Percent Sodium Chloride via Potentiometric Titration using Hanna Instruments' HI5148B Combination Silver Billet Electrode

Introduction

Salt (NaCl) is naturally found in food products, and it is also a regularly used additive. The addition of salt to food products helps to maintain the taste, texture, act as a binder, and to extend the shelf life of a product. As a large portion of the salt we consume is from packaged foods, it is very important that the amount of salt in products is known and reported. In a sample matrix as complex as food, it is standard practice for the salt content (as NaCl) to me measured via potentiometric titration. This report investigates the accuracy and repeatability of results obtained from the Hanna Instruments' HI932C potentiometric titrator and HI5148B combination silver billet electrode. This report details both an accuracy study as well as a repeatability study.

The analysis used a basic customized method for salt determination by weight or by volume as indicated for the individual analyses was used. The HI5148 was evaluated for accuracy and repeatability against a known 30 g/L standard. The HI5148 was tested for repeatability in a complex sample matrix (ketchup). The tests conducted in this report demonstrated that accurate and repeatable results will be obtained using the HI5148B in combination with a Hanna Instruments' potentiometric titrator.

Equipment and Reagents

- ☐ Hanna Instruments' Potentiometric Titrator
- ☐ HI5148B Combination billet electrode
- ☐ HI902C Potentiometric titrator
- ☐ HI7072: 1 M KNO3
- ☐ HI70427: 1.5 M HNO3
- ☐ HI70422: 0.1 M AgNO3
- ☐ HI4015-01: 0.1M Ag std.
- ☐ HI7081L: 30g/L NaCl std.
- ☐ >99.5% NaCl Sigma
- ☐ >99.5% NaCl GFS
- ☐ 100 mL volumetric flasks
- ☐ 5 mL Eppendorf pipette
- ☐ 1 mL Eppendorf pipette
- ☐ 100 mLEppendorf pipette
- ☐ 10 mL volumtric pipette
- ☐ 50 mL volumetric pipette
- ☐ Weigh boats
- ☐ Analytical balance
- ☐ Scoopula
- ☐ Deionized water
- ☐ 150 mL plastic beakers

Procedure

A basic customized method for salt determination by weight or by volume was used with a standard salt titration procedure for both the analysis of the sodium chloride standard and sodium chloride in ketchup. Prior to analysis, the electrolyte within the HI5148B was removed and replaced with 1M potassium nitrate (KNO_3) using standard cleaning procedures. A slope check was performed with a 0.1M Silver Standard to verify that the response of the electrode was within acceptable specifications. The titrant of 0.1M silver nitrate ($AgNO_3$) was standardized using a modified HI0202 method for titrant standardization. The sample was prepared either my mass on an analytical balance (solid or viscous samples) or by volume using a 100 µmL pipette. The exact mass or volume was recorded. Approximately 60 mL of deionized water was added to each beaker. Then, 10mL of 1.5M nitric acid (HNO_3) was added using a 5 mL Eppendorf pipette (two 5 mL additions). The beaker was then titrated. Each result was recorded after each measurement and was given a replicate number.

Results

The results of this study demonstrated that when the Hanna Instruments' HI5148 combination silver billet electrode is used with the Hanna Instruments' potentiometric titrator accurate and repeatable results are produced. The HI5148B was both accurate and repeatable in determining the g/L of a known standard of 30g/L across 10 replicates. An average recovery of 101.1% with a 0.4041% relative standard deviation was achieved. The HI5148B was extremely repeatable in salt determination across 8 replicates in a ketchup sample. A 0.4904% relative standard deviation was achieved with the ketchup sample. All of these values for recovery and standard deviation are well within the limits of acceptability established by the AOAC.

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Table 1 - Results of Study of HI5148B with % NaCl Standard

Analysis of the HI7081 30 g/L Sodium Chloride NIST Traceable Standard

Replicate	mL Sample	mL Titrant	Time	g/L NaCl	Expected Value (g/L per COA)	% Recovery
1	2.0	10.382	2:26	30.4	30.1 ±0.2	101.0
2	2.0	10.501	2:24	30.7	30.1 ±0.2	102.0
3	2.0	10.410	2:22	30.4	30.1 ±0.2	101.0
4	2.0	10.420	2:27	30.5	30.1 ±0.2	101.3
5	2.0	10.319	2:24	30.2	30.1 ±0.2	100.3
6	2.0	10.394	2:27	30.4	30.1 ±0.2	101.0
7	2.0	10.381	2:29	30.4	30.1 ±0.2	101.0
8	2.0	10.377	2:26	30.4	30.1 ±0.2	101.0
9	2.0	10.391	2:21	30.4	30.1 ±0.2	101.0
10	2.0	10.382	2:26	30.4	30.1 ±0.2	101.0

Average	30.4	Average	101.1
St. Dev	0.12293	AOAC Expected Recovery	98-103%
% RSD	0.4041		
AOAC Expected % RSD	2.70		

Table 2 - Results of Repeatability Study

Complex Sample Matrix (Ketchup)

Replicate	g Sample	mL Titrant	Time	% NaCl
1	1.9584	7.701	2:11	2.3003
2	1.8811	7.501	2:08	2.3326
3	1.9078	7.508	2:10	2.3020
4	1.9017	7.475	2:07	2.2993
5	2.1525	8.460	2:14	2.2993
6	2.1163	8.322	2:13	2.3004
7	1.9962	7.864	2:13	2.3045
8	2.0225	7.956	2:09	2.3011

Average	2.305
Std. Dev.	0.01130
% RSD	0.4904
AOAC Expected % RSD	2.70

Quaternary Ammonium Salts Determination Data Set 1.0 4/2019 PRINTED IN USA