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: 14-02-2023, *Date of Submission:*

Course-Teacher: DR. MOHAMMAD ANISUR RAHMAN JAMIL

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: MD. SHOHANUR RAHMAN SHOHAN
ID No: 22-46013-1, *Section:* M, *Group:* 08

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

Objectives:

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:

Methods: (Acid-base Titration)

An acid-base titration is a method in chemistry that allows quantiative analysis of the concentration of an unknown acid or base solution. The technique relies on the neutralization reaction between acids and bases, and measurement of the reaction endpoint. The reactivity between acids and bases can be determined with knowledge of their chemical formula.

Reactions:

1. $HO_2C\text{-}CO_2H + 2NaOH = NaO_2\text{-}CO_2Na + 2H_2O$
2. $NaOH + HCl = NaCl + H_2O$

In this first reaction, NaOH acts as a strong base and oxalic acid acts as a weak acid. When NaOH reacts with oxalic acid, it neutralizes the acid forms salt (sodium oxalate) and water.

The secon reaction is also the neutralization of hydrolic acid (HCl), a strong acid, with NaOH. This reaction results in the formation of sodium chbride (NaCl) and H_2O.

Indicator: (Phenolphthalein, Methyl Orange)

In the first step of this experiment, we use phenolphtalein as an indicator because oxalic acid is a weak organic acid

and sodium hydroxide is a strong base. It is colourless in acidic solutions and turns pink in the base solutions. The endpoint of the titration can be easily determined by observing the color change of the solution.

In the second step of this experiment, we use Methyl Orange as an indicator because when we titrate a strong base (NaOH) with strong acid (HCl), it is more acceptable to use Methyl Orange as an indicator. It turns yellow in base solution and change colour to red when reached at the endpoint of the reaction.

Required Chemicals

Chemicals Name	chemicals Formula
1. Sodium Hydroxide Solution	$NaOH$
2. Standard Oxalic Acid Solution	HO_2C-CO_2H
3. Hydrochloric Acid solution	HCl
4. Phenolphthalein indicator	$C_{20}H_{14}O_4$
5. Methyl Orange indicator	$C_{14}H_{14}N_3NaO_3S$

Apparatus:

1. Burette (50ml).
2. Pipette (10 ml).
3. Conical Flask (250 ml).
4. Volumetric Flask (100ml).
5. Pipett Filler.
6. Dropper,
7. Stand,
8. Clamp.
9. Funnel.
10. Measuring Cylinder,
11. Wash Bottle.

Name MD. GHOHANUR RAHMAN SHOHAN, ID No 22-46013-1 Section (Group) M(08)

(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	0.00	11.20	11.20	10.233
2	10	11.20	21.80	10.60	
3	10	21.80	30.70	8.90	
4	10				

CALCULATIONS:

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

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

$10 \times 0.0880 = 10.233 \times N_{dill\ HCl\ to\ be\ determined}$

$N_{dill\ HCl\ to\ be\ determined} = 0.0859\ N$

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

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

$1000 \times 0.0859 = 10 \times N_{conc.\ HCl\ to\ be\ determined}$

$N_{conc.\ HCl\ to\ be\ determined} = 8.59\ N$

RESULTS: The strength of supplied dill HCl solution is 0.0859N

The strength of Con. HCl solution is 8.59 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)

Discussion:

Precautions Taken:

1. Wear apron to avoid skin contact with chemicals.
2. All the lab apparatus were washed properly by distilled water.
3. Avoid investing the chemicals or inhaling fumes produced during the reaction
4. Dispose the waste solution acording to local regulations

Possible Errors:

1. There might be some measurement error while taking the chemical
2. There might be some instrumental error while taking the reading.
3. The presence of other ions in the solution can interfere with the reaction an result in inaccurate results.