Report Cover Page

AMERICAN INTERNATIONAL UNIVERSITY – BANGLADESH

Department of Natural Science (Chemistry)
Faculty of Science & Technology
Programs: B.Sc. Eng'g (EEE/CSE/IPE)
CHEM 1101: CHEMISTRY

Chemistry Lab Report

Semester: Spring **Session:** 2022-2023

NO EXPERIMENT, NO REPORT

Experiment No: 2
Name of the Experiment: Standardization of Hydrochloric Acid (HCl) Solution with Standard Sodium Hydroxide (NaOH) Solution.

Date of Performance: 15-02-23, *Date of Submission:* 22-02-23

Course-Teacher: Dr. Mohammad Tariqul Islam

Instructions:

1. *A lab report consists of three parts: a cover page, body of the report and a data and results sheet (lab-sheet).*
2. *This is the cover page of a report and students will collect and preserve the lab-sheet of a particular experiment to be performed.*
3. *Body of the report includes-(1) Objective of the Experiment, (2) **Theory**, (3) Name of the Chemicals, (4) Name of the Apparatus, (5) Percentage of Error (if necessary) and (6) Discussion (**I. Precautions taken**, **II. Possible errors**).*
4. *Use A4-size off-set paper, write on one side of the paper by hand keeping suitable margin.*
5. ***Staple the lab-sheet at the end** of the report and **cover page on the top**.*
6. *Submit the report in time to avoid deduction of marks.*
7. *Students working in a group will write and submit the report individually.*
8. *Copying of the report from others is strictly prohibited.*

Name of the Student: TRIDIB SARKAR
ID No: 22-46449-1, *Section:* F, *Group:* 3

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Faculty comments: ....., *Signature:* .....
Date: .....

Objective: To know the strength of HCl solution (being a solution made from secondary standard substance) against a previously standard solution by acid-base titration.

Theory:

(i) Method: In presence of a suitable indicator the volumetric analysis in which a standard solution is added in another solution (whose strength is not known) to reach its end point to determine the strength of that solution is called titration. A solution of known concentration is called a standard solution. In titration, primary and secondary standard solutions are commonly used.

(ii) Reactions:

1. $HO_2C-CO_2H + 2NaOH = NaO_2C-CO_2Na + 2H_2O$

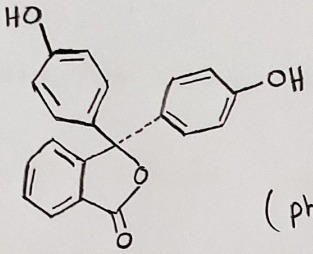
This is an acid-base neutralization reaction. Oxalic acid reacted with NaOH and produce NaO_2C-CO_2Na and water.

2. $NaOH + HCl = NaCl + H_2O$

This is also an acid-base neutralization reaction. Here sodium hydroxide reacts with hydrochloric acid and produce sodium chloride (NaCl) and water (H_2O).

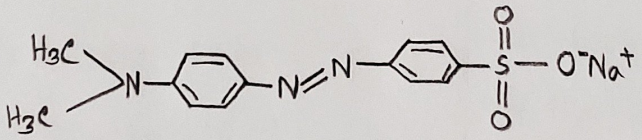
(iii) Indicators:

In first reaction HO_2C-CO_2H is weak acid and NaOH is strong base. So, here used phenolpthalein. In acid it is colourless and in base it is pink.



(phenolpthalein)

In second reaction NaOH is strong base and HCl is strong acid so any indicator is preferable. Here in this reaction methyl orange indicator is used.



(methyl orange)

Required Chemicals:

Name of the Chemicals		Chemical formula
1. Supplied NaOH solution	——	$NaOH$
2. Standard Oxalic Acid Solution	——	$C_2H_2O_4$
3. Phenolphthalein indicator	——	$C_{20}H_{14}O_4$
4. HCl acid solution	——	HCl
5. Methyl orange indicator	——	$C_{14}H_{14}N_3NaO_3S$

Apparatus:

(i) Burette (50 ml)

(ii) Pipette (10 ml)

(iii) Conical flask (250 ml)

(iv) Volumetric flask (100 ml)

(v) Watch glass.

(vi) Pipette filler.

(vii) Dropper.

(viii) Stand and clamp etc.

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AMERICAN INTERNATIONAL UNIVERSITY – BANGLADESH (AIUB)

Department of Chemistry

Experiment 2

CHEM 1101: CHEMISTRY (EEE/CoE/CSE/IPE)

EXPERIMENT NO. 2: STANDARDIZATION OF HYDROCHLORIC ACID (HCl) SOLUTION WITH STANDARD SODIUM HYDROXIDE (NaOH) SOLUTION.

