Finding out how much salt there is in seawater

In this experiment you will be using the microscale titration apparatus to find out how much salt there is in seawater. You will be titrating silver nitrate solution against seawater using potassium chromate as indicator.

Students must wear appropriate eye protection.

Instructions

1. Set up the microscale titration apparatus (see 'Apparatus and techniques for microscale chemistry' handout).
2. Fill the apparatus with silver nitrate solution (see 'Apparatus and techniques for microscale chemistry' and 'Element solutions' handouts).
3. Using a pipette add 1 cm^3 of seawater to a 10 cm^3 beaker.
4. Add one drop of potassium chromate indicator solution.
5. Titrate until a permanent red colour is observed and record the titre and any other observations.
6. Repeat and take the mean titre.
7. Calculate the salt content of the seawater. (The information below will help you with the calculations.)

Results and calculations

1. What do you think a reasonable answer for the percentage of salt in seawater is likely to be? Compare this with the value you get after working through the following calculations.
2. The equation for the reaction that occurs during the titration is:

$AgNO_3$ (aq) + NaCl(aq) → AgCl(s) + $NaNO_3$(aq)

What is the white precipitate that you see during the titration?

What causes the red colour at the end-point?

(Hint: think of some of the characteristics of transition element compounds)

3. From the equation it follows that:

1 mol of $AgNO_3$ ≡ 1 mol Ag^+ ≡ 1 mol Cl^-

Calculate the number of moles of silver nitrate used in the titration using the formula:

$t/1000 \times C$

where t = mean titre volume in cm^3

and C = concentration of silver nitrate

4. Hence find the number of moles of chloride ion present in 1 cm^3 of seawater.
5. Convert your answer in (3) to a mass by multiplying by the relative atomic mass of chlorine.
6. Convert you answer for (4) to a mass of sodium chloride and hence a percentage of sodium chloride in the seawater. What assumption are you making in your calculation?

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7. Compare your result with your earlier guess. Are they similar?
8. Compare your results with others in your group.

Health and Safety

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

Silver nitrate, 0.5 M $AgNO_3$ (aq) is CORROSIVE and will stain skin & clothing.

Potassium chromate, 0.2 M $KCrO_4$ is a carcinogen, mutagen and skin sensitiser as well as a skin/eye irritant. Explosive or vigourous-burning mixtures can be formed with aluminum and other metals and combustible materials.

Disposal: silver residues from a whole class should be collected and disposed of appropriately; small quantities can be washed to waste.

Credits

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