Electrolysis of a binary salt

Transcript

In this practical you will observe the decomposition of a binary salt, copper chloride. This process, called electrolysis, is achieved by passing an electrical current through an aqueous solution of the salt. This diagram shows the standard setup of an electrolysis cell. Two electrodes are connected to a direct current power source, and immersed into a solution of the salt, called the electrolyte. The positive electrode, the anode, attracts the negative ions, and an oxidation reaction occurs. The negative electrode, the cathode, attracts the positive ions, and a reduction reaction occurs. In this practical, you will carry out a microscale version of the electrolysis.

This version uses much less electrolyte, making the reaction more sustainable. Additionally, much less of the toxic product chlorine is produced, making the reaction safer. Finally, several different observations can be made within the practical setup. Here are the materials and apparatus you will need to carry out this practical.
Set up the electrolysis cell step by step.
Place the electrodes into the cell. Make sure the ends of the electrodes sit inside the plastic channel and the holes in the Petri dish. Check that the electrode ends are about 5 millimeters apart. Add about ten drops of copper chloride solution into the channel. Make sure the ends of the electrodes are completely submerged. Notice the blue colour of the solution.
Add 2-3 drops of potassium bromide into the Petri dish. Notice the solution is colourless.
Add 2-3 drops of potassium iodide into the Petri dish. Notice the solution is colourless.
Dampen a piece of blue litmus paper and lay it in the Petri dish. Notice the colour of the indicator paper.
Finally, place the lid on the Petri dish. This will keep the chlorine that is produced inside the dish, and allow it to react with the other substances.
Connect the 9V battery to the battery clip. Use the crocodile clips to connect the battery to the electrode. Double check that the electrodes are submerged in the blue copper chloride solution. Use extra sticky-tack to hold the electrodes in place as necessary.

Observe the positive electrode, the anode. Notice that there are bubbles of gas forming. This is due to the oxidation of chloride ions forming elemental chlorine as a gas. Observe the negative electrode, the cathode. Notice that there is a solid forming. This is due to the reduction of cooper ions forming elemental copper as a solid.

Observe the colour of the electrolyte solution. Notice that the blue colour is slowly fading as the concentration of copper ions drops.

Observe the colour of the potassium bromide and potassium iodide drops. As the chlorine diffuses into the drops, a displacement reaction occurs. Chlorine is a more reactive halogen than bromine and iodine. Both bromide and iodide are displaced from their respective compounds by chlorine. Bromine and iodine are both strongly coloured substances when dissolved in water, making the solutions turn from colourless to orange or brown.
Observe the colour of the damp blue litmus paper.

As chlorine diffuses into the damp paper, the chlorine reacts with water producing hydrochloric acid and a chlorate. The hydrochloric acid will react with the litmus, which turns from blue to red. The chlorate acts as a bleach, turning the litmus colourless.
When you are finished making your observations, detach the battery, waft away any remaining chlorine gas with the Petri dish lid, place the litmus paper in the bin, remove the sticky-tack and rinse the remaining equipment.