Lab Report: To Estimate the Volume of Ammonia in the Cleansing Solution Using Titration Analysis

Titration (titrimetric analysis) is one of the oldest chemical methods for quantitative analysis. The essence of the method is to add the solution to be analysed to a solution of a known concentration (titrant). The simplest case of titration is to determine the acidity or alkalinity of the solution. For example, if hydrochloric acid is used as a titrant and its volume is known, it is easy to calculate the concentration of alkali in the analyzed solution. The latter determines the end point of the titration, the moment when the chemical reaction is completed and the additional dosing of the titrant only leads to an excess of added substances. In fact, the method consists of calculating the volume of the substance spent on the analysis of the titrant. The end of the interaction between the components of the solutions is called titration end point. Thus, the purpose of the current lab report is to find the volume of ammonia in the cleaning solution using indicator that changes colour at the end point of the acid to base or base to acid.

Materials

- 250 cm³ Conical flask
- Burette and stand
- Filter funnel
- Standard Sodium hydroxide solution
- Phenolphthalein indicator
- Hydrochloric acid
• Commercial cleaning solution

Procedure

When standardizing HCl, 2 drops of phenolphthalein indicator were added into the hydrochloric acid. The solution was then titrated along with sodium hydroxide until the end point. The titration process was repeated to get three values that agreed to 0.05ml range of each other. The molarity of HCl was then calculated.

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<th>Volume of HCL</th>
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<tr>
<td>Initial Volume of NaOH (ml)</td>
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<td>Final Volume of NaOH (ml)</td>
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Determining the amount of Ammonia

Given the concentration of molarity from the first procedure, the cleaning solution was diluted. The cleaning solution was diluted with water in a way to ensure that it would require 20-25ml of HCl to reach its end point. The solution was then titrated along with HCl and was repeated until three values that agreed to 0.05 range to each other were collected. The molarity of Ammonia was then calculated.

<table>
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<tr>
<th>Volume of cleaning solution</th>
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Results

Colour change in the experiment
Phenolphthalein changed colour from yellow to pink as it changed from an aqueous state into an acidic state.

Calculating the molarity of HCl

The first procedure was aimed at standardization of HCl. A known volume of sodium chloride was used because one mole of HCl reacts with one mole of NaOH. The reaction was in the ratio of 1:1.

Molarity of NaOH= 0.1m

Number of moles of NaOH=Molarity × Volume in dm3

\[ M_a \times V_a = M_b \times V_b \]

\[ M_a \times 0.2 = 0.1 \times 2.5 \]

\[ M_a = 1.25 \]

Calculating the molarity of NaOH for diluted and undiluted cleaning solution

\[ NH_3 + OH^- = NH_4OH \]

The dilution factor of the cleaning solution to water is 1:4. 25 ml of cleansing solution was diluted with 100ml of water.

To get Molarity of the diluted cleansing solution

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<tbody>
<tr>
<td>Cleansing solution</td>
<td>10</td>
<td>10</td>
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<tr>
<td>Initial Volume of HCL</td>
<td>15.5</td>
<td>13</td>
<td>8</td>
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</table>
Average=39.5÷3=13.2

Ma×Vb=Mb×Vb

Ma×10=0.959×9.8

Ma=0.9398

Ma×Va= Mb×Vb

0.9398×13.2=Mb×10

Mb=1.2405

This molarity is then multiplied by the dilution factor to get the concentration of the Ammonia in the cleaning solution.

Therefore, the concentration of ammonia is 1.2405×4=4.962M

Result

In the reaction between Ammonia and HCl, Ammonia acts like the weak base when it is aqueous solution and makes the titration with HCl possible (Stoker 302). Ammonia exists as a gaseous compound and is used in its aqueous state. The chemical equation for this reaction is HCL(aq) + NH₃ (aq)→NH₄ + Cl-

The graph representing the reaction will look it follows
At the end point, the indicator changes colour from yellow to pink.

Possible sources of errors

Errors in temperature control as well as in electrode calibration contribute to instrumental systemic errors in the final result. Systemic errors spread all over the calculations (Stoker 302). This method can also cause errors if the wrong indicator is used. Such errors contribute to low accuracy or wrong results. If the wrong indicator is used, it will lead to over titration or under titration in other cases. In this experiment, the results are reliable because they matched the expected ratios.

Works Cited