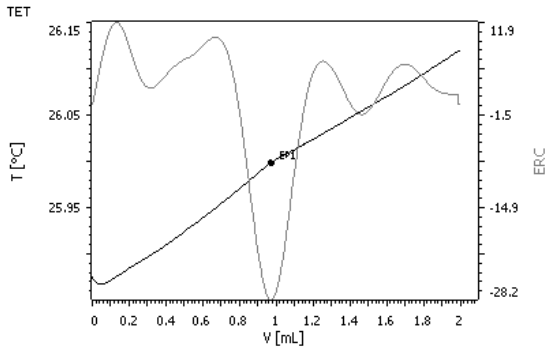
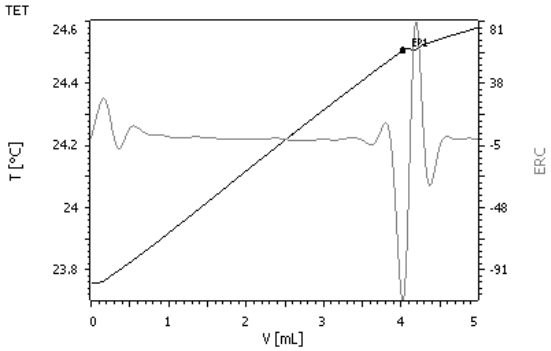
Titration Application Note H–123

# Sodium in instant noodles




This Application Note describes the determination of the total sodium content of instant noodles, which are also called «two minute noodles» in some countries. These products contain considerable amounts of sodium (approximating at least half of the recommended daily dietary intake), so an accurate assessment of the sodium content is important. Argentometric titration of the chloride content (and thereby imputing the sodium content as deriving solely from sodium chloride addition) is inappropriate for accurate analysis, since reference to the nutrition information on the product label shows the following mineral salts to be present as well as sodium chloride:

| Food Code no. | Salt |
|---|---|
| 508 | Potassium chloride (titrates argentometrically, would be analyzed falsely as sodium) |
| 451 | Pentasodium triphosphate (not analyzed argentometrically) |
| 500 | Sodium carbonates (not analyzed argentometrically) |
| 621 | Monosodium glutamate (not analyzed argentometrically) |
| 635 | Disodium ribonucleotides (not analyzed argentometrically) |

Metrohm

# 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 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. In this case, the noodles are made with high protein wheat flour.

## Sample

Nestlé Maggi «Two minute noodles» snack packs, chicken and beef flavors.

## Sample preparation

1. Noodle cake
The entire noodle cake was first weighed, then roughly broken, and ground to the consistency of a coarse flour in a food blender. The ground material was then mixed and „cone and quartered" to take representative samples.

2. Flavor sachets
The entire contents of the flavor sachets were first weighed, then transferred quantitatively to a 500 mL volumetric flask, which was then made to volume with deionized water, and thoroughly mixed. To remove solids which might otherwise block volumetric pipettes used to take aliquots, the flask contents were filtered through a rapid flow qualitative filter paper.

## 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 |
| 2 × 800 Dosino | 2.800.0010 |
| 1 × Dosing unit 10 mL | 6.3032.210 |
| 1 × ETFE cylinder unit 10 mL<br>1 × Dosing unit 5 mL | 6.1566.150<br>6.3032.150 |
| *tiamo*™ | 6.6056.222 |

** Acidified solutions of fluoride ion are used in this determination.*

Additional equipment:
Polypropylene or PTFE titration vessels
small blender with sealed vessels («rocket blender»)
Polytron PT 1300 D homogenizer

## 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 |
| | $c(CCl_3COOH)$ = 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 aluminium nitrate solution |
| | concentrated HCl solution |
| | acetone, commercial grade |

## Analysis of samples

1. Analysis of noodle cake
Approximately 2.5 g of ground noodle cake is weighed into a titration vessel and 10 mL trichloroacetic acid solution added. After allowing the contents to stand for a few minutes, 10 mL acetone is added, and the suspension homogenized for 60 seconds at 20,000 rpm with a Polytron PT 1300 D homogenizer. The acetone is added to prevent swelling of the starch, which would otherwise produce a material not able to be titrated. Wash the shaft of the Polytron with approx. 5 mL 1:1 acetone/water into the titration vessel.
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.
Due to the heterogeneity of the material, it is recommended that the mean of triplicate analysis is taken.

