TITRATION LAB MANUAL

Experiment_ID : 23

Standardization of Acid by Titration with Standard Alkali

EXPERIMENT OBJECTIVE:

To standardize hydrochloric acid using standard sodium hydroxide solution

MATERIALS REQUIRED

Apparatus:

* 2 Burettes - 50 mL each (Acid and Alkaline)
* 3 Conical Flasks - 250 mL (Erlenmeyer)
* 2 Beakers - 500 mL
* 2 Pipettes - 20 mL Volumetric and Dropper
* 1 Round-bottom Flask - 250 mL
* 2 Burette Stands with clamps
* 2 Glass Rods
* 1 Funnel
* 1 White Tile
* Beaker Tongs

Chemicals:

* Standard NaOH Solution - 0.1 M
* HCl Solution - Unknown concentration
* Phenolphthalein Indicator - 1% solution
* Distilled Water

PROCEDURE - STEP BY STEP

STEP 1: Prepare the Burettes

Instructions: Clean and rinse burettes thoroughly with water and distilled water
Expected Outcome: Burettes clean and ready without water residue

STEP 2: Fill the Burettes

Instructions: Fill one burette with NaOH and other with HCl solution
Expected Outcome: No air bubbles, filled to 0.00 mL mark

STEP 3: Prepare the Conical Flask

Instructions: Take 20 mL HCl in conical flask using pipette, add 3 drops of indicator
Expected Outcome: Colorless solution ready for titration

STEP 4: Note Initial Burette Reading

Instructions: Record the initial reading of burette to 0.1 mL precision
Expected Outcome: Initial reading recorded (Example: 0.20 mL)

STEP 5: Perform the Titration

Instructions: Add NaOH dropwise from burette while swirling the flask
Expected Outcome: Solution changes from colorless to pale pink at endpoint

STEP 6: Note Final Burette Reading

Instructions: Record final burette reading to 0.1 mL precision
Expected Outcome: Volume of NaOH used = Final reading - Initial reading

STEP 7: Repeat for Concordant Trials

Instructions: Repeat steps 3-6 for at least 3 trials
Expected Outcome: Get 3 trials with difference of 0.20 mL or less

STEP 8: Calculate Concentration

Instructions: Use average volume and formula N1V1=N2V2
Expected Outcome: HCl concentration determined in Normality and Molarity

SAFETY PRECAUTIONS

SAFETY PRECAUTIONS AND GUIDELINES

* Always wear safety glasses and lab coat when handling chemicals
* Handle burettes and glassware carefully to avoid breakage
* Never pipette by mouth - always use a rubber bulb
* Ensure burette tips do not touch other glassware to avoid contamination
* Add indicator drop by drop to avoid overdosing
* Perform titration in well-ventilated area
* Do not mix or store chemicals without proper labeling
* In case of chemical splash, rinse immediately with water
* Dispose of chemical waste in appropriate containers only
* Keep MSDS (Material Safety Data Sheet) available
* Know location of eye wash station and emergency equipment
* Never leave heated equipment unattended
* Wash hands thoroughly after handling chemicals
* Report any spills or accidents to your instructor immediately

CALCULATIONS

Formula: $N_1V_1 = N_2V_2$

N_1 = Normality of HCl (to find)
V_1 = Volume of HCl used = 20 mL
N_2 = Normality of NaOH = 0.1 N
V_2 = Average volume of NaOH from concordant trials

To convert Normality to Molarity: M = N / number of H^+/OH^-

EXPECTED RESULTS

* Typical HCl concentration: 0.1 - 0.2 M
* Typical volume of NaOH used: 18-22 mL
* Color change should be abrupt at endpoint
* Concordant values within 0.20 mL difference

CONCLUSION

The titration experiment successfully standardizes HCl using standard NaOH. The concentration of HCl is determined using the formula $N_1V_1=N_2V_2$. Accurate results require careful technique, precision measurements, and adherence to all safety precautions.

------- END OF MANUAL -------

This manual covers all essential aspects of acid-base titration including procedures, expected outcomes, safety, and calculations.