# OXIDIZING POWER OF LAUNDRY BLEACH

Introduction:

Many times in chemistry we must use indirect methods to find the concentration of a chemical in a solution. In this experiment the concentration of NaOCl, the active reagent in laundry bleaches, will be found. The bleach is reacted with iodide and iodine is formed. The amount of iodine formed is then determined by reaction with sodium thiosulfate. Thus, the amount of NaOCl is found indirectly from the amount of iodine it produces.

This procedure is one type of redox titration known as an iodometric analysis. In the first step, excess potassium iodide is added to a solution of bleach and is oxidized to iodine by the hypochlorite ion. Acetic acid is added to provide the hydrogen ion needed for the reaction.

(A) $ClO^- + 2\,H^+ + 2\,I^- \rightarrow I_2 + Cl^- + H_2O$
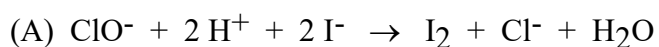
The amount of iodine formed by this reaction is found by titrating with a sodium thiosulfate solution.

(B) $I_2 + 2\,S_2O_3^{2-} \rightarrow 2\,I^- + S_4O_6^{2-}$
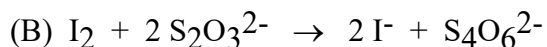
The endpoint of the reaction would normally be difficult to determine. The reaction mixture would go from pale yellow to colorless at the endpoint. The addition of starch produces an intense blue-black complex. The endpoint is detected by the disappearance of the intense blue color of the iodine-starch complex.

Purpose:

The purpose of this experiment is to determine the NaOCl content of laundry bleaches.

Equipment/Materials:

buret

magnetic stirrer/stirring bar (optional)   100 mL graduated cylinder

250 mL Erlenmeyer flask   0.100 M sodium thiosulfate

250 mL volumetric flask   10 mL graduated cylinder

spoon/spatula   balance

5 mL pipet   buret clamp

wash bottle   ring stand

vial or small beaker   glacial acetic acid

potassium iodide   starch solution

beaker for buret waste   distilled water

Safety:

- Always wear goggles and an apron in the lab.
- The glacial acetic acid has a very strong odor. Measure it out in the fume hood.

Procedure:

1. Use a 5 mL pipet to measure out a sample of a laundry bleach of your choice. Place the bleach in a vial or a small beaker that has been previously weighed. Determine the mass of the 5 mL of bleach and its mass per mL. Record these values on your data sheet.

2. Transfer the bleach to a 250 mL volumetric flask. Rinse the original container with distilled water and add this to the volumetric flask. Bring to volume.

3. Rinse the buret with distilled water. Add two small portions of sodium thiosulfate solution to the buret. Drain these samples through the buret and discard them. Fill the buret with the sodium thiosulfate solution. Adjust the level and make sure the tip is filled. Record the initial level of the solution in the buret on the data table.

4. Use a 100 mL graduated cylinder to measure out a 50 mL portion of the bleach solution. Place the sample in an Erlenmeyer flask. Add the stirring bar if one is to be used.

5. Add 2 grams of potassium iodide to the flask. The amount added does not have to be precise. In the hood, add 10 mL of glacial acetic acid.

6. Titrate with the sodium thiosulfate until the solution is light yellow. At this time add about 5 mL of the starch indicator.

7. Titrate slowly until the blue color disappears. Record the amount of sodium thiosulfate solution in the buret at the end of the titration. Record this value in your data table. Note: The blue color may reappear after the titration has been completed due to air oxidation of the iodide.

8. Each group should titrate three samples of one brand of bleach.

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Data:

1. Brand of bleach used: _____

2. Mass of 5 mL of bleach: _____ g = _____ g/mL

3. Concentration of bleach solution: _____

4. Concentration of sodium thiosulfate solution _____

	Trial 1	Trial 2	Trial 3
End			
Start			
Used			

Average volume of sodium thiosulfate used: _____

Calculations:

1. Calculate the moles of sodium thiosulfate used.

2. Calculate the moles of iodine formed.

3. Calculate the moles of NaClO in the original sample.

4. Convert the moles of NaClO to mass of NaClO.

5. Determine the mass of NaClO per gram of bleach.

6. Calculate the percent NaClO in the brand of bleach.

Questions:

1. In each equation in the introduction section indicate:

	Equation A	Equation B

a. species oxidized

b. species reduced

c. oxidizing agent

d. reducing agent

2. Suppose the density of a bleach was found to be 1.07 g/mL. How would the results of an experiment be affected if a correction for this were not made?