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Ministère de l'Enseignement Supérieur et de la Recherche Scientifique
المدرســة العليـــا للعلـــوم البيـــولـوجيـة بوهـــران
Ecole Supérieure en Sciences Biologiques d'Oran

Workshop 04: Titration of Active Chlorine in Commercial Bleach Solution and Preparation of Dakin Aqueous Solution

I. Introduction :

Dakin's solution is a diluted neutral aqueous solution of sodium hypochlorite prepared from bleach. It contains 5 grams per liter of active chlorine. Its preparation requires the prior determination of the active chlorine content in bleach, followed by mandatory control of the content of the resulting solution.

II. Objective :

Preparation and determination of the content of active chlorine (T.C.A g/l) and the chlorometric degree (0°chl) of a solution of sodium hypochlorite: commercial bleach; also known as Dakin's solution.

III. Determination of Active Chlorine in Commercial Bleach (Iodometry):

- **Principle:**

  This determination involves two steps, each of which is a redox reaction.

  - **Step 1:**

    We react hypochlorite ions ClO- with excess iodide ions I-.

$$\begin{cases} ClO^- + 2H^+ + 2é \longrightarrow Cl^- + H_2O \\ 2I^- \longrightarrow I_2 + 2é \end{cases}$$

$$ClO^- + I^- + 2H^+ \longrightarrow Cl^- + I_2 + H_2O$$

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- **Step 2:**

  The resulting mixture of I_2 is titrated with a 0.1M solution of sodium thiosulfate, $Na_2S_2O_3$.

$$\begin{cases} I_2 + 2é \longrightarrow 2I^- \\ 2S_2O_3^{2-} \longrightarrow S_4O_6^{2-} + 2é \end{cases}$$

$$I_2 + 2S_2O_3^{2-} \longrightarrow 2I^- + S_4O_6^{2-}$$

IV. Materials and products used :

Materials	Products
- 250ml Erlenmeyer flask - 7ml graduated cylinder - 5ml graduated cylinder - Magnetic stirrer - Magnetic stir bar - Burette - Plastic pipette	- Bleach (sodium hypochlorite) - Potassium iodide (KI) - Sulfuric acid (H_2SO_4) - Sodium thiosulfate ($Na_2S_2O_3$) - Starch

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- **Operating procedure :**
  - Place the following in an Erlenmeyer flask:
    - 5 ml of a 10% dilute bleach solution.
    - Add 7 ml of 0.1 M potassium iodide (KI) solution.
    - Add 5 ml concentrated sulfuric acid (H2SO4).
  - Allow mixture to stand under magnetic stirring.
  - The observed color turns brown, indicating the formation of iodine (I2).
  - Fill burette with 0.1 M sodium thiosulfate solution (Na2S2O3).
  - Titrate the solution with sodium thiosulfate solution.
  - When titration is almost complete (the solution takes on a straw-yellow color), add a few drops of starch (the color obtained is dark blue).
  - Continue titration until the dark blue color disappears.
  - Note the volume of equivalent sodium thiosulfate solution.
  - Repeat titration once more.

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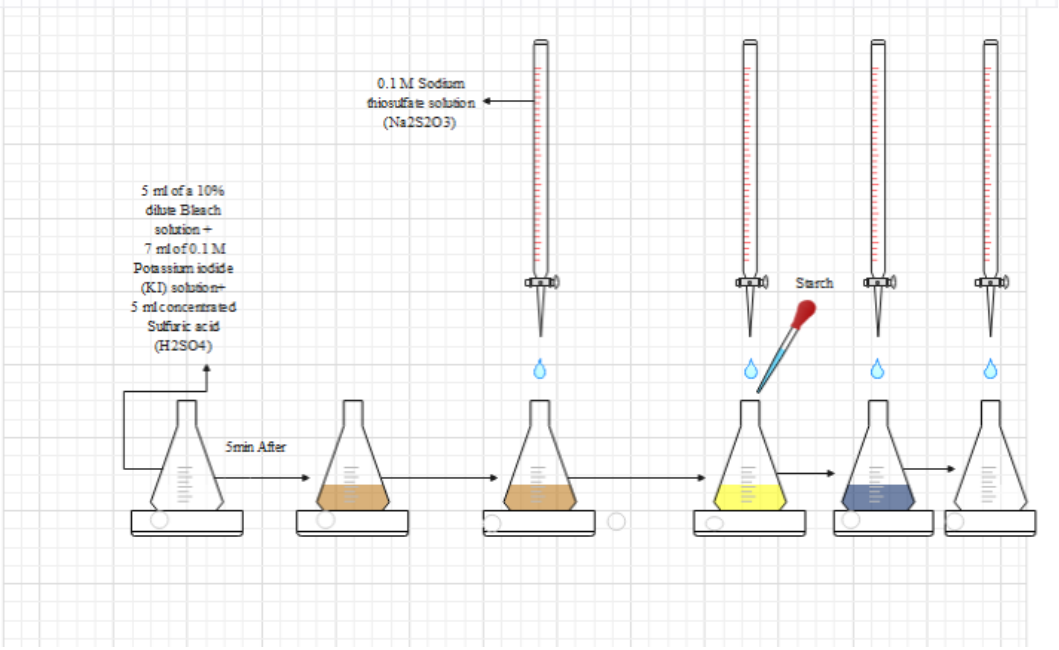

Figure 01 : Titration of Active Chlorine in Commercial Bleach Solution.

V. Preparation of Aqueous Sodium Hypochlorite Solution (Dakin's Solution):

- **Composition :**
  - Sodium bicarbonate : 2.3g
  - Potassium permanganate : 0.001g (1mg)
  - Bleach (sodium hypochlorite solution) : 6.8ml
  - Distilled water : 100ml

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- **Materials and products used :**

Materials	**Products**
- 250ml Erlenmeyer flask - 100ml graduated cylinder - Watch glass - Funnel - Spatula - 7ml graduated cylinder - Scale	- Sodium bicarbonate - Potassium permanganate - Bleach (sodium hypochlorite) - Distilled water

- **Preparation of 100ml Dakin's Solution:**
- **Operating Procedure:**

  - Place the following into a 250ml Erlenmeyer flask:
  - 2.3g of sodium bicarbonate ($NaHCO_3$).
  - Add 0.001g (1mg) of potassium permanganate (KMnO4) .
  - Add 6.8ml of bleach (sodium hypochlorite).
  - Stir.

- **Instructions for Use and Dosage of Dakin COOPER STABILIZED:**

  - This solution is used undiluted. It can be used for washing, local baths, soaked compresses, or as a wet dressing.
  - The local application of the antiseptic solution Dakin Stabilized Cooper should be used without dilution; the product must be used undiluted, for washes, local baths (such as foot, finger, or sitz baths), or irrigations, either using an applicator, soaked compresses, or wet dressings.
  - You can repeat the treatment with Dakin Stabilized Solution as often as necessary.
  - Do not use Dakin Stabilized Solution in conjunction with another antiseptic product that could counteract its effects.

- Make sure to close the Dakin bottle promptly after use to prevent microbial contamination.

- **Precautions for Use:**

This solution should not be stored for more than a week.
The bottle should be stored sealed in a cool place and protected from light.
Once opened, the stability of the solution is reduced to two months.