

# Finding out how much salt there is in seawater

## Topic

Earth science, scientific methodology and chemical analysis.

## Timing

30 min.

## Description

In this experiment students determine the chloride content of seawater by using a microscale version of the Mohr titration – titrating standard silver nitrate against the seawater using potassium chromate as indicator. Having found the chloride content the assumption is then made that all the chloride is associated with sodium ions and hence the percentage by mass of sodium chloride in the water is calculated.

A particular advantage of this microscale method is the reduction in cost of the experiment since far smaller quantities of silver nitrate solutions are used compared with conventional titrations.

## Apparatus (per group)

- Microscale titration apparatus (see 'Apparatus and techniques for microscale chemistry' handout.)
- Two 10 cm<sup>3</sup> beakers
- One 1 cm<sup>3</sup> pipette + pipette filler.

## Chemicals (per group)

- Plastic pipette filled with potassium chromate indicator solution
- Silver nitrate solution
- Sample(s) of seawater (or artificial seawater made by dissolving ca 3 g sodium chloride in 100 cm<sup>3</sup> water).

### Silver nitrate solution

Dissolve ca 4 g of silver nitrate, accurately weighed, in deionised water and make up to 50 cm<sup>3</sup> in a volumetric flask. This solution will be ca 0.5 mol dm<sup>-3</sup> and should be sufficient for 20–30 titrations. If fewer titrations are envisaged the quantities can be scaled down to reduce cost – eg by dissolving 2 g of silver nitrate in 25 cm<sup>3</sup> of water.

### Potassium chromate solution

Dissolve 2 g of K<sub>2</sub>CrO<sub>4</sub> in 50 cm<sup>3</sup> of deionised water. This solution will be ca 0.2 mol dm<sup>-3</sup>.

## Observations

Adding one drop of potassium chromate indicator gives the seawater a yellowish colour prior to the titration. During the titration a white precipitate of silver chloride forms until the end-point when a permanent red colour of silver chromate appears – silver chloride is less soluble than silver chromate.



A titre of ca 1.5 cm<sup>3</sup> should be obtained.

## Note

Teachers may wish to use this experiment without the section on results and calculations.

Students could be asked how they could show that the salt in seawater was sodium chloride and not, say, potassium chloride (flame test) and whether there may be anything else in the seawater that could have interfered with their titration.

## References

*J. Chem.Ed.*, 1992, **69**, 830.

## Safety

Students must wear appropriate eye protection (Splash resistant goggles to BS EN166 3).

Silver nitrate, 0.5 M AgNO<sub>3</sub> (aq) is CORROSIVE and will stain skin & clothing.

Potassium chromate, 0.2M KCrO<sub>4</sub> is a carcinogen, mutagen and skin sensitiser as well as a skin/eye irritant. Explosive or vigorous-burning mixtures can be formed with Aluminum and other metals and combustible materials.

## Credits

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*Health & safety checked May 2018*

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