Your name
Date

*Experiment 9: Standardization of 0.1 M Hydrochloric Acid with Standard Sodium Hydroxide and Determination of Equivalence Point Using a Titration Curve*

1. **Objectives**

The goals of this experiment were to (1) standardize hydrochloric acid by titration with a standard solution of sodium hydroxide, (2) use the titration curve from the HCl-NaOH titration to determine the equivalence point, and (3) to identify an unknown acid by titration.

1. **Data and Results:**

Table 1 shows the titration data for NaOH-HCl titration, including the mean and standard deviation of three replicate analyses. Figure 1 shows the corresponding titration curve for Unknown Acid # 21 titrated with standardized 0.1000 M NaOH.

Table 1: Titration data for NaOH-HCl titration

|  |  |
| --- | --- |
| Trial # | mL NaOH |
| 1 | 25.21 |
| 2 | 25.42 |
| 3 | 25.08 |
| Mean | 25.24 |
| Stdev | 0.17 |



Figure 1. Titration curve for Unknown #21 titrated with standardized 0.1000 M NaOH.

Table 2. Molarity of prepared HCl calculated from the titration data in Table 1.

|  |  |
| --- | --- |
| Trial # | Molarity of HCl |
| 1 | 0.09990 |
| 2 | 0.1001 |
| 3 | 0.09886 |
| Mean | 0.09962 |
| Stdev | 0.00067 |
| % RSD | 0.67 |

**III. Discussion**

Hydrochloric acid was successfully standardized with 0.1000 M NaOH solution. Table 1 shows the precision of the titration to be excellent, with a mean volume of 0.1000 M NaOH titrant being 25.24 ± 0.17 mL. This is reflected also in the mean molarity for HCl (see Table 2), giving 0.09962 ± 0.00067 mole/L, with a precision of 0.67 % RSD, which is excellent. The titration curve in Figure 1 shows a typical curve with smooth lines, indicating good data gathered during the titration. Expansion of the titration curve near the equivalence point, which is the midway point at the break in the titration curve, gave an equivalence volume of 24.98 mL. Using the equation below and the mass of the acid unknown used in the titration, the molecular weight of the unknown was determined to be 122.42 mol/L. Among the given list of unknowns this molecular weight came to within 0.50 % that of potassium acid phthalate. Thus, the unknown acid’s identity is most likely *potassium acid phthalate* or simply KHP.