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: 5
Name of the Experiment: Standardization of Sodium Thiosulphate ($Na_2S_2O_3$) Solution with Standard Potassium Dichromate ($K_2Cr_2O_7$) Solution.

Date of Performance: 15-03-23, *Date of Submission:* 22-03-23

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: 22-46494-1, *Section:* F, *Group:* 3

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

Objective: To know the strength of $Na_2S_2O_3$ solution (being a solution made from secondary standard substance) against standard $K_2Cr_2O_7$ solution by oxidation-reduction titration.

Theory:

(i) Method: A redox titration is based on an oxidation reduction reaction between the analyte and titrant. A redox indicator is used to determine the end point. Frequently the reactants or the titrant have color intense enough that an additional indicator is not needed. Titration involving with iodine or dealing with iodine liberated in chemical reaction is called Iodimetric and Iodometric titration respectively. This reaction is Iodometric because Iodine is got from KI.

(ii) Reaction:

1. $K_2Cr_2O_7 + 14HCl + 6KI = 8KCl + 2CrCl_3 + 7H_2O + 3I_2$

2. $2Na_2S_2O_3 + I_2 = Na_2S_4O_6 + 2NaI$

Here, $K_2Cr_2O_7$ is an oxidizing agent and I is a reducing agent. Again in the second reaction I_2 is an oxidizing agent and $S_2O_3^-$ is a reducing agent. In the second step of the reaction a specific indicator is used that is 'starch'.

(iii) Indicator:

Starch solution: Starch is the indicator of choice for those procedures involving iodine because it forms an intense blue complex with iodine. Starch is not a redox indicator. It responds specifically to the presence of I_2, not to a change in redox potential. The active friction of starch is amylose, a polymer of the sugar α-d-glucose.

Required chemicals:

Name of the chemicals		Chemical formula
1. 12% Potassium Iodide solution	——	KI
2. Sodium bycarbonate	——	$NaHCO_3$
3. Cone. Hydrochloric acid	——	HCl
4. Standard Potassium dichromate solution	——	$K_2Cr_2O_7$
5. Sodium Thiosulphate solution	——	$Na_2S_2O_3$
6. Starch solution	——	$(C_6H_{10}O_5)_n$

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.

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AMERICAN INTERNATIONAL UNIVERSITY – BANGLADESH (AIUB)

Department of Chemistry

Experiment 5

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

EXPERIMENT NO. 5: STANDARDIZATION OF SODIUM THIOSULPHATE ($Na_2S_2O_3$) SOLUTION WITH STANDARD POTASSIUM DICHROMATE ($K_2Cr_2O_7$) SOLUTION.

OBJECTIVE: To know the strength of $Na_2S_2O_3$ solution (being a solution made from secondary standard substance) against standard $K_2Cr_2O_7$ solution by oxidation-reduction titration.

THEORY:

(i) *Method*: Redox titration

(ii) *Reaction*:

1. $K_2Cr_2O_7 + 14HCl + 6KI = 8KCl + 2CrCl_3 + 7H_2O + 3I_2$
2. $2Na_2S_2O_3 + I_2 = Na_2S_4O_6 + 2NaI$

(iii) *Indicator*: Starch solution

APPARATUS:

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

REQUIRED CHEMICALS:

1. 12% KI solution,
2. $NaHCO_3$,
3. Conc. HCl acid,
4. Standard $K_2Cr_2O_7$ solution
5. $Na_2S_2O_3$ solution,
6. Starch solution

PREPARATION OF APPROX. 0.1N POTASSIUM DICHROMATE SOLUTION.

Transfer approx. 0.49 gram of pure $K_2Cr_2O_7$ into a 100 mL measuring flask and then dissolve it with distilled water up to the mark.

$$\textit{Strength of } K_2Cr_2O_7 \textit{ solution} = \frac{\textit{Weight taken (in gm)} \times 0.1}{0.49} \text{ (N)}$$

(0.52)

$= 0.10612$ N

Name: TRIDIB SARKAR ID No: 22-46444-1 Section (Group): F (03)

(Expt.5 contd.)

PROCEDURE:

Take 4 mL of 12% KI solution in a conical flask and dilute to about 50 mL. Add about one gm of $NaHCO_3$ and shake the flask until the salt dissolves. Add 4 mL conc. HCl acid and then add 10 ml standard $K_2Cr_2O_7$ solution by means of a pipette in the same flask. Shake the flask and cover it with a watch glass, allow the solution to stand for about five minutes in the dark (inside the desk or dark chamber). Rinse the watch glass and dilute the solution about 100mL. Titrate the liberated iodine with sodium thiosulphate solution from a burette until the brown color fades (light yellow). Add about 1 mL starch solution and continue titration by adding sodium thiosulphate solution from the burette until one drop of the sodium thiosulphate solution changes the color of the solution from deep blue to light green. This is the end point. Repeat the whole experiment 2-3 times. Calculate the strength of sodium thiosulphate solution.

EXPERIMENTAL DATA:

Table: *Standardization of supplied $Na_2S_2O_3$ solution against standard $K_2Cr_2O_7$ solution by oxidation-reduction titration.*

No. of reading	*Vol. of $K_2Cr_2O_7$ (in mL)*	*Vol. of $Na_2S_2O_3$ (burette reading) (in mL)*			*Mean (in mL)*
		Initial	*Final*	*Difference*	
1	10	0	11.00	11.00	11.60
2	10	22.00	34.50	12.50	
3	10	34.50	45.80	11.30	

CALCULATIONS:

Strength of supplied $Na_2S_2O_3$ solution:

$$V_{Na2S2O3} \times N_{Na2S2O3} = V_{K2Cr2O7} \times N_{K2Cr2O7}$$

$$\Rightarrow 11.60 \times N_{Na_2S_2O_3} = 10 \times 0.10612$$

$$\Rightarrow N_{Na_2S_2O_3} = 0.09148$$

RESULTS:

The strength of supplied $Na_2S_2O_3$ solution is 0.09 N

Students should know

- What are redox reaction, oxidizing agent and reducing agent?
- What is the difference between acid-base and redox indicator?
- Why it is necessary to keep your experimental solution in the dark?
- Is it iodometric or iodimetric that you are performing?
- Tell molecular weight and gram equivalent weight of $K_2Cr_2O_7$ and $Na_2S_2O_3$.
- What is the function of starch?
- Can you calculate the normality and molarity of $K_2Cr_2O_7$ and $Na_2S_2O_3$?

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

Discussion:

(i) Precautions:

1. The apparatus was washed first two times with normal water and one time with distilled water.

2. Care was taken to add conc. HCl acid in the time of titration.

3. Carefully added $Na_2S_2O_3$ dropwise.

4. The liberated iodine solution was shaken continuously.

5. Iodine solution was taken into black box for 5 minutes.

(ii) Possible errors:

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

2. The starch solution might be added early in the titration because of the absorption of the Iodine by starch.

3. Might have added more than 46 ml distilled water while making the solution.

4. Error might be occured while calculating the concentration.