CH1202: Lab Report IV

Determination of the Strength of a Solution of a Strong Acid through Conductometric Titration

Abhisruta Maity

21MS006

am21ms006@iiserkol.ac.in

Indian Institute of Science Education and Research, Kolkata
Mohanpur, West Bengal, 741246, India

Contents

§1 Brief Theory and Equation

For a solution containing electrolytes, the conductance is defined as:

$$G = \frac{1}{R} = \frac{1}{\rho \frac{l}{A}} = \kappa \frac{A}{l}$$

where κ is the conductivity (in other words, specific conductance) of the solution.

In aqueous solution of HCl, if we gradually add the NaOH, the following reaction will take place:

$$H^+ + Cl^- + Na^+ + OH^- \rightleftharpoons Na^+ + Cl^- + H_2O$$

We observe, if we add NaOH then the conductivity decreases since H^+ is used up to react with OH^- and replaced by Na^+ and OH^- which have relatively low conductivities. This happens till the equivalence point. Then, adding more NaOH increases OH^- in the solution, consequently increasing the conductivity.

§2 Dataset

- Weight of Oxalic Acid taken = 1.2607 g

Vol. of NaOH in burette (mL)	Vol. of Oxalic Acid (mL)
10.1	10
10.1	10
10.1	10

Table 1: Standardization of NaOH solution using 0.2 N Oxalic Acid solution

Thus, average volume of NaOH solution in the burette = 10.1 mL. Now,

$$N_{\text{NaOH}} V_{\text{NaOH}} = N_{\text{Oxalic Acid}} V_{\text{Oxalic acid}}$$
$$N_{\text{NaOH}} = \frac{0.2 \times 10}{10.1}\,\text{N} = 0.198\,\text{N}$$

- Concentration of NaOH solution = 0.198 N
- Volume of strong acid HCl = 25 mL

Vol. of NaOH solution added (mL)	Total vol. of NaOH solution (mL)	Observed conductance (mS)
0	0	3.00
0.5	0.5	3.12
0.5	1	2.94
0.6	1.6	2.73
0.6	2.2	2.52
0.5	2.7	2.34
0.5	3.2	2.15
0.5	3.7	1.947
0.5	4.2	1.744
0.5	4.7	1.581
0.5	5.2	1.388
0.2	5.4	1.303
0.2	5.6	1.249
0.2	5.8	1.172
0.2	6	1.094
0.2	6.2	1.027
0.2	6.4	0.957
0.2	6.6	0.983
0.2	6.8	1.022
0.2	7	1.073
0.2	7.2	1.138
0.2	7.4	1.183
0.2	7.6	1.236
0.2	7.8	1.288

0.1	7.9	1.32
0.1	8	1.356
0.1	8.1	1.383
0.2	8.3	1.442
0.2	8.5	1.497
0.2	8.7	1.545
0.2	8.9	1.589
0.3	9.2	1.664
0.3	9.5	1.735
0.3	9.8	1.819
0.3	10.1	1.905
0.3	10.4	1.976
0.3	10.7	2.05
0.5	11.2	2.19
0.5	11.7	2.31
0.5	12.2	2.45
0.5	12.7	2.56
0.5	13.2	2.67
0.5	13.7	2.81

Table 2: Observational Data of Conductometric Titration

§3 Plots

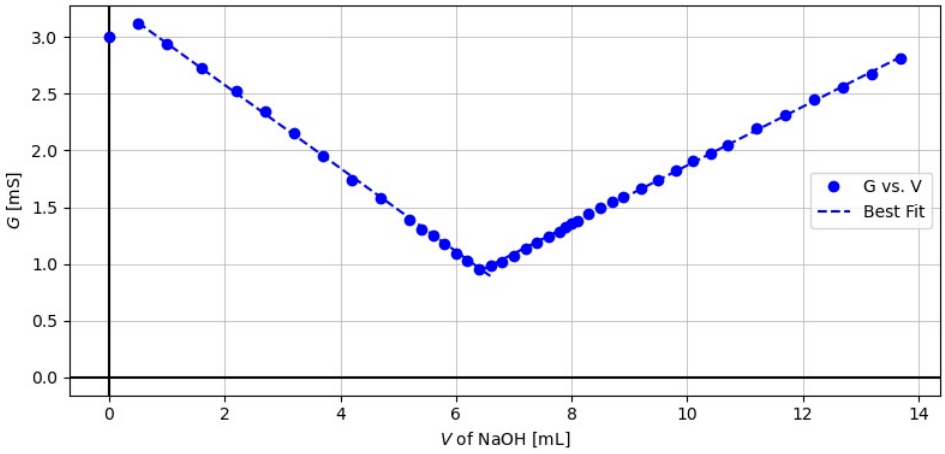

Figure 1: Conductance vs. Total vol. of NaOH: Fitting dataset using linear regression

§4 Results

Analyzing the intersection point of the fitted lines, we get the volume of NaOH solution at the endpoint of this conductometric titration = 6.447 mL. Now,

$$N_{\text{NaOH}} V_{\text{NaOH}} = N_{\text{HCl}} V_{\text{HCl}}$$
$$N_{\text{HCl}} = \frac{0.198 \times 6.4}{25}\,\text{N} \approx 0.0507\,\text{N}$$

Hence, the concentration of the HCl solution was found to be 0.0507 N by this experiment through conductometric titration.