



Application Note AN-I-036

# Sodium content in water using an ion-selective electrode

Fast, accurate, and selective determination in mineral water and leachate according to AOAC 976.25

## SUMMARY

Groundwater naturally occurs by means of precipitation, and it gathers dissolved minerals as it filters and passes through the soil. Typically, groundwater is used as a source for drinking water and irrigation purposes.

Rain and snow can also leach various substances, such as sodium salts, from landfills into groundwater. This so-called leachate is considered hazardous to the

environment and can contaminate groundwater reserves.

This Application Note describes sodium analysis in water (mineral water as well as leachate) using the separate sodium-selective electrode, also known as the Na-ISE. All samples in this study were determined by standard addition. The method is based on the standard AOAC 976.25.

# INTRODUCTION

The standard addition (STDADD) is recommended for undefined or complex sample matrices. In the standard addition method, a defined amount of the ion of interest is added to a known volume of sample (in several steps). The unknown concentration can be

calculated from the resulting potential differences between the sample and the sample with added standard solution. This calculation is performed automatically by modern ion meters or software such as OMNIS.

# SAMPLE AND SAMPLE PREPARATION

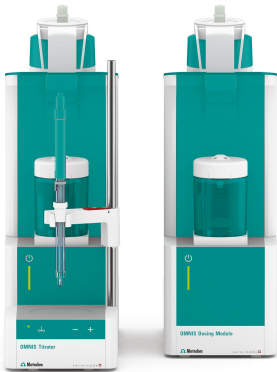
The analysis is demonstrated on mineral water and leachate.

No sample preparation is required.

# EXPERIMENTAL

An OMNIS Advanced Titrator and an OMNIS Dosing Module equipped with a separate sodium-selective electrode were used to measure sodium in water samples (Figure 1).

To a reasonable amount of sample, ISA solution consisting of  $c(\text{CaCl}_2) = 1 \text{ mol/L}$  is automatically added and the standard addition is carried out with the sodium standard solution  $\beta(\text{Na}^+) = 200 \text{ mg/L}$  or  $\beta(\text{Na}^+) = 2000 \text{ mg/L}$ , respectively. The mineral water is measured without ISA addition, as this is not necessary if the concentration in the sample solution is  $<50 \text{ mg/L Na}^+$ .



**Figure 1.** OMNIS Advanced Titrator and OMNIS Dosing Module equipped with Na-ISE for the determination of sodium.

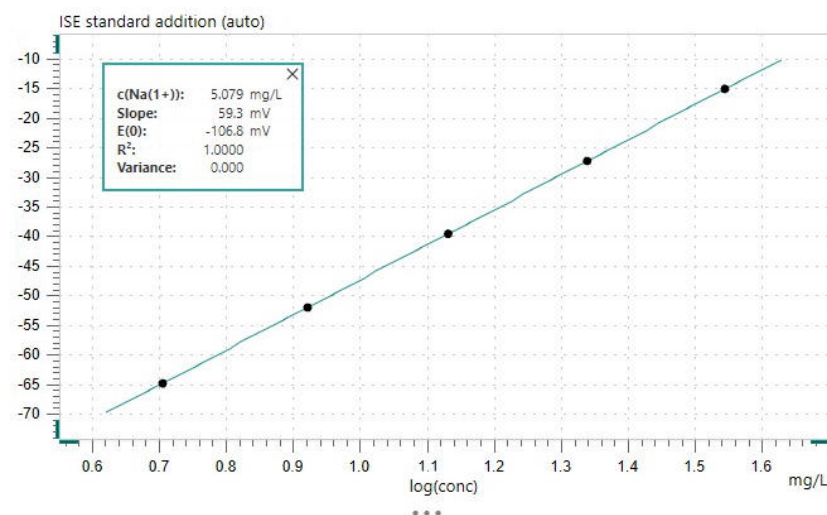
# RESULTS

Standard addition provides accurate and reproducible results with  $\text{SD}(\text{rel}) < 2.0\%$  as shown in Table 1. An

example of standard addition is shown in Figure 2.

