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Course: Chemistry Lab

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QNO. 01 Experiment: Determining the Percentage Purity of Sodium Carbonate Using Volumetric Analysis

The goal is to titrate an impure sample of sodium carbonate (Na_2CO_3) with a standard hydrochloric acid (HCl) solution in order to ascertain the sample's % purity.

Making the Materials for the Sodium Carbonate Solution Needed:
Balance and Weighing
bottle for weighing
250 mL beaker
A funnel
250 mL volumetric flask
distilled water
Rod of glass
A sample of impure sodium carbonate

Procedure

Using a dry, clean weighing vial, precisely weigh 2.65 g of the impure sodium carbonate sample. This is approximately what is required to create a solution of 0.1 mol/dm^3.
Pour roughly 100 mL of distilled water into a 250 mL beaker containing the sample.
Using a glass rod, stir the mixture until all of the sodium carbonate has been dissolved.
Pour the solution into a 250 mL volumetric flask using a funnel.
To prevent sample loss, rinse the funnel and beaker with a little distilled water, then transfer the rinses into the volumetric flask.
Pour distilled water into the volumetric flask until the meniscus's bottom reaches the 250 mL threshold.
To guarantee even mixing, stop the flask and give it a gentle shake.

(b) Hydrochloric acid standardization, if required
A primary standard, like pure sodium carbonate, must be used if the hydrochloric acid isn't already standardized.

Steps: As previously mentioned, make a standard solution of pure sodium carbonate at 0.1 mol/dm³.

25.00 mL of this standard solution should be pipetted into a conical flask.
Add two or three drops of the indicator methyl orange.
Use the hydrochloric acid solution to titrate until the yellow turns orange or pink.
To get results that are consistent (within 0.1 mL of one another), repeat.
Utilising the formula in section (d), determine the precise HCl concentration based on the titration data.

(C) Burette as the apparatus for the titration procedure

25 mL pipette
Filler in a pipette
Flask with a conical shape
Stand and clamp
White tiles
Methyl orange indication

Procedure:

Fill the burette after rinsing it with the standardized HCl solution, making sure the tip is free of air bubbles.
Transfer 25.00 mL into a conical flask after rinsing the pipette with the sodium carbonate solution.
Fill the conical flask with two to three drops of methyl orange.
To see the colour shift clearly, place the conical flask on a white tile.
Swirl constantly as you gradually add HCl from the burette to the sodium carbonate solution.
The endpoint of the titration is reached when the solution turns from yellow to light orange/pink.
Note how much HCl was used.
To obtain at least three consistent findings, repeat the titration.

(d) Calculation:

Assume that the chemical equation is balanced:

$2HCl + Na_2CO_3 \rightarrow 2NaCl + H_2O + CO_2$

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First Step: Determine the number of HCl moles utilised.
HCl moles are equal to $C \times V$
1000 C×V equals 1000 moles of HCl.
Where:
C is the HCl concentration (mol/dm³).
V = average HCl volume utilised (mL)
Step 2: Determine the moles of Na_2CO_3 using the stoichiometry
According to the balanced equation, one mole of NaCO3 and two moles of HCl react as follows:
Moles of HCl = Moles of NaCO3
Two moles of NaCO3 equals two moles of HCl

Step 3: Determine the moles of Na_2CO_3 using the stoichiometry
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Two moles of NaCO3 equals two moles of HCl
Determine the mass of pure Na_2CO_3 in 25.00 mL in step three. Mass = Mole of Na_2CO_3 × Molar mass of Na_2CO_3 (106 g/mol)
Mass is equal to moles of NaCO3×molar mass of NaCO3 (106 g/mol).
Step Four: Increase the volume to 250 mL (full solution).
Mass in 25.00 mL × 10 equals Mass in 250 mL
Mass in 25.00 mL×10 = Mass in 250 mL

Step 5: Determine the purity %
If the impure sample has a weight of 2.65 g, then:
Mass of pure Na_2CO_3 Mass of impure sample × 100 equals Percentage Purity
(Mass of impure sample Mass of pure NaCO3)×100 equals Percentage Purity

(e) Safety Measures
When working with chemicals, always wear gloves, a lab coat, and safety eyewear.
Because hydrochloric acid is caustic, handle it with caution. Spills should be cleaned up right away with lots of water.
If working with higher amounts of acid or if the CO_2 gas produced makes you uncomfortable, utilise a fume hood.
Always use a pipette filler instead of pipetting by mouth.

Follow the safety procedures in your lab when disposing of chemical waste.
To prevent contamination, wash all glassware both before and after the experiment.

Qno.:02 Test: Qualitative Analysis to Verify Silver Ion (Ag^{+}) Presence

to use straightforward qualitative assays with observable chemical reactions to detect and validate the presence of silver ions (Ag^{+}) in a solution.

(a) The expected observation and the reagent

First, add Hydrochloric acid diluted (HCl)
Utilised Reagent: Dilute HCl (or HCl after diluted nitric acid)
Method: To the test solution, add a few drops of diluted HCl.
Anticipated Observation: If silver ions are present, a white precipitate will occur.
Silver chloride (AgCl), the white precipitate, is insoluble in water.

(b) One or more confirmatory tests

Aqueous Ammonia (NH_3) is added in step three. The reagent used is diluted aqueous ammonia.
Method: Mix the white precipitate from step 1 with a diluted ammonia solution.
Anticipated Finding: A colourless solution is produced when the white precipitate dissolves in ammonia.
Because AgCl dissolves in aqueous ammonia to generate a complex ion, this verifies the presence of silver ions.

(c) Applicable Equilibrium Chemical Equations for Silver Chloride Precipitate Formation:

$AgCl\ (s) = Ag^{+}\ (aq) + Cl^{-}\ (aq)$
$AgCl\ (s) = Ag^{+}\ (aq) + Cl^{-}\ (aq)$
AgCl Dissolution in Watery Ammonia:

$2\ NH_3\ (aq) + AgCl\ (s) \rightarrow [Ag(NH_3)_2]$
$+\ (Cl^{-}(aq) + (Cl$⌧$)$
$[Ag(NH_3)_2] = AgCl\ (s) + 2NH_3\ (aq) \rightarrow$
$+\ (aq) + Cl^{-}\ (aq)$
AgCl photodecomposition (when exposed to light):

$2\ AgCl\ (s) \rightarrow$ light
$2\ Ag\ (s) + Cl_2\ (g)$
The light of $2AgCl(s) + Cl_2(g)$

(d) Safety Measures
Throughout the experiment, put on a lab coat, gloves, and safety eyewear.
Because hydrochloric acid is corrosive, keep it away from skin and eyes. If it does spill, wash it off with lots of water.
Work in an area with good ventilation or behind a fume hood because ammonia solution has a strong, unpleasant smell.
Silver compounds should not be poured down the sink; instead, dispose of them appropriately. Observe the waste disposal guidelines in your lab.
To prevent mishaps, clearly label all reagents and handle all glassware carefully.