OBJECTIVE: To know the strength of HCl solution (being a solution made from secondary standard substance) against a previously standard solution by acid-base titration.

THEORY:

(i) *Method*: Acid-base titration

(ii) *Reactions*: 1. $HO_2C\text{-}CO_2H + 2NaOH = NaO_2C\text{-}CO_2Na + 2H_2O$

2. $NaOH + HCl = NaCl + H_2O$

(iii) *Indicators*: Phenolphthalein, Methyl orange

APPARATUS:

Burette (50mL), pipette (10mL), conical flask (250mL), volumetric flask (100mL), watch glass, pipette filler, dropper, Stand and clamp etc.

REQUIRED CHEMICALS:

1. Supplied NaOH solution
2. Standard oxalic acid solution
3. HCl acid solution
4. Phenolphthalein indicator
5. Methyl orange indicator

(A) **Standardize the supplied NaOH solution as in Experiment No. 1**

$$\textit{Strength of oxalic acid solution} = \frac{\textit{Weight taken (in gm)} \times 0.1}{0.63} \text{ (N)} \quad = 0.10158 \text{ N}$$

(0.64g)

Table-1: *Standardization of supplied NaOH solution against standard oxalic acid solution by acid-base titration.*

No. of reading	*Vol. of NaOH (in mL)*	*Vol. of Oxalic acid (burette reading) (in mL)*			*Mean (in mL)*
		Initial	**Final**	**Difference**	
1	10	0	9.40	9.40	9.30
2	10	9.4	18.60	9.20	
3	10	~~18.6~~			

Strength of supplied NaOH solution:

$V_{NaOH} \times N_{NaOH} = V_{Oxalic\ acid} \times N_{Oxalic\ acid}$

$\Rightarrow 10 \times N_{NaOH} = 9.30 \times 0.10159$

$\therefore N_{NaOH} = 0.0943$

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(Expt.2 contd.)

(B) **Preparation of approximately 0.1N hydrochloric acid solution:**

Take 10 ml conc. HCl in a 1000 ml measuring flask and add distilled water up to the mark.

PROCEDURE: Take 10 mL of NaOH solution in a conical flask by means of a pipette and dilute it to about 50 mL. Add 2-3 drops of methyl orange indicator to the solution. Then add previously prepared (approx. 0.1N) HCl acid solution drop wise from a burette. Shake the flask frequently during addition of HCl acid. Stop the addition of HCl acid solution as soon as the yellow color of the solution just changes to orange or pink. Note the burette reading. Repeat the process at least three times and take the mean of the readings. Calculate the strength of the dilute HCl solution and from there calculate the strength of commercial HCl.

EXPERIMENTAL DATA:

Table-2: *Standardization of supplied HCl solution against standard NaOH solution by acid-base titration.*

No. of reading	*Vol. of NaOH (in mL)*	*Vol. of HCl (burette reading) (in mL)*			*Mean (in mL)*
		Initial	*Final*	*Difference*	
1	10	17.40	28.40	11.00	11.00
2	10	28.40	38.80	10.40	
3	10	20.90	32.50	11.60	
4	10				

CALCULATIONS:

(A) *Strength of supplied dil. HCl solution*:

$V_{NaOH} \times N_{NaOH} = V_{dil.\ HCl} \times N_{dil.\ HCl\ to\ be\ determined}$

$10 \times 0.0943 = 11.00 \times N$

$\Rightarrow N = 0.08575 \Rightarrow 0.09$

(B) *Strength of conc. HCl solution*:

$V_{dil.\ HCl} \times N_{dil.\ HCl\ determined} = V_{conc.\ HCl\ taken} \times N_{conc.\ HCl\ to\ be\ determined}$

$1000 \times 0.08575 = 10 \times N$

$\Rightarrow N = 8.5750$

RESULTS:

(2a) The strength of supplied dil. HCl solution is 0.09 N

(2b) The strength of conc. HCl solution is 8.76 N

Students should know

- What is normality and molarity?
- Atomic weight, molecular weight and gram equivalent weight of NaOH, HCl and HOOC-COOH, $2H_2O$
- Why phenolphthalein and/or methyl orange are used?
- Reason of using methyl orange instead of phenolphthalein.

Text: M. Mahbubul Huque and A. Jabber Mian, "Practical Chemistry", 2nd ed. (1972)

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Discussion:

Precaution:

1. All the apparatus were washed with first normal water and then with distilled water.

2. Had to be very keen while adding oxalic acid solution and Hcl acid solution.

3. Solution was shaken spontaneously.

Possible errors:

1. Error might be occured while taking the burette reading.

2. Might added more than 40 ml distille water in the NaOH solution.

3. The lower meniscus and the eyelevel should be at same level while taken the burette reading.