Name of exp : precipitation titration (Mohr's Method)

Purpose of exp: Determination of Chloride Ion Concentration by Titration (Mohr's Method)

Introduction:

This method determines the chloride ion concentration of a solution by titration with silver nitrate. As the silver nitrate solution is slowly added, a precipitate of silver chloride forms.

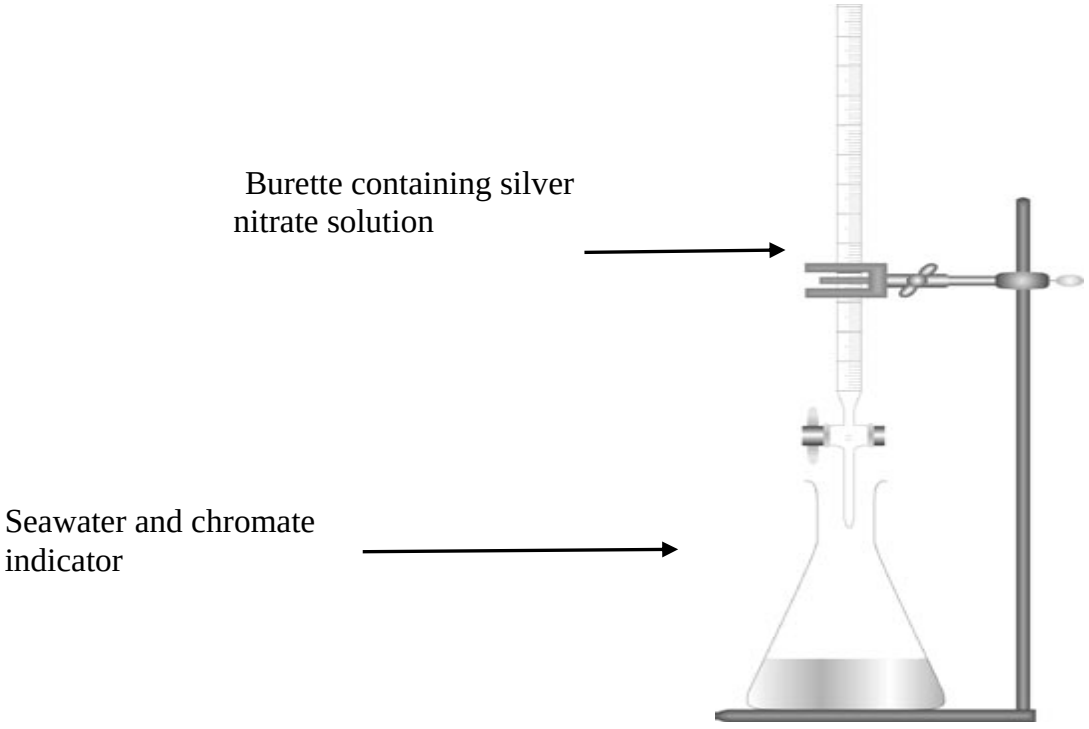
$$Ag^+(aq) + Cl^-(aq) \rightarrow AgCl(s)$$

The end point of the titration occurs when all the chloride ions are precipitated. Then additional silver ions react with the chromate ions of the indicator (potassium chromate) to form a red-brown precipitate of silver chromate.

$$2\ Ag^+(aq) + CrO_4^{2-}(aq) \rightarrow Ag_2CrO_4(s)$$

This method can be used to determine the chloride ion concentration of water samples from many sources such as seawater, stream water, river water and estuary water. Seawater is used as the example here.

The pH of the sample solutions should be between 6.5 and 10. (Refer to the additional notes (3) for the explanation). If the solutions are acidic, the gravimetric method or Volhard's method should be used.



Equipment Needed:

burette and stand

10 and 20 mL pipettes

100 mL volumetric flask

250 mL conical flasks

10 mL and 100 mL measuring cylinders

Method:

Sample Preparation:

If the seawater contains traces of solid matter such as sand or seaweed, it must be filtered before use.

Titration:

1. Dilute seawater by pipetting a 20 mL sample into a 100 mL volumetric flask and making it up to the mark with distilled water.
2. Pipette a 10 mL aliquot of diluted seawater into a conical flask and add about 50 mL distilled water and 1 mL of chromate indicator.
3. Titrate the sample with 0.1 mol L^{-1} silver nitrate solution. Although the silver chloride that forms is a white precipitate, the chromate indicator initially gives the cloudy solution a faint lemon-yellow colour (figure 1).

The endpoint of the titration is identified as the first appearance of a red-brown colour of silver chromate (figure 2).

Result Calculations

1. Determine the average volume of silver nitrate used from your concordant titres.
2. Calculate the moles of silver nitrate reacting.
3. Use the following reaction equation to determine the moles of chloride ions reacting.

$$Ag^+(aq) + Cl^-(aq) \rightarrow AgCl(s)$$

4. Calculate the concentration of chloride ions in the diluted seawater.
5. Calculate the concentration of chloride ions in the original undiluted seawater.

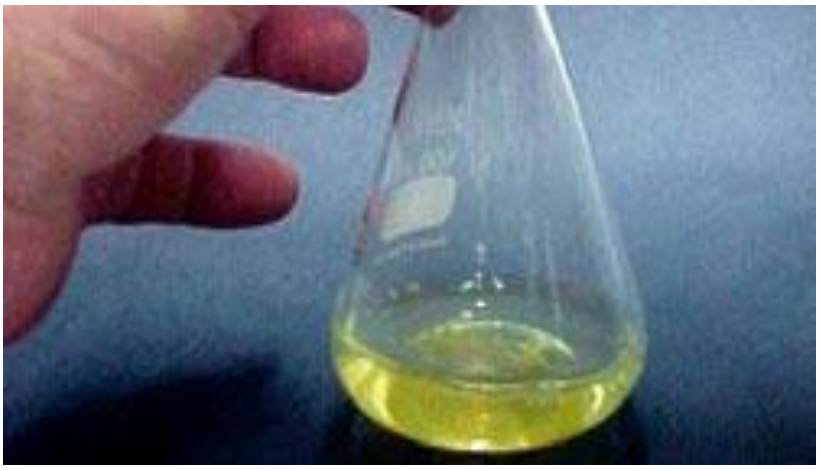


Figure 1 : Before the addition of any silver nitrate the chromate indicator gives the clear solution a lemon-yellow colour.

Figure 2 : Left flask: before the titration endpoint, addition of Ag+ ions leads to formation of silver chloride precipitate, making the solution cloudy. The chromate indicator gives a faint lemon-yellow colour. Centre flask: at the endpoint, all the Cl^- ions have precipitated. The slightest excess of Ag+ precipitates with the chromate indicator giving a slight red-brown colouration. Right flask: If addition of Ag+ is continued past the endpoint, further silver chromate precipitate is formed and a stronger red-brown colour results. NB: The titration should be stopped when the first trace of red-brown colour is observed. Using an incompletely titrated reference flask for comparison is a helpful way to identify the first appearance of red-brown colouration.