CH1202

Physical Chemistry Laboratory

Experiment Number - 02

Determination of the Degree of Hydrolysis and the Hydrolysis Constant by Potentiometry

---

Submitted to: Dr. Mousumi Das, Dr. Pradipta Purkayastha, and Dr. Ratheesh K Vijayaraghavan

By: Priyanshu Mahato (*pm21ms002@iiserkol.ac.in*)
Roll No.: pm21ms002

May 18, 2022

1 Aim

To determine the degree of hydrolysis and the hydrolysis constant by potentiometry.

2 Diagram

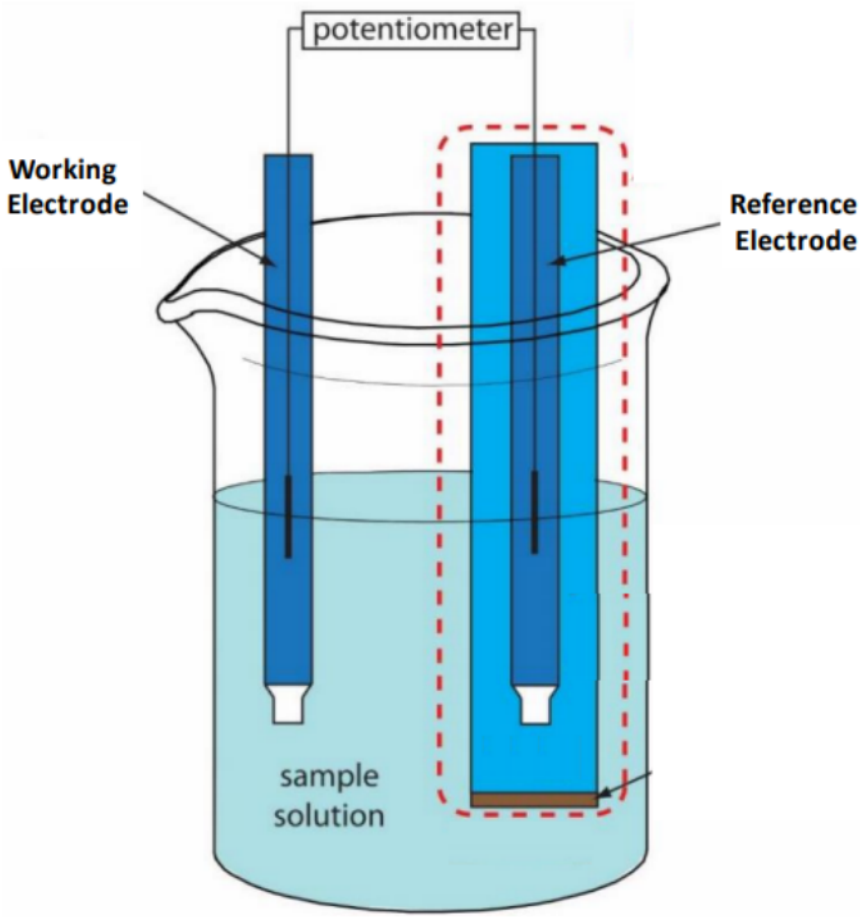

Figure 1: Schematic Diagram of the Experiment

3 Apparatus Required

1. Potentiometer

2. Platinum Electrode
3. Calomel Electrode

4 Chemicals Required

1. Anilinium Hydrochloride
2. Quinhydrone

5 Working Principle

A potentiometer is used to determine the difference between the potential of two electrodes. The potential of one electrode—the working electrode—responds to the analyte's activity, and the other electrode—the reference electrode—has a known, fixed potential.

6 Procedure

1. Prepare an N/10 aniline hydrochloride solution by dissolving appropriate quantity of the substance in distilled water (100 mL).
2. From this stock solution, dilute appropriately and get 25 mL of M/20, M/50 and M/100 solutions.
3. Then construct the following cell:
   Transfer the 25 mL solution to 100 mL beaker; add a pinch of Quinhydrone, stir properly to dissolve it, dip the electrodes (Pt and Calomel electrodes) in to the solution.

$$\oplus\ Pt \mid 0.1\ M\ Aniline\ Hydrochloride,\ Quinydrone \mid\mid Calomel\ \ominus$$

4. Determine the potential of the cell. Repeat the experiment with each of the other solutions.

7 Working Formulae

1. $pH = \dfrac{(E_{cal} + E_{QH} - E_{obs})}{0.0591}$
   $E_{QH} = 0.6996V$
   $E_{cal} = -0.242V$
2. $pH = -\log(c\alpha) = -\log(c) - \log(\alpha)$
3. $K_h = \dfrac{c\alpha^2}{(1-\alpha)}$
4. $K_h = \dfrac{K_w}{K_b} \Rightarrow K_b = \dfrac{K_w}{K_h}$

8 Tables

$C_6H_5NH_3^+Cl^-$	E_{obs}(V)	pH	α (10^{-2})	K_h $molL^{-1}$ (10^{-5})	K_b (10^{-10})
N/10	0.227	3.06	0.87	0.77	12.99
N/20	0.274	3.11	1.55	1.22	8.20
N/50	0.264	3.28	2.63	1.42	7.04
N/100	0.260	3.34	4.57	2.19	4.57

9 Conclusions

1. Mean K_h in the order of $10^{-5} = 1.4\ molL^{-1}$
2. Mean K_b in the order of $10^{-10} = 8.2$
3. Mean α in the order of $10^{-2} = 2.4$