Application Note AN-I-036

使用离子选择电极测量水中的钠含量

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

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 $c(CaCl_2)$ = 1 mol/L is automatically added and the standard addition is carried out with the sodium standard solution $\beta(Na^+)$ = 200 mg/L or $\beta(Na^+)$ = 2000 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 mg/L Na^+.

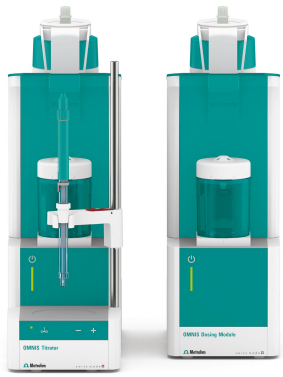


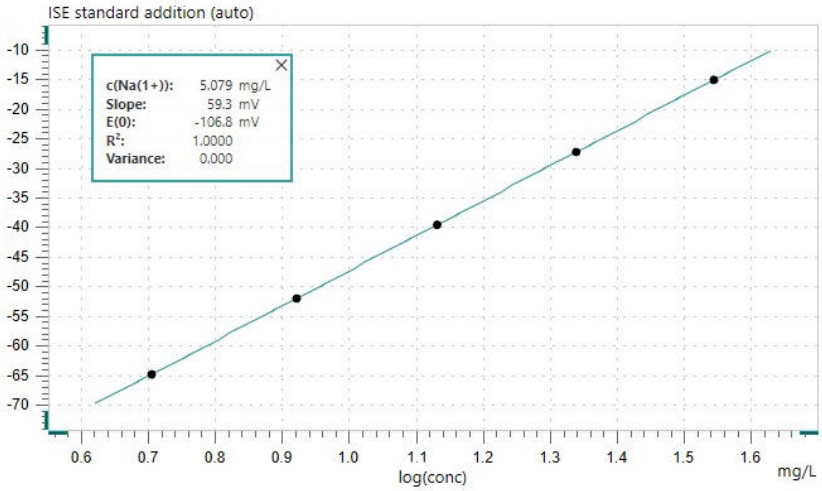
Figure 1. OMNIS Advanced Titrator and OMNIS Dosing Module equipped with Na-ISE for the determination of sodium.

RESULTS

Standard addition provides accurate and reproducible results with SD(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 5×10^{-6} mol/L and 1 mol/L Na^+ (corresponds to approximately 0.11 mg/L Na^+) 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

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CONFIGURATION

OMNIS Advanced Titrator

创新型、模块式电位分析 OMNIS Titrator 滴定仪,适于独立运行或作为 OMNIS 滴定系统的核心元件运行,用于使用 OMNIS Sample Robot 进行终点和等当点滴定(单一/动态)。由于采用 3S 试剂瓶适配器技术,处理化学品很安全。可以使用测量模块和计量管单元自由配置滴定仪,并在需要时扩展一台螺旋搅拌器。在需要时可以通过相应的软件功能许可证为平行滴定升级 OMNIS Advanced Titrator。

- 通过计算机或本地网络控制
- 可以为其他应用或辅助溶液另外连接四个滴定模块或加液模块
- 螺旋搅拌器的连接方式
- 可提供不同大小的计量管:5、10、20 或 50 mL
- 采用 3S 技术的试剂瓶适配器:安全处理化学品,自动传输生产商的原始试剂数据

测量模式和软件选项:

- 终点设定滴定:“Basic” 功能许可证
- 终点和等当点滴定(单一/动态):“Advanced” 功能许可证
- 终点和等当点滴定(单一/动态),包括平行滴定:“Professional” 功能许可证

OMNIS Dosing Module

用于与 OMNIS Titrator 滴定仪相连的加液模块,以扩展额外用于滴定/加液的滴定管。可以扩展磁力搅拌器和/或螺旋搅拌器,以作为单独的滴定台使用。可自由选择 5、10、20 或 50 mL 计量管单元。

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 Na+ 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.