

Quaternary Ammonium Salts Determination by Titration with Hanna Instruments HI931 Automatic Titration System



Introduction

Quaternary ammonium salts, commonly referred to as “quats”, are used in the production of a variety of common household products including disinfectants, shampoos, and fabric softeners. They are especially common in cleaners because of their detergent and anti-microbial properties. For reporting and safety purposes, both manufacturers and users of commercial cleaning products may be required to monitor the concentration of said cleaners. Due to increasing regulations, there has been a push to move away from or supplement the testing of these concentrations with test strips. These test strips are often subjective, and provide little in the way of record keeping.

Automatic Titration is a way to obtain an objective quantitative result that can be logged for record keeping. This test was to determine the repeatability of results obtained using the Hanna Instruments SOP for the determination of quaternary ammonium salts on the Hanna Instruments HI931 Automatic Titration System in a “409 Multi-Surface Cleaner”. The results demonstrated not only repeatability to AOAC guidelines, but also a 99.3% recovery of the labeled concentration.

Equipment and Reagents

- Hanna Instruments HI931 Automatic Titrator
- Hanna Instruments HI4113 Combination Nitrate ISE
- HI7078 (NH₄)₂SO₄ Fill Solution
- 0.005 M Sodium Lauryl Sulfate (SLS)
- 1% Triton X-100 Solution
- Borate Buffer pH adjusted to 9.5
- Isopropyl Alcohol
- Hyamine 1622 (for titrant standardization)
- 409 Multi-Surface Cleaner
- 120 mL Beakers
- Deionized water
- 10 mL Class-A Volumetric Pipette
- Adjustable Eppendorf Pipette

Procedure

The Hanna Instruments SOP for determining quaternary ammonium salts was used for this analysis. Prior to the analysis, the 0.005 M SLS titrant was standardized with a 0.004M Hyamine 1622 standard a total of three times. The average titre value was then used in the calculation for quaternary ammonium salts. Using an Eppendorf pipette, 5 mL of 409 Multi-Surface Cleaner, 2 mL of isopropyl alcohol, and 2 mL of 1% Triton X-100 was transferred to a 120 mL beaker. A 10 mL Class-A Volumetric Pipette was used to add 10 mL of borate buffer to the same beaker. Deionized water was added to sufficiently submerge the electrode. The sample was titrated immediately, and the results were reported in % Alkyl Benzyl Dimethyl Ammonium Chloride (the active ingredient). This procedure was repeated for a total of 8 replicates.

NOTE: Because of the soapy nature of both the titrant and the sample, care should be taken to avoid the presence of bubbles in the burette and when taking an aliquot of sample.

Results

This test demonstrated that when the Hanna Instruments HI931 is used for the determination of quaternary ammonium in a cleaning agent the results obtained were repeatable to the guidelines set by the AOAC (Association of Agriculture Chemists). According to the AOAC guidelines, the %RSD should be no more than 3.7% for analyte concentration between 0.1-1%. Eight replicates were run on the 409 cleaner, which yielded a 2.02%RSD between replicates, which is less than the max of 3.7%. The test also yielded an average result of 0.29793%, which is 99.3% of the expected concentration of 0.3% Alkyl Benzyl Dimethyl Ammonium Chloride.

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Table 1 - % Alkyl Benzyl Dimethyl Ammonium Chloride in 409 Multi-Surface Cleaner

Replicate	% Quats	mL Sample	mL Titrant	Time
1	0.30108	5.0	10.191	2:42
2	0.29123	5.0	9.858	2:43
3	0.30856	5.0	10.444	2:48
4	0.29872	5.0	10.111	2:37
5	0.29018	5.0	9.822	2:41
6	0.30295	5.0	10.254	2:39
7	0.29491	5.0	9.982	2:45
8	0.29583	5.0	10.013	2:36

Average	0.29793	0.300
Std.Dev	0.00618	99.3
% RSD	2.0738	