The Can Ripper

Introduction

Show the power of chemistry by tearing apart an aluminum soda can with little effort. Just score the inside of a soda can to break the plastic lining, add some copper(II) chloride and water, and sit back—chemistry will do the rest. The single replacement reaction of aluminum metal with copper(II) ions " dissolves" the aluminum from the inside out. With only the paint on the outside of thecan holding it together, the can will rip apart with just a firm twist.

Concepts

- Redox reaction
- Metal activity series

Materials

Aluminum soda can, Al

Copper(II) chloride, $CuCl_2$, 0.5 M, 300 mL

Tap water

Triangular file

Safety Precautions

Do not leave the cans containing the copper(II) chloride solution in an area where they may be mistaken for soda. Torn cans have sharp edges; use caution when handling. Copper(II) chloride is a body tissue irritant and is highly toxic by ingestion. LD_{50} = 140 mg/kg. Avoid all contact with eyes, skin, and clothing. Wear chemical splash goggles, chemical-resistant gloves, and a chemical-resistant apron. Please review current Safety Data Sheets for additional safety, handling, and disposal information.

Preparation

1. Insert a triangular file into the opening of an aluminum soda can. Score a fine line around the inside of the can about half-way down.
2. Add enough of the 0.5 *M* copper (II) chloride to cover the scoring. *Note:* Using warm water will speed up the reaction.
3. Wait about 3–5 minutes until the reaction is complete. The reaction is complete when the paint on the can begins to darken around the scoring.
4. Pour out the solution and rinse the can with water. The can is now ready to use for the demonstration.

Procedure

1. Hold the prepared can horizontally so that the scoring is between your hands.
2. Twist your hands in opposite directions to rip the can in half along the scoring. The can should rip with a firm twist.

Disposal

It is recommended that you consult your local school board and/or municipal regulations for proper disposal methods that may apply before proceeding.

Tips

- Copper(II) chloride, either anhydrous or dihydrate, may be used for this demonstration.

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- A fun suggestion from a teacher: Prepare several cans ahead of time. Then, during class, ask for two unsuspecting volunteers who will take the challenge to see who can rip apart a soda can the fastest and easiest. Give the "stronger" student an untreated soda can which will not rip apart easily. Give the "weaker" student the copper(II) chloride–treated can, which should rip apart with just a firm twist.
- For a more conventional demonstration of the reaction of copper(II) chloride with aluminum, see "Foiled Again" in the Demonstrations section of Chemical Reactions, Volume 6 in the Flinn ChemTopic™ Labs series. "Foiled Again" is also available as a chemical demonstration kit from Flinn Scientific (Catalogue No. AP5936).

Discussion

Aluminum cans are lined with a plastic coating to prevent liquid from reacting with the metal. Scoring the inside of the can breaks the coating and exposes the aluminum metal to the copper(II) chloride. An oxidation–reduction reaction occurs as the copper(II) ions from the copper(II) chloride oxidize the aluminum metal to aluminum ions, according to Equation 1. The copper(II) ions, in turn, are reduced to copper metal.

$$3Cu^{2+}(aq) + 2Al(s) \rightarrow 3Cu(s) + 2Al^{3+}(aq) \quad \text{Equation 1}$$

When the reaction is complete, only the paint and ink on the outside of the can are holding it together. The demonstration can be explained in terms of the reactivity of metals. Since aluminum metal is more reactive than copper metal, a redox reaction occurs and the aluminum metal is oxidized and dissolves in the solution in the form of aluminum ions. Ask students to predict what would happen if a different salt solution or if a different type of metal were used. Would all metal ion solutions give similar results? Why or why not?

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Materials for The Can Ripper are available from Flinn Scientific Canada, Inc.

Catalogue No.	Description
CJ0097	Copper(II) Chloride, 500 g

Consult www.flinnsci.ca or your *Flinn Scientific Canada Catalogue/Reference Manual* for current prices.