Experiment 4 precipitation titration

- Argentimetry is a type of perciptation titration involving Silver Ion (Ag^+) ($AgNO_3$) ...
- Typically, it is used to determine the amount of chloride present in the Sample
- It can be used to determin helids, cyanides, arsenate, isocyanate, phosphate, sulfide and other ions
- The sample solution is titrated against a solution of $AgNO_3$ of known Solution

↳ how to choose indicator in this experiment ??

At the end point, an excess drop from the titrant will form a percipitate with the indicator which will give a color change due to ads color change

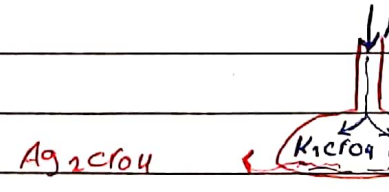
Mohr method's

$Ag^+ + Cl^- \rightarrow AgCl(s) \rightarrow$ white percipitate $AgNO_3 + NaCl \rightarrow AgCl\downarrow + NaNO_3$

The indicator is potassium chromat or mixed of potassium chromate and dichromate

When we add the excess drop of $AgNO_3$, The Ag^+ will react with chromates Ion (CrO_4^{-2}) and produce Ag_2CrO_4 (silverchromate) red to brown ppt

$2Ag^+ + CrO_4^{-2} \rightarrow Ag_2CrO_4$ Color change: yellow → red



↳ in Mohr's method the pH should be neutral or slightly basic media (6.5 - 9)

*** in Basic media

$Ag^+ + OH^- \rightarrow AgOH \rightarrow Ag_2O$

There will be a (+) error

*** in Acidic Media

$K_2CrO_4 + H^+ \rightarrow K_2Cr_2O_7 \xrightarrow{Ag^+} Ag_2Cr_2O_7$

There will be a positive error

* Fajan's methods

$Ag^+ + Cl^- \rightarrow AgCl$

* indicator used : adsorbtion indicators such as dichlorofluorescein (weak organic acid)

* At the end point, the excess of the Ag^+ will adsorp on AgCl, imparting a positive charge (Ag^+) which anoionic indicator will attract and causing a color change from green to pink

$Ag^+ + ind^- \rightarrow Ag^+ ind^-$ (silverfluorocenate) → ppt

↳ pink

* Volhard's method :

an example of back titration

- involves the addition of excess silver nitrate to the Analyte and the remaing of $AgNO_3$ is titrated against potassium thiocyanate ($KSCN$)

$AgNO_3 + KSCN \rightarrow AgSCN + KNO_3$

indicator :- ferric indicator

- @ the end point the excess drops of SCN^- will react with the indicator to form a red brown complex

$Fe^{+3} + SCN^- \rightarrow [FeSNC]^{+2}$

(color change :- colorless to red)

* steps of volhard method *

1) Analyte is treated with measured excess of $AgNO_3$

$X^- + Ag^+ \rightarrow AgX + Ag^+$ (excess)

2) The unreacted Ag^+ are titrated with standard sol. of thiocyanate ion using Fe^{+3} as indicator

$Ag^+ + SCN^- \rightarrow AgSCN$

3) The first slight excess of (SCN^-) thiocyanate ion will reach with Fe^{+3} indicator to give red blood color

$Fe^{+3} + SCN^- \rightarrow [FeSCN]^{+2}$

↳ red

* in Volhard method in acidic media to ensure the stability of the complex formed

* in Basic media

Fe^{+3} will hydrolosis

$Fe^{+3} + OH^- \rightarrow Fe(OH)_3 \rightarrow Fe_2O_3$

↳ red

- we ~~will reach ... before~~

=> we'll get a color red before reaching the end point thus we'll stop the titration and this will lead to error

↳ we must add nitrobenzen to adhere on AgCl & prevent it from rxn with SCN^- resulting elimination of (-) error

* calculations *

Part (1)

↳ Standarization $AgNo_3$ by Mohr's Method

$$M_{NaCl} = \frac{\text{mass of NaCl}}{\text{m.w.} \cdot \text{volume}} \qquad \boxed{V = 10\ ml}$$

@ end point color change yellow → red

$(M * V)_{AgNo_3} = (M * V)_{NaCl}$

?? ↳ find - initial

part (B)

Standardization $AgNO_3$ using Fajan's methods.

?

$(M * V)_{AgNO_3} = (M * V)_{NaCl}$

↳ find - initial ✓ ↳ 10 ml

↳ $\left[M_{AgNO_3}\right]_{part\ A} + \left[M_{AgNO_3}\right]_{part\ B} = M_{AgNO_3}$.

2

to find M_{AgNO_3} in [g/L] = $M_{AgNO_3} * M.W_{(AgNO_3)}$

part (C)

Standardization SCN^- (Volhard's method's)

?

$(M * V)_{AgNO_3} = (M * V)_{SCN^-}$

↳ find - initial

part a + part B

↳ $M_{KSCN^-} * M.W \Rightarrow g/L$

part D

using Mohr's methods

$n_{AgNO_3} = n\ Cl^-$

X => mass of NaCl in 10 ml

y => mass of KCl in 10 ml

Then $X + y = 0.065$

$n_{Cl^-} = \frac{X}{58.5} + \frac{y}{74.5}$

NaCl as m.w KCl

$n_{AgNO_3} = \frac{X}{58.5} + \frac{y}{74.5}$ Then $M_{NaCl}\ (g/L) = \frac{X * 1000}{10}$ (1 L = 1000 ml)

$M_{KCl}\ (g/L) = \frac{y * 1000}{10}$

$(M * V)_{AgNO_3} = \frac{0.065 - y}{58.5} + \frac{y}{74.5}$

Five Apple

Part D

2) Volhard's

$X + y = 0.065\ g$

Moles $AgNO_3$ = $n Cl^-$ + $n\ SCN^-$

$(M*V)_{AgNO_3} = \left(\frac{X}{58.5} + \frac{y}{74.5}\right) + (M*V)_{SCN^-}$

↳ $(M*V)_{AgNO_3} = \left(\frac{0.065 - y}{58.5} + \frac{y}{74.5}\right) + (M*V)_{SCN^-}$

$X = V$

$y = V$

$M_{NaCl}\ (g/L) = \frac{X * 1000}{10}$ $\qquad M_{KCl} \Rightarrow \frac{y * 1000}{10}$