Green University of Bangladesh

Dept. of Computer Science and Engineering

Lab report-4

Course Code: CHE-102

Course Title: Chemistry Laboratory

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Remarks

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Experiment number: 04

Experiment name: Standardization of Sodium Thiosulphate solution with standard Potassium Dichromate solution.

Objectives:

1. To study the strength of thiosulphate.

2. To study oxidation reduction titration.

3. To study the liberation and its titration.

Learning Outcome:

After completing this experiment the students will be able to:

1. Determine the strength of thiosulphate with the standard dichromate solution & liberated iodine.

2. Observe the end point by color change with starch indicator

Theory:

Standardization is the process by which the strength of a solution is determined with the help of a standard solution. A solution of known concentration is called a standard solution. This experiment is done by means of titration. In presence of a suitable indicator, a chemical substance that detects the end point of reaction by changing its color, the volumetric analysis in which a standard solution is added in another solution (whose strength is unknown) to reach its end point to determine the strength of that solution is called titration.

Titration involving iodine or dealing with liberated iodine in chemical reaction is called iodimetry and iodometry respectively. This reaction is iodometric because iodine is obtained from KI. The reactions of this experiment are:

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

$(6\ I^- + 14\ H^+ + Cr_2O_7^{-2} + 6e- = 2\ Cr^{+3} + 3\ I_2 + 7\ H_2O)$

$2Na_2S_2O_3 + I2 = Na_2S_4O_6 + 2NaI$

$(S_2O_3{}^{2-} - e^- = S_4O_6\ 2- + I-)$

Here $K_2Cr_2O_7$ is an oxidizing agent and I- is a reducing agent. Again in the second reaction I2 is an oxidizing agent and S_2O_3-- is a reducing agent.

In the 2nd Step of the reaction a specific indicator is used that is “Starch”-which has a significant effect on iodine.

$Starch+I_2$=Starch-Iodine (blue colour)

Starch-Iodine+$6S_2O_3$--=Starch +6I- + $3S_4\ O_6$—

If to a solution containing a little iodine, some starch solution is added and $Na_2S_2O_3$ is run in from the burette, the blue color of the starch-iodine complex will disappear from the solution as soon as all the iodine has been reduced to iodide ion.

Apparatus:

1. Conical flask,
2. Burette,
3. Pipette,

4. Volumetric flask,

5. Stand,

6. Funnel

Chemicals:

1. $Na_2S_2O_3$,

2. $K_2Cr_2O_7$,

3. KI,

4. $NaHCO_3$

5. HCl (Concentrated),

6. Starch (Indicator)

Procedure:

Take 4 ml of 12% potassium iodide (KI) solution in a conical flask and dilute it to about 50 ml. Add about 1 g. of $NaHCO_3$ and shake the flask until the salt dissolves. Add about 4 ml. conc. HCl acid and then add 10 ml. standard $K_2Cr_2O_7$ solutions by means of a pipette in the same flask and cover it with a watch glass, allow the solution to stand for about five minutes in the dark (inside the desk). Rinse the watch glass and dilute the solution about 100 ml. titrate the liberated iodine with sodium thiosulphate solution from 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 sodium thiosulphate solution changes the color of the solution from deep blue to light blue. This is the end point. Calculate the strength of sodium thiosulphate solution using the following equation: $6V_1S_1=V_2S_2$

Data and calculation:

(Standardization of $Na_2S_2O_3$ solution with standard $K_2Cr_2O_7$ solution)

Number of Objects	Volume of $K_2Cr_2O_7$(ml)	Burette reading (ml)		Volume of $Na_2S_2O_3$(ml)	Average volume of $Na_2S_2O_3$(ml)	
		Initial Reading	Final Reading			
1	10	0	5	5		
2	10	5	10.2	5.2	5.1	
3	10	10.2	15.3	15.3		

Calculation:

We know,

$6V_{red}$ x $S_{red} = V_{ox} \times S_{ox}$

Here,

$VK_2Cr_2O_7$ = 10ml, `$SK_2Cr_2O_7$ =0.5M

$VNa_2S_2O_4$ = 5.1ml, $SNa_2S_2O_4$ =?

$SNa_2S_2O_4 = 6(10\times0.5)/5.1$

Result:

Determined strength of $Na_2S_2O_3$ solution is = 5.88M

Discussion:

As the color change of the titration of Na2S2O3 with K2Cr2O7 is very confusing, the end point of the titration may not have been properly determined. This may be the cause of error.