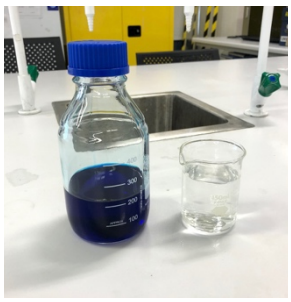
Demonstration: Cobalt blue and pink solutions

Description



Cobalt chloride is dissolved in Ethanol to form a blue solution. Adding water changes the solution to a deep pink colour.

Curriculum topics

- Chemical reactions
- Equilibria
- Le Chatelier's Principle

Materials

- 5g Cobalt chloride, anhydrous
- 250ml Ethanol
- 250ml Water
- 500ml Glass bottle or Flask

Safety

Cobalt (II) chloride, anhydrous

Danger – Toxic; irritant; suspected of causing cancer and genetic defects; may damage fertility. May cause skin or lung sensitisation.

Waste – Do not wash solutions down sink. All cobalt-containing solutions should be disposed of as hazardous waste.

Procedure

Before the demonstration

1. Add 5 g of cobalt (II) chloride, anhydrous, to 250ml of ethanol in a 500ml glass bottle or flask. It will readily dissolve.
2. Have ready at least 250ml of water in a bottle. A plastic water bottle can be used for added theatrical effect.

The demonstration

1. In front of the audience, show the blue solution in the flask.
2. When ready, add the water to the blue solution. As you add it, it will change to a deep pink colour.

Teaching notes

The two different coloured Co(II) complex ions, $[Co(H_2O)_6]^{2+}$ and $[CoCl_4]^{2-}$, exist together in equilibrium in solution in the presence of chloride ions:

$[Co(H_2O)_6]^{2+}(aq)$(**pink**) + $4Cl^-(aq) \rightleftharpoons [CoCl_4]^{2-}(aq)$(**blue**) + $6H_2O(l)$

The presence of ethanol changes the polarity of the solvent system and forces the chloride to coordinate more closely with the cobalt, $[CoCl_4]^{2-}$, and so the solution is blue.

This equilibrium of cobalt chloride can be disturbed by changing the concentration of water present. The colour changes accompanying the changes in equilibrium position are as predicted by Le Chatelier's principle.

References

This demonstration was a modification of a common equilibria chemical activity using cobalt chloride hexahydrate and hydrochloride acid to demonstrate changes in equilibria (Le Chatelier's principle) due to the addition of more chloride ions, changing the temperature and so on.

The Royal Society of Chemistry (UK) has a good demonstration (which can be modified into a student activity) for investigating cobalt equilibria.

https://edu.rsc.org/resources/the-equilibrium-between-two-coloured-cobalt-species/1.article