



# Rapid Response

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## Rapid Response Research Service

**Question:** Is there an alternative to the silver nitrate titration method for testing salt content that does not result in a hazardous or dangerous waste stream?

**Requestor:** Anonymous

**Date:** August 2010

**Request:** A food products company is currently using a silver nitrate titration process to test for salt in food products. This process generates a silver-bearing solution. If a silver-bearing waste stream has a concentration above 5mg/liter, it requires regulated disposal under the Resource Conservation and Recovery Act (RCRA). The company would like to know if there are alternatives.

## Key Findings & Recommendations

**Disclaimer:** PPRC **does not endorse** or have direct experience with any of the alternative methods or products mentioned herein.

The requesting company did not provide details on the amount or concentration of the silver effluent, nor the type of food they were testing. Therefore, the information presented below is fairly generic.

The use of silver nitrate in titration generates a silver-bearing waste solution, and if above 5mg/liter in concentration requires regulated disposal under RCRA. States may additionally regulate silver or offer voluntary silver reduction programs. For example, in Washington state, any silver-bearing solution of over 5 parts per million (ppm) is a dangerous waste and must be managed per Washington's dangerous waste regulations.

According to the Washington State University's School of Food Science, the silver nitrate titration method is relatively easy (although somewhat tedious), but many firms now use an ion-specific electrode (ISE) probe to monitor sodium and/or chloride. ISEs are widely used in testing various foodstuffs but there are other techniques which might be employed depending on the nature of the food - and measurements can only be made in aqueous extracts.

The electrodes do not measure sodium chloride (NaCl) directly, but measure sodium (Na) and/or chloride (Cl) and use the value to estimate salt (NaCl) concentration. Although unlikely to be found in foodstuffs, silver, iodine, sulfur, bromine, and copernicium can interfere with ISE readings.

One ISE probe on the market is offered by Lazar, who offers their [Ultra-SR Salt](#) system that measures ion concentration in both solid food (such as meats, canned vegetables and cheese), and liquid foods (such as soft drinks and vegetable juices). Another available product on the market is a [chloride ISE](#) offered by ELIT.

We also identified a titration strip (Quantab®) that tests filtrate of a food product (mixed with water) for sodium chloride content.

Example procedures for using ISE or Quantab® strips - for several different food products - can be found in the *Food Analysis Laboratory Manual*, by Suzanne Nielsen (page 82).

The only potential waste generated with this method is the strip itself, which is non-hazardous, and can actually be stored as a permanent record. No waste is generated with use of the ISE.

The use of silver nitrate titration for measuring ion content of foods for estimating NaCl content, may be an industry standard, customer requirement, a regulatory requirement, or in some cases, may provide more accurate results than the other alternatives mentioned. But before switching to an alternative method, the testing entity should ensure a new method has acceptable accuracy and precision, and satisfies customer, legal, regulatory, and industry standards.

There may be hurdles in switching to a new process, especially when customer or other requirements are well established. By working with customers or industry or agencies to evaluate whether test strips or ISE are suitable alternatives to silver nitrate titration in terms of accuracy and quality assurance – it may be possible to change policies so that generation of silver bearing waste can be eliminated.

## **Conclusions**

Silver-bearing solutions are corrosive and toxic to aquatic and microbial life. Every effort should be made to eliminate environmental releases of these materials. If the waste solution concentration is above 5 mg/L, or 5 ppm, it must be managed per federal and possibly state regulations.

There are viable alternatives to conventional silver nitrate titration for measuring salt content in food products, including ion-selective electrodes and titration strips. Use of these methods does not generate any hazardous or dangerous waste byproducts, and eliminates environment release of the material.

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## **References and Further reading**

Nielsen, S. 2010. Food Analysis Laboratory Manual. (*Chapter 10 – Sodium Determination Using Ion Selective Electrodes, Mohr Titration, and Test Strips*).

Rundle, Chris. BSc, PhD. Last Web Update: Oct. 2009. [A Beginners Guide to Ion-Selective Electrode Measurements](#) (Nico2000 Ltd, London, UK.)

U.S. Environmental Protection Agency METHOD 9253 Chloride (Titrimetric, Silver Nitrate).  
<http://www.epa.gov/osw/hazard/testmethods/sw846/pdfs/9253.pdf>