Zinc by zincon assay

Student worksheet

Principle

Zn(II) ions in solution react with zircon to form a blue complex. You can use this reaction for the quantitative analysis of low concentrations of Zn\(^{2+}\)(aq) in solution. You can find the concentration of the solution of Zn\(^{2+}\) using a colorimeter. You can also use simple colour matching although the results will be less precise.

Equipment and materials

- test tube x 6
- 5 cm\(^3\) volumetric flask x 7 (or use one, thoroughly washing it between samples)
- 1 cm\(^3\) graduated pipettes x 3
- colorimeter and suitable filter (red) A solution of the complex displays maximum absorption at 620 nm.
- buffer solution, pH 9 (3.5 cm\(^3\))
- Zincon solution (2.1 cm\(^3\))
- zinc sulfate solution containing 0.01 g dm\(^{-3}\) Zn\(^{2+}\) (10 ppm) (24 cm\(^3\))
- solution of unknown Zn\(^{2+}\) concentration (10 cm\(^3\))

Method

Care: Wear eye protection.

1. Fill two burettes, one with the 10 ppm Zn\(^{2+}\) solution and one with deionised water
2. Label six boiling tubes and use the burettes to add the volumes of solutions shown in the table:

<table>
<thead>
<tr>
<th>Beaker</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume of 10 ppm Zn(^{2+}) solution / cm(^3)</td>
<td>8.0</td>
<td>6.0</td>
<td>4.0</td>
<td>3.0</td>
<td>2.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Volume of water / cm(^3)</td>
<td>2.0</td>
<td>4.0</td>
<td>6.0</td>
<td>7.0</td>
<td>8.0</td>
<td>9.0</td>
</tr>
<tr>
<td>Concentration of Zn(^{2+}) / ppm</td>
<td>8.0</td>
<td>6.0</td>
<td>4.0</td>
<td>3.0</td>
<td>2.0</td>
<td>1.0</td>
</tr>
</tbody>
</table>

3. Use a graduated pipette to transfer a 1 cm\(^3\) aliquot of the sample containing 8.0 ppm of Zn\(^{2+}\) to a 5 cm\(^3\) volumetric flask.
4. Add 0.5 cm\(^3\) of buffer solution to the sample and mix well.
5. Add zincon solution drop by drop until the red colour is one drop in excess, mix well again and dilute to 5 cm\(^3\) using distilled or deionised water.
6. Measure the absorbance of the solution.
7. Repeat the procedure for the solutions containing 6.0, 4.0, 3.0, 2.0, 1.0 ppm Zn\(^{2+}\) and for a solution where the concentration of Zn\(^{2+}\) is unknown.
8. Plot a graph of absorbance (y axis) against Zn\(^{2+}\)(aq) concentration (in ppm Zn\(^{2+}\)) (x axis) for the six samples A-F.
9. Use the graph to find the concentration in ppm of Zn\(^{2+}\)(aq) in the unknown solution.