

Chem lab 1007 : Oxidation - Reduction Titration (Analysis of Bleach)

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Purpose: To understand how redox reactions can be used to solve calculations.

Procedure: Refer to lab Manual # 7: Oxidation - Reduction Titration (Analysis of Bleach)

Reference : Lund. K, Experiment #7 Oxidation - Reduction Titration (Analysis of Bleach), Chem 1007 Lab Manual, Nipissing University.

Materials :

Tabel.1: Part A Standardization of sodium thiosulfate

<u>Trail #</u>	<u>Initial Volume</u>	<u>End Volume</u>	<u>Volume used</u>	<u>[sodium Thiosulfate]</u>
Trail #1	0.9ml	22.6	21.7	4.15×10^{-5}
Trail #2	22.6ml	40.5	17.9	5.03×10^{-5}
Trail #3	66.4ml	44.2	22.2	4.05×10^{-5}

	<u>Average concentration</u>	<u>Standard deviation</u>
Sodium Thiosulfate	1.32×10^{-4}	-2.0×10^{-4}

Table.2: Part B Analysis of Bleach

<u>Trail #</u>	<u>Volume NaOCl Used</u>	<u>Mass of Bleach</u>	<u>Mass of Sodium Hypochlorite</u>	<u>% Mass</u>
Trail #1	6.3ml	0.4622	9.73×10^{-3}	2.1%
Trail #2	6.2	0.4666	1.16×10^{-2}	2.49%
Trail #3	6.5	0.4664	9.80×10^{-3}	2.1%

	<u>Average []</u>	<u>Standard deviation</u>
Bleach	2.78×10^{-4}	7.33×10^{-2}

Observations:

Part A: Standardization of sodium thiosulfate

<u>Trail #</u>	<u>Initial Volume</u>	<u>End Volume</u>
Trail #1	0.9ml	22.6
Trail #2	22.6ml	40.5
Trail #3	66.4ml	44.2

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Part B: Analysis of Bleach

<u>Trail #</u>	<u>Initial volume of NaOCl</u>	<u>End Volume of NaOCl</u>	<u>Mass of Bleach</u>
Trail #1	21.0ml	27.3ml	0.4622
Trail #2	27.3ml	33.5ml	0.4666
Trail #3	33.5ml	40.0ml	0.4664

Calculations:

Part A: finding the mol of $\text{S}_2\text{O}_3^{2-}$

Example trail #1

$$\text{KI} \text{O}_3 [\text{I}^-] = 0.01\text{M} \times 0.015\text{ml}$$

$$= 0.00015$$

$$0.00015 \times 3 \text{ mol I}_2 / 1 \text{ mol}$$

$$\text{I}_2 = 0.00045\text{ml}$$

$$0.00045 \times 2 \text{ mol S}_2\text{O}_3^{2-} / 1 \text{ mol I}_2$$

$$\text{S}_2\text{O}_3^{2-} = 0.0009 \text{ mol}$$

Part A: finding concentration at the end of titration

Example #1

$$[\text{S}_2\text{O}_3^{2-}] = \text{mol/v}$$

$$0.0009 / 21.7$$

$$= 4.15 \times 10^{-5}$$

Part A: Standard deviation

Example

$$E \text{ Sum exp value} - E \text{ avg Value} / n$$

$$= [(4.15 \times 10^{-5}) - (1.323 \times 10^{-4})] / 3 + [(5.03 \times 10^{-3}) - (1.323 \times 10^{-4})] / 3 +$$

$$[(4.05 \times 10^{-3}) - (1.323 \times 10^{-4})] / 3$$

$$= -2.04 \times 10^{-4}$$

Part B: Finding grams of NaOCl

Example # 1

$$[\text{S}_2\text{O}_3^{2-}] \times \text{volume} = \text{mol S}_2\text{O}_3^{2-}$$

$$4.15 \times 10^{-5} \times 6.3 = 2.6 \times 10^{-4}$$

$$\text{mol S}_2\text{O}_3^{2-} \times 1 \text{ mol I}_2 / 2 \text{ mol mol S}_2\text{O}_3^{2-} \times 1 \text{ mol HOCl} / 1 \text{ mol I}_2 = \text{mol HOCl} = \text{Mol NaOCl}$$

$$2.6 \times 10^{-4} \times 1 \text{ mol I}_2 / 2 \text{ mol mol S}_2\text{O}_3^{2-} \times 1 \text{ mol HOCl} / 1 \text{ mol I}_2 = 1.3 \times 10^{-4} \text{ mol HOCl} = 1.3 \times 10^{-4} \text{ Mol NaOCl}$$

$$\text{Mol NaOCl} \times \text{Mw NaOCl} = \text{g NaOCl}$$

$$1.3 \times 10^{-4} \times 74.44 = 9.73 \times 10^{-3}$$

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% mass = g NaOCl/g Bleach

Example #1

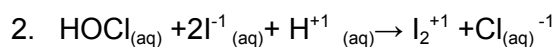
$$\% \text{ mass} = 9.73 \times 10^{-3} / 0.4662$$

$$= 2.10 \times 10^{-2} \times 100$$

$$= 2.1\%$$

Questions :

1. The results of the experiment show that we can use stoichiometry to find the %mass of bleach, for this experiment the average %mass was 2.3%. This experiment is reliable because of the results significantly similar when it came to not only %mass of the solution but when it also came to mol of HOCl and mol of NaOCl; also the ratio for the stoichiometry were small so chances of miscalculations are small, and with the addition of literature value to the calculations the results are reliable.



$\text{HOCl}_{(\text{aq})} \rightarrow \text{Cl}^{-1}_{(\text{aq})}$ = Oxidation reaction - is the reducing agent

$2\text{I}^{-1}_{(\text{aq})} \rightarrow \text{I}_2^{+1}$ = Reduction reaction - is the oxidizing agent