Titration of HCL with NaOH

Kimmy Pathanasap (5861052)
Supichaya Nobnom (5861155)
Pichayathida Siriwechdaruk (5861105)
Pnotporn Jantarakolica (5861115)
Passawas Satitjindawong (5861095)

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Ms.Patraphorn Sanguansat
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Discussion

Questions:

1. How would it affect your results if you used a beaker with residual water in it to measure out your standardized sodium hydroxide solution?
    - Our experiment would not be accurate because there is initially some leftover water inside, which would affect the pH of the acid inside the erlenmeyer flask.
2. How would it affect your results if you used a wet Erlenmeyer flask instead of a dry one when transferring your acid solution from the volumetric pipette?
    - With a wet Erlenmeyer flask, the result will not be accurate. It might be contaminated by any type of liquid such as basic or acidic. Therefore, an error will occur since it is not 100% acid.
3. How do you tell if you have exceeded the equivalence point in your titration?
    - We have to find an indicator which will be able to tell us whether the solution is neutralized into pH 7. The indicator might have different color for each pH. So, it will be able to tell us the pH of that particular solution. For example, Bromthymol Blue which its color will be turned to blue when the solution is acidic, green if it solution is neutral, and blue if the solution is basic.
4. Vinegar is a solution of acetic acid (CH3COOH) in water. For quality control purposes, It can be titrated using sodium hydroxide to assure a specific % composition. If 25.00 mL of acetic acid is titrated with 9.08 mL of a standardized 2.293 M sodium hydroxide solution, what is the molarity of the vinegar?

$$CH_3COOH(aq) + NaOH(aq) \rightarrow H_2O(l) + CH_3COONa(aq)$$

$$mol\ NaOH(aq) = concentration\ of\ NaOH\ x\ volume\ of\ NaOH = 0.00908\ x\ 2.293 = 0.02082044\ mol$$

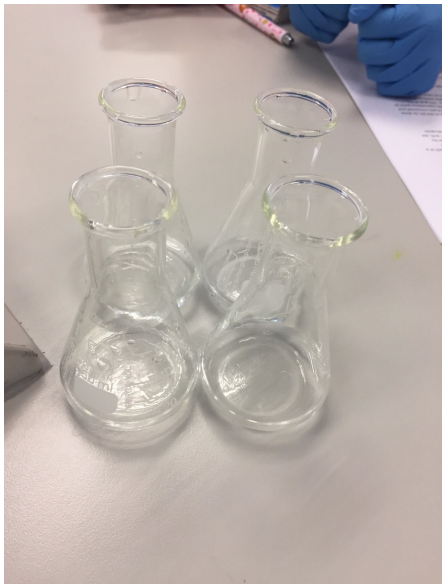
$$0.02082044\ mol\ NaOH = 0.02082044\ mol\ CH_3COOH$$

$$CH_3COOH\ concentration = \frac{0.02082044}{0.025} = 0.8328176\ mol/L$$

    - The molarity of the vinegar is 0.83.

Why result turn out in different shades of pink?

- The different shades of pink color is based on the amount of NaOH released into the beaker. If there is an increase in NaOH, then the color of pink will become darker. However, if the amount of NaOH is decreased, then the color of pink will be lighter.



Calculation:

$NaOH\,(aq) + HCl\,(aq) \rightarrow NaCl(aq) + H_2O\,(l)$

$Molarity = \frac{mol}{volume\ (L)}$

$mol\ base = molarity\ x\ volume = 0.1\ x\ 0.009 = 0.0009\ mol\ acid$

From equation: Acid to Base mole ratio = 1:1

Thus, mol acid = mol base = 0.0009 mol

$Molarity\ of\ base = \frac{mol}{volume\ (L)} = \frac{0.00009}{0.0010} = 0.009\ mol/L$

$Average\ acid\ concentration = \frac{\Sigma\ concentration\ of\ acid}{\Sigma\ number\ of\ trials} = \frac{0.0087+0.009+0.0089+0.0091+0.0094}{4} = 0.0074\ mol/L$

	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Volume of base (L)	0.0087	0.009	0.0089	0.0091	0.0094
Concentration of base (mol/L)	0.1	0.1	0.1	0.1	0.1
Mole of base (mol)	0.00087	0.0009	0.00089	0.00091	0.00094
Acid to Base (mol)	1:1	1:1	1:1	1:1	1:1
Moles of acid (mol)	0.00087	0.0009	0.00089	0.00091	0.00094
Volume of acid (L)	0.01	0.01	0.01	0.01	0.01
Acid concentration (mol/L)	0.087	0.09	0.0089	0.0091	0.0094
Average acid concentration (mol/L)	0.0074				

Conclusion

According to the experiment, 0.009 litres of 0.1M sodium hydroxide can neutralize 0.01 litres of 0.09M hydrochloric acid effectively.