3COOH (TCA) has been found to be suitable in denaturing the protein and assisting in complete liberation of the sodium.

Sample

The sample chosen was a «snack pack» of chunk-style tuna canned in «natural spring water». The average sodium content claimed on the product label was 253 mg sodium in 100 g product.

Sample preparation

The entire contents of the can were emptied into a small blender container, which had been previously rinsed with deionized water and dried with a clean towel. The sample was blended until smooth, with no fluid separating from the mass.

Configuration

Basic equipment list for automated titration

814 USB Sample Processor	2.814.0030
859 Titrotherm	2.859.0010
Sample rack 24 x 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
2 × 800 Dosino	2.800.0010
1 × Dosing unit 10 mL	6.3032.210
1 x 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*

Additional equipment:
Small blender with sealed vessels («rocket blender»)
Polytron PT 1300 D homogenizer

Solutions

Titrant	$c(Al(NO_3)_3)$ = 0.5 mol/L aluminum 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
	$c(CCl_3COOH)$ = 30% (w/v) trichloroacetic acid in deionized water (TCA solution)
	c(NaCl) = 0.1 mol/L sodium chloride, for standardization of the $c(Al(NO_3)_3)$ = 0.5 mol/L aluminum nitrate solution
	concentrated HCl solution

Analysis of samples

Approximately 5-10 g of freshly blended canned fish product is weighed accurately into a titration vessel and 5 mL TCA solution and 15 mL deionized water added. The vessel contents are then treated with the Polytron PT 1300 D homogenizer at 20,000 rpm for 60 seconds.
The suspension is then titrated with standardized $c(Al(NO_3)_3)$ = 0.5 mol/L solution after automated addition of 5 mL $c(NH_4F)$ = 40% (w/v) solution.

Initial determination of reagent blank

This determination is only required for the initial setup for analysis of this type of food product.

Five separate titrations are performed, employing samples masses ranging from ~4 to ~10 g in roughly equal increments.

A regression analysis is performed on the results, with the x-axis denoting sample mass in g and y-axis titration endpoint volumes in mL.

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Method description

Standardization of titrant

Aliquots of 5, 10, 15, 20, and 25 mL of 0.1 mol/L c(NaCl) are pipetted into titration vessels and diluted with deionized water to bring the volume to ~25 mL. To each vessel, 1 mL of concentrated HCl is added. The solutions are titrated under the same conditions as for the samples.

A regression analysis is performed, with the amount of NaCl titrated (as mmol) plotted on the x-axis, and the volume of $c(Al(NO_3)_3)$ = 0.5 mol/L in mL plotted on the y-axis. The molarity of the Al^{3+} solution is calculated from the reciprocal of the gradient. A dedicated *tiamo*™ program has been created to automatically perform this standardization.

Parameters

Basic experimental parameters

Titrant dose rate (mL/min)	2
ERC EP1 (exothermic)	–8
Data smoothing («filter factor»)	47
Stirring speed (802 Rod Stirrer)	15
Evaluation start (mL)	0.7
Damping until (mL)	0.7

Calculations

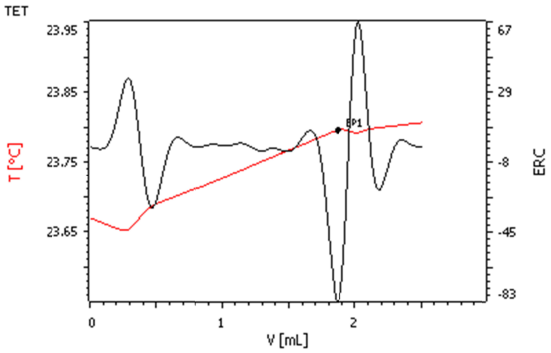
% Na w/w = ((EP1 – blank) × C001 × C002 x 0.1)/C00

EP1 = endpoint in mL
blank = titration blank in mL
C00 = sample mass in g
C001 = concentration of titrant in mol/L
C002 = atomic mass of Na (22.98977 g/mol)

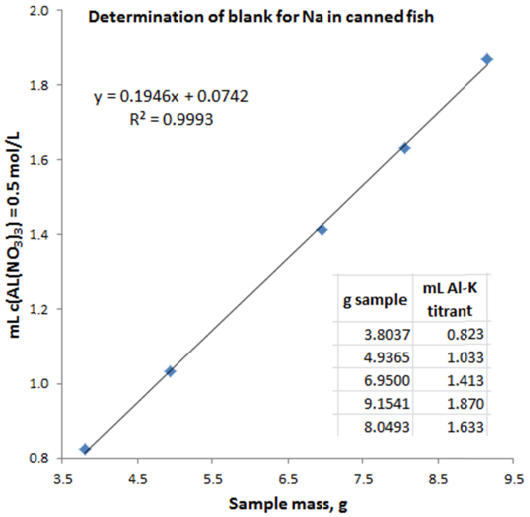
Results

Na in chunk-style tuna in natural spring water (claimed average value = 253 mg/100g)	236 ± 2.1 mg/100 g (n = 5)

Titration plot



Blank determination



Blank = y – intercept = 0.0742 mL

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