Dithizone Paper

Indicator for Zinc Ions

Introduction

A simple method to test for the presence or absence of zinc ions in a solution.

Concepts

- Qualitativeanalysis
- Indicators
- Coordinationcomplexes

Materials

Dithizone, $C_{13}H_{12}N_4S$, 0.05 g

Ethanol, 95%, 100 mL

Beaker, 250-mL

Filter Paper, cut in strips approximately 12 cm long × 2 cm wide

Solutions to be tested

Safety Precautions

Ethyl alcohol is flammable and a dangerous fire risk. The addition of the denaturant makes the product poisonous. Students should wear chemical splash goggles, a chemical-resistant apron, and chemical resistant-gloves. Please review current Material Safety Data Sheets for additional safety, handling, and disposal information.

Procedure

1. Prepare the dithizone solution by dissolving 0.05 g dithizone in 100 mL of 95% ethanol in a 250-mL beaker. The solid may not completely dissolve, but upon stirring, a dark blue/green solution is obtained. This solution should be made fresh.
2. Dip the filter paper strips about halfway (6 cm) into the dithizone solution. Remove the strip quickly and place on a paper towel to dry. (This will only take about 1–2 minutes.)
3. Test the solution(s) under investigation by dipping the dry dithizone paper strips into the solution(s). Any solution containing Zn^{2+} ions will turn the green/blue/gray strip to a bright pink. (Other ions in the solution(s) can interfere—see the Discussion section.)

Disposal

Thionin is an organic compound that can exist in two forms, an oxidized form which is purple and a reduced form which is colorless. When a reducing agent such as iron(II) ion (Fe^{2+}) is added to an acidic thionin solution, the protonated thionin molecule ($thio^{+}$) accepts two hydrogen atoms and is reduced to its colorless form—but only in the presence of an intense light source. The reduction is a photochemical reaction that is catalyzed by light. This demonstration is a dramatic example of the conversion of light energy to chemical energy. The reaction can also be reversed; when the light source is removed the purple color due to the oxidized form of thionin returns.

The demonstration also provides a vivid example of a reversible reaction and equilibrium. The equilibrium is represented by the following chemical equation:

Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

Unifying Concepts and Processes: Grades K–12

Evidence, models, and explanation

Publication No. 311
032317

Constancy, change, and measurement

Content Standards: Grades 5–8

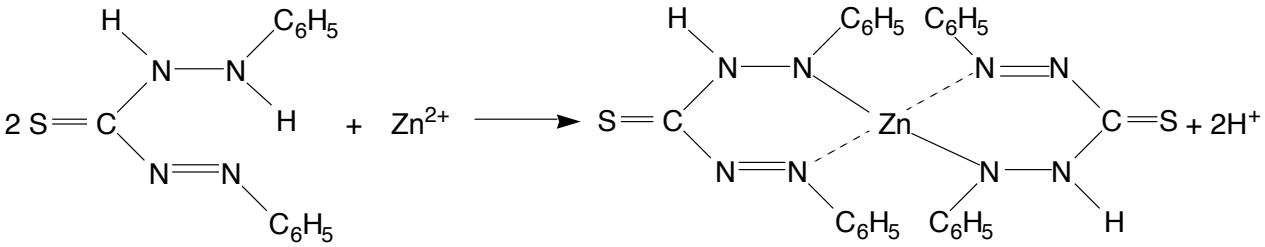
Content Standard B: Physical Science, structure and properties of matter, chemical reactions

Tips

Dithizone solution should be made fresh; it does not store well.

Discussion

Dithizone (also known as diphenyl thiocarbazone) forms a red complex with zinc ions:



When using dithizone paper, the paper will turn from a dark green/blue/gray to a definite pink color in the presence of Zn^{2+} ions..

There are limitations to this test, however, because dithizone forms complexes with many metal ions. Ions such as Cu^{2+}, Hg^{2+}, Hg_2^{2+}, Ag^{+}, $Au^{3+}$and Pd^{2+} all interfere and/or mask the test for zinc. Of other ions that we tested, Co^{2+}, Pb^{2+} and Cd^{2+} all produced shades of pink/red when in contact with dithizone paper, and Sn^{2+} produced exactly the same result as Zn^{2+}. Therefore, although a pink color of dithizone paper can indicate that Zn^{2+} ions may be present, the dithizone paper test cannot, by itself, confirm the presence or absence of Zn^{2+} ions, unless the absence of the other competing/interfering ions has been confirmed first..

References

Svehla, G. Vogel's Qualitative Inorganic Analysis; Longman Scientific and Technical: Essex, England, 1987; p 130.

Materials for *Dithizone Paper* are available from Flinn Scientific, Inc.

Catalog No.	Description
D0028	Dithizone, 2.5 g
E0009	Ethyl Alcohol, 95%, 500 mL
AP3105	Luminol, 5 g
H0028	Filter Paper, Qualitative, 15 cm diam., Pkg/100

Consult the Flinn Scientific website for current prices.