**Table 1.** Results for sodium in mineral water and leachate by standard addition.

| Sample (n = 6) | Mean value  | SD(abs)   | SD(rel) in % |
|----------------|-------------|-----------|--------------|
| Mineral water  | 5.08 mg/L   | 0.00 mg/L | 0.1          |
| Leachate       | 151.1 mg/kg | 0.4 mg/kg | 0.3          |



|             | Volume increment / mL | Potential / mV | Potential difference / mV | Temperature / °C |
|-------------|-----------------------|----------------|---------------------------|------------------|
| Sample      |                       | -64.9          |                           | 25.4             |
| Increment 1 | 0.684                 | -52.1          | 12.8                      | 25.4             |
| Increment 2 | 1.132                 | -39.6          | 12.5                      | 25.5             |
| Increment 3 | 1.947                 | -27.3          | 12.3                      | 25.6             |
| Increment 4 | 3.505                 | -15.1          | 12.2                      | 25.7             |

**Figure 2.** Standard addition of mineral water with four increments made with 200 mg/L sodium.

## CONCLUSION

Results of sodium measurement in water with the sodium ion-selective electrode are fast, reproducible, and accurate. In principle, this method can be used for any type of wastewater or sewage water for different sodium concentrations. Appropriate dilution or clarification (e.g., filtration or centrifugation) may be required prior to analysis.

Handling the Na-ISE is user friendly and there is no need to condition the electrode, which means it is immediately ready for use. Furthermore, this method conforms to AOAC 976.25.

The analytical system presented in this application

offers users flexibility combined with high-end software. The measuring range of the separate polymer Na-ISE lies between  $5 \times 10^{-6}$  mol/L and 1 mol/L Na<sup>+</sup> (corresponds to approximately 0.11 mg/L Na<sup>+</sup>) and is suitable for a wide range of different samples, from foodstuffs to pharmaceutical products and cosmetics.

As well as improving the precision and speed of sodium determinations, OMNIS delivers results that are equal to or better than other established titration systems.

## CONTACT

Metrohm France  
13, avenue du Québec - CS  
90038  
91978 VILLEBON  
COURTABOEUF CEDEX

[info@metrohm.fr](mailto:info@metrohm.fr)

## CONFIGURATION



**OMNIS Advanced Titrator avec agitateur magnétique**  
OMNIS Titrator, innovant, modulaire, potentiométrique pour un mode autonome ou en tant que pièce centrale d'un système de titrage OMNIS pour le titrage à point final et à point d'équivalence (monotone/dynamique). Grâce à la technologie 3S de l'adaptateur Liquid Adapter, la manipulation des produits chimiques est plus sûre que jamais. Avec des modules de mesure et des unités de cylindre, le titreur peut être librement configuré et il est possible au besoin d'y ajouter un agitateur à tige. Au besoin, l'OMNIS Advanced Titrator peut être amélioré pour le titrage en parallèle avec la licence fonctionnelle correspondante.

- Commande via PC ou un réseau local
- Possibilité de connecter jusqu'à quatre autres modules de titrage ou de dosage pour d'autres applications ou solutions auxiliaires
- Possibilité de connecter un agitateur à tige
- Différentes tailles de cylindre disponibles : 5, 10, 20 ou 50 mL
- Liquid Adapter avec la technologie 3S :  
Manipulation de produits chimiques plus sûre, transfert automatique des données originales des réactifs provenant des fabricants

### **Modes de mesure et options logicielles :**

- Titrage à point final : licence fonctionnelle « Basic »
- Titrage à point final et à point d'équivalence (monotone/dynamique) : licence fonctionnelle « Advanced »
- Titrage à point final et à point d'équivalence (monotone/dynamique) avec titrage en parallèle : licence fonctionnelle « Professional »



### OMNIS Dosing Module sans agitateur

Module de dosage à connecter à un OMNIS Titrator pour ajout d'une burette supplémentaire pour titrage/dosage. Peut être utilisé avec un agitateur magnétique et/ou un agitateur à hélice pour une utilisation en tant que poste de titrage séparé. Unité de cylindre au choix de 5, 10, 20 ou 50 mL.



### Separate polymer membrane electrode, Na

Sodium-selective electrode with polymer membrane. This ISE has to be used in combination with a reference electrode and is suitable for:

- ion measurements of  $\text{Na}^+$  ( $10^{-6}$  to 1 mol/L) in aqueous solutions
- ion measurements in small sample volumes (minimum immersion depth 1 mm)
- titrations in aqueous solutions

Thanks to a robust/break-proof plastic shaft made of PVC, this sensor is mechanically very resistant.