ANALYSIS OF SODA ASH (#11.2)

The CCLI Initiative
Computers in Chemistry Laboratory Instruction

Learning Objectives

The objectives of this experiment are to ...

- to understand the titration curve for a diprotic base.
- to use the titration curve to calculate the percent of Na_2CO_3 in an unknown sample of soda ash.

Background

Sodium carbonate is an important industrial chemical. It is used in the manufacture of soap, glass, paper and as a source of alkalinity, that is, as a base. About half the sodium carbonate used in the United States is manufactured by the Solvay process. The crude product obtained from this thermal decomposition is called soda ash, which is primarily Na_2CO_3, although it also contains un-reacted $NaHCO_3$ and other impurities.

Procedure

Preparation: Primary standard grade Na_2CO_3 , KHP and the unknown soda ash sample are dried for two hours at 110 °C, one liter of de-ionized water is boiled and stored in a capped Nalgene bottle and one 1 L of approximately 0.1 *M* hydrochloric acid is made by adding 8.4 mL 12 *M* HCl to 1000 mL of deionized water.

Calibration of drop size: The drop counter is accurately calibrated to determine the number of drops per 1.000 mL for conversion of drops to volume.

Calibration of the pH electrode: The pH electrode is calibrated at 4, 7 and 10 pH.

Standardization of HCl: HCl solution is standardized against reagent grade KHP.

Titration of an unknown soda ash sample: 0.3 g of unknown is dissolved and titrated with the standardized HCl Solution. This Is Repeated for at Least a Total of Four Acceptable Analyses.

Data Analysis: Guidance is given in determining the exact equivalence points by taking the first and second derivatives and interpolation, and in doing the calculations to determine the percentages of Na_2CO_3, $NaHCO_3$ and NaOH in the unknown.

Instructor Resources Provided

- Sample Report Sheets providing the format to organize the data collection with sample data.
- Questions to consider, answer and turn-in with suggested answers.
- Tips and Traps section to assist the instructor with potential problems and solutions.
- Sample ***MicroLAB*** screen shots and graphs.
- Laboratory preparation per student station.

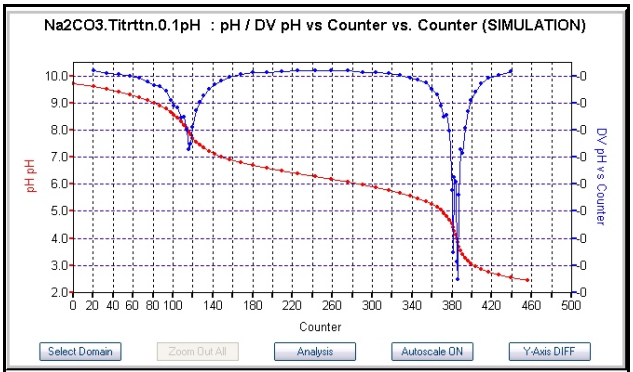

Figure 1. Titration graph of soda ash showing the double equivalence point and the first derivative for approximating the equivalence point volume.

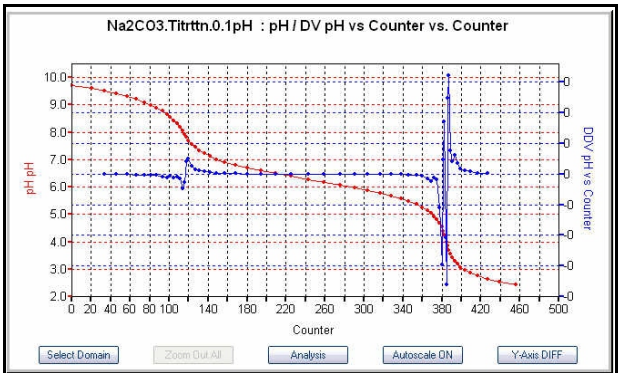

Figure 2. Titration graph of soda ash showing the double equivalence point and the second derivative for exactly determining the equivalence point volume.

www.microlabinfo.com email: info@microlabinfo.com (888) 586 3274
P.O. Box 7358 Bozeman, MT 59771-7358