Application Note AN-I-023

Fluoride in tea

Fast and inexpensive determination according to DIN 10807

Fluoride is found in soil, water, rocks, air, plants, and animals in different quantities. One of the major sources of fluoride intake for humans comes from foodstuff (e.g., tea). Tea actually has one of the highest potentials to increase the daily fluoride intake. Tea trees accumulate and store fluoride mainly in their leaves by absorbing it from the air and soil. After harvesting, leaves are dried, and a substantial amount of fluoride is then released during tea infusion, as fluoride is easily water-soluble. In the gastrointestinal tract, fluoride is absorbed at almost 100%, which then becomes relevant to human health. Excessive fluoride intake may lead to dental or skeletal fluorosis. The WHO (World Health Organization) does not recommend consuming water with a fluoride content higher than 1.5 mg/L.

Therefore, it is important to monitor the fluoride content in extracted tea leaves, allowing classification of the amount of fluoride in the tea. In the presented method according to DIN 10807, the fluoride content can be assessed quickly with an ion selective electrode.

SAMPLE AND SAMPLE PREPARATION

The method is demonstrated for two different dried tea samples. The tea leaves are extracted for 5 minutes in boiling water. After cooling down to room temperature, the suspension is filtered.

EXPERIMENTAL

The direct measurement is carried out using an OMNIS Basic Titrator equipped with a fluoride ion selective electrode, a reference electrode, and a temperature sensor. The ion selective electrode is calibrated prior to the analysis with four calibration standards.

To the prepared sample, the same volume of total ionic strength adjustment buffer (TISAB I) is added to fix the ionic strength and pH value. The sensors are placed into the sample and while stirring, the fluoride concentration is measured.

Figure 1. OMNIS Basic Titrator for precise and reliable ion measurement.

RESULTS

Results are taken after a minimum of 10 seconds when the concentration reading is stable. The obtained absolute standard deviation for the analyzed samples is smaller than 3 mg/kg (SD(rel) < 1.1%).

Table 1. Amount of fluoride in mg per kg dried tea leaves (n = 3).

	Mean F^- content in mg/kg	SD(abs) in mg/kg	SD(rel) in %
Green tea	198.3	0.4	0.22
Black tea	259.6	2.8	1.09

CONCLUSION

The concentration of fluoride can be assessed quickly and inexpensively according to DIN 10807 by using direct ion measurement technique. It is possible to measure concentrations of fluoride in dried tea between 50 and 10,000 mg/kg with the presented technique.
Using an OMNIS Titrator for measurements allows a system customization according to your needs, and the added ability to expand it for other titration or measurement applications required for the quality control of tea (e.g., moisture analysis). Furthermore, the analysis can be fully automated to increase throughput and accuracy while saving valuable time.

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