**Analysis of Oxygen Bleach**

Ref: Copper, C. L.; Koubek, E. J. Chem Educ. 2001, v78 p652.

**Introduction**

 This experiment allows students to balance an oxidation-reduction reaction equation and use the reaction to analyze a consumer product. The experiment calls for the balancing of the reaction of H2O2 and MnO4 - two different ways. Then it is necessary to determine which of these balanced equations has the correct Stoichiometry by titrating a standard H2O2 solution with KMnO4. The correct equation is used to determine the the mass percent of H2O2 in a commercially available, environmentally friendly, oxygen bleach solution.

**Purpose**

 To balance the equation for a redox equation.

 To determine the mass percent of Hydrogen Peroxide in a full strength bleach sample.

 To determine the environmental advantage of an oxygen bleach.

**Materials**

Analytical balance 1.0g NaBO3 - 4H2O

Distilled water 1.0 M H2SO4

Non-chlorine bleach0.0100 MnO4

100 ml volumetric flask 250 ml beaker

50 ml Burette

**Safety**

 Hydrogen Peroxide, potassium permaganate and sulfuric acid are hazardous, Wear goggles and apron for this lab. Consult an MSDS for details.

**Procedure**

**Parts I and II. Preparation and Titration of standard H2O2 solutions:**

1. First, using a top loading balance, weigh out, in a plastic dish, ~1.0 g of NaBO3•4H2O.

2. Next, weigh the sample on an analytical balance. Transfer the sample to a 100 mL volumetric flask and reweigh the empty dish. Record, in the Data Section, the actual mass of NaBO3•4H2O used.

3. Add 20 mL of 1.0 M H2SO4 to the flask and mix well. Dilute this solution to the mark and distilled water and mix again to make sure all of the solid has dissolved. Use this solution for all of Parts I and II.

4. Pipet 10 mL of the NaBO3•4H2O solution that you just prepared into a 250 mL Erlenmeyer flask. Add 20 mL of 1.0 M H2SO4 to this flask.

5. Fill a 50 mL buret with 0.0100 mKMnO4.

6. Titrate the NaBO3 solution in the flask with 0.0100 M KMnO4 solution.

7. Repeat steps #1-6 until you get at least two results that are in good agreement (within ~0.5 mL KMnO4 used).

**Part III Titration of bleach solutions.**

1. Dilute the Seventh Generation Non-Chlorine Bleach by pipetting 10 mL of bleach in a 100 mL volumetric flask and filling the flask to the mark with distilled water. Thoroughly mix the contents of the flask by inverting it several times. (Note: Take care not to get bleach on your skin.)

2. Pipet 10 mL of the diluted bleach solution into a 250 mL Erlenmeyer flask.

3. Add 20 mL of1.0 M H2SO4 to the flask.

4. Titrate the bleach solution in the flask with 0.0100 M KMnO4 solution.

5. Repeat steps #1-4 until you get at least two results that are in good agreement (~0.5 mL KMnO4  used).

**SAMPLE DATA**

**Part I Preparation of NaBO3•4H2O solutions:**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  Trial #1 |  Trial #2  |  Trial #3 |
|  mass of NaBO3•4H2O + weighing boat  |  |  |  |
|  mass of weighing boat after transfer |  |  |  |
|  mass of NaBO3•4H2O added to flask |  |  |  |

**Part II Titration of 20 mL of known H2O2 solutions:**

|  |  |  |  |
| --- | --- | --- | --- |
|   |  Trial #1  |  Trial #2 |  Trial #3 |
|  final buret reading |  |  |  |
|  initial buret reading |  |  |  |
| volume of 0.0100 M KMnO4 used |  |  |  |

**Part III Titration of diluted bleach solutions:**

|  |  |  |  |
| --- | --- | --- | --- |
|   |  Trial #1  | Trial #2 | Trial #3 |
| final buret reading |  |  |  |
| initial buret reading |  |  |  |
| volume of 0.0100 M KMnO4 used |  |  |  |

**SAMPLE DATA TREATMENT SECTION:**

**Part I and II. Preparation and Titration of standard H2O2 solutions:**

1. Knowing the mass of NaBO3•4H2O used, calculate the number of moles of H2O2 present in each sample that you titrated in Parts I and II. Use the balanced equation for the reaction.

 Trial #1 (show Calculation)

 Trial #2\_\_\_\_\_\_\_\_\_\_\_

 Trail #3\_\_\_\_\_\_\_\_\_\_\_

2. Calculate the number of moles KMnO4 used in each titration in Parts I and II.

 Trial #1 (show Calculation)

 Trial #2\_\_\_\_\_\_\_\_\_\_\_

 Trail #3\_\_\_\_\_\_\_\_\_\_\_

3. Determined the CORRECT stoichiometry of the reaction that took place in each titration in Part II. (i.e. find the mole ration of H2O2:MnO4-).

**Part III Titration of bleach solutions:**

1. Using the stoichiometry determined in Parts I and II, report the mass percent of H2O2 in the full strength bleach solution taking into account the dilution that you made in step 1. of Part III. Assume the density of the bleach solution is 1.00 g/mL.

 Trial #1 (show Calculation)

 Trial #2\_\_\_\_\_\_\_\_\_\_\_

 Trail #3\_\_\_\_\_\_\_\_\_\_\_

Average mass percent of H2O2 in full strength bleach sample

Balance this equation by the half reaction method



**Questions for Students to Address:**

1. What is the source of O2(g) produced during the titration? Explain.

2. Do you want a faint pink color at the equivalence point of the titration or a dark one? Explain.

3. What was the indicator for this titration?

4. What environmental advantage do you think an oxygen bleach has over a chlorine bleach? (If you don’t know, look it up using the Internet and cite your source as part of your answer).