2. Analysis of flavor sachet
A 20 mL aliquot of filtered flavor solution is pipetted into a titration vessel and 2 mL of concentrated HCl and 5 mL deionized water added.
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.

# Method description

### Initial determination of reagent blank

These determinations are only required for the initial setup for analysis of this type of food product.

1. Noodle cake

Seven separate titrations are performed, employing accurately weighed sample masses ranging from approx. 5 to 3 g in roughly equal increments.

2. Flavor sachets

Aliquots of 5, 10, 15, and 20 mL of prepared filtrate are titrated. Separate determinations are made for both the beef and chicken flavor sachets.

In each case, 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. The higher number of titrations required for analysis of the noodle cake is due to the heterogeneity of this material.

### 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 approx. 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 Stirrer) | 15 |
| Evaluation start (mL) | 0.5 |
| Damping until (mL) | 0.5 |

### Calculations

The mean of the results for analysis of the noodle cake are added to the result from analysis of the flavor sachet. This gives the total amount of sodium in milligrams per serving of instant noodles.

Na mg in single serve = ((EP1 – blank) × C001 × C002 × C003)/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)
C003 = total mass of noodle cake or flavor sachet

### Results

1. Na content of instant noodles («two minute noodles»)

| Component | Na, mg |
|---|---|
| Noodle cake | 273 ± 4.8 (n = 8) |
| Beef flavor sachet | 984 ± 3.3 (n = 5) |
| Chicken flavor sachet | 1228 ± 3.5 (n = 5) |
| Total beef-flavored noodles | 1256* (55% of rec. daily intake) |
| Total chicken-flavored noodles | 1501** (66% of rec. daily intake) |

**Compare with average claimed value on product label = 1025 mg Na*
*** Compare with average claimed value on product label = 1255 mg Na*

(Recommended average daily intake = 2280 mg Na)

2. Blank values obtained by regression analysis of titration results.

| Component | Blank, mL titrant | Coeff. determination $R^2$ |
|---|---|---|
| Noodle cake | 0.092 | 0.9920 |
| Beef flavor sachet | 0.170 | 0.9998 |
| Chicken flavor sachet | 0.110 | 1.0000 |



Metrohm

# Method description

## Titration plots

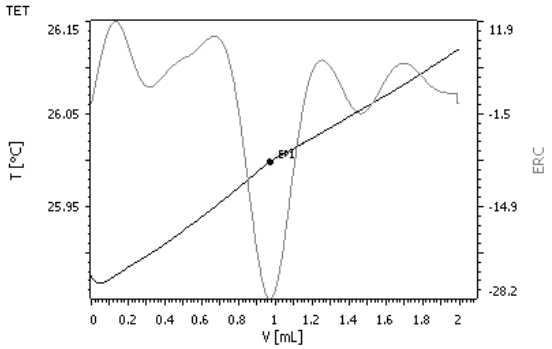



Fig. 1. TET determination of sodium in noodle cake

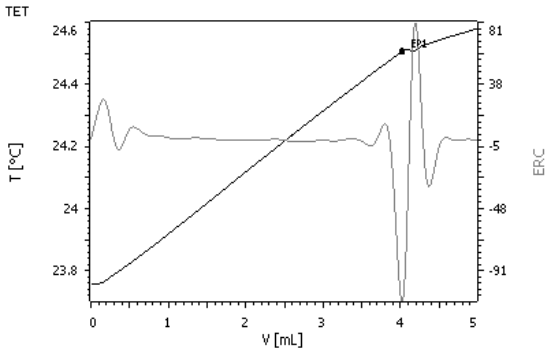



Fig. 2. TET determination of sodium in chicken flavor sachet