Course Code: 13554/Y1

Student Name: Chow Man Chung
Lam Kwok Kei
Lee Long Sing
Chan Ka Chun

Date performed: 22nd September, 2010

Experiment 2: Acid base titration I

Objective:

1) To practice the procedure for preparing a standard solution
2) To perform the standardization of an unknown hydrochloric acid solution
3) To determine the given sodium hydroxide solution
4) To estimate the ethanoic acid content in commercial vinegar solution

Apparatus & equipments used:

1) Burette, 50mL capacity
2) Bulb pipette, 25mL capacity
3) Volumetric flask, 250mL capacity
4) Conical flask, 250mL capacity
5) Analytical balance

Chemicals used:

1) Anhydrous sodium carbonate
2) Hydrochloric Acid, 0.1M
3) Methyl orange indicator
4) Phenolphthalein indicator
5) Commercial vinegar solution

Results and Data Treatment:

Weighting Data:

Mass of vial: 6.281g

Mass of vial and Na_2CO_3: 7.583g

Mass of Na_2CO_3: 1.302g

Na_2CO_3 solution made up to: 250.0cm^3

Titration I: Standardization of 0.1M hydrochloric acid solution

Titrant (in burette): Hydrochloric acid
Titrate (in conical flask): 25.0cm^3 of Na_2CO_3
Indicator used: Methyl Orange
Colour of indicator changed from: yellow to pink

Titration No.	1(trial)	2	3	4
Final burette reading (cm^3)	23.00	23.30	23.10	23.15
Initial burette reading (cm^3)	0.00	0.00	0.00	0.00
Volume of titrant used (cm^3)	23.00	23.30	23.10	23.15

Average volume: 23.18 cm^3

Calculation:

$Na_2CO_{3\,(s)} + 2HCl \rightarrow 2NaCl_{(s)} + H_2O_{(l)} + CO_{2(g)}$

Number of mole of $Na_2CO_{3(aq)}$ = 1.302g / 105.8089$gmol^{-1}$

= 0.0123

$\because$ HCl : Na_2CO_3 = 2 : 1

$\therefore$ Number of mole of HCl = (0.0123)(2)(25/250)

= 0.00246

Molarity of HCl = 0.00246 / (23.183 / 1000)

= 0.1062

~0.11M

Titration II: Determination of the given sodium hydroxide solution

Titrant (in burette): Hydrochloric acid
Titrate (in Conical flask): 25.0cm^3 of NaOH
Indicator used: Methyl Orange
Colour of indicator changed from: yellow to pink

Titration No.	1(trial)	2	3	4
Final burette reading (cm^3)	23.55	23.85	47.70	23.80
Initial burette reading (cm^3)	0.00	0.00	23.85	0.00
Volume of titrant used (cm^3)	23.55	23.85	23.85	23.8

Average volume: 23.83 cm^3

Calculation:

$HCl_{(aq)} + NaOH_{(aq)} \rightarrow NaCl_{(aq)} + H_20_{(l)}$

Number of mole of HCl = (0.1062)(23.83 / 1000)

= 0.00253

∵ HCl : NaOH = 1 : 1

∴ number of mole of NaOH = number of mole of HCl = 0.00253

Molarity of NaOH = 0.00253 / (25/1000)

= 0.1012

~0.10M

Titration III: Estimation of acetic acid content in commercial vinegar

Titrant (in burette): dilute commercial vinegar solution

Titrate (in Conical flask): 25.0cm^3 of NaOH

Indicator used: Phenolphthalein

Colour of indicator changed from: purple to colourless

Titration No.	1(trial)	2	3	4
Final burette reading (cm^3)	17.10	16.95	17.00	34.00
Initial burette reading (cm^3)	0.00	0.00	0.00	17.00
Volume of titrant used (cm^3)	17.10	16.95	17.00	17.00

Average volume: 16.98 cm^3

Calculation:

$CH_3COOH_{(aq)} + NaOH_{(aq)} \rightarrow CH_3COONa_{(aq)} + H_2O_{(l)}$

Number of mole of NaOH = (0.1012)(25/1000)

= 0.00253

∵ CH_3COOH : NaOH = 1 : 1

∴ number of mole of $CH_3COOH_{(dil)}$ = number of mole of NaOH = 0.00253

Molarity of $CH_3COOH_{(dil)}$ = 0.00253 / (16.98 / 1000)

= 0.1489999

Molarity of CH_3COOH = (0.1489999)(250 / 25)

= 1.489999

Number of mole of CH_3COOH in commercial vinegar = (1.489999)(250/1000)

= 0.3725

Mass of CH_3COOH in commercial vinegar =

(0.3725)[(2)(12.0107)+(4)(1.00794)+(2)(15.9994)]

= 22.369

The percentage of CH_3COOH in commercial vinegar = (22.369 / 250)(100%)

= 8.948

~ 8.95%

Conclusion:

We prepared standard solution 0.05M NaOH.

Through the titration I, we know that the molarity of HCl was 0.11M.

In the titration II, we determinate NaOH solution is 0.1012M.

At the titration III, we found out the molarity of diluted commercial vinegar is ~0.15M and also calculation out the origina1 vinegar was ~1.49M. In calculation, we found out there are 8.95% ethanoic acid in commercial vinegar.