

You Hit the Nail on the Head - Synthesis and Analysis of an Iron Oxalate Complex

by Dayna Mason, Susan Turland

Experiment Overview

During this exercise students are able to synthesise a complex, iron oxalate, and then analyse it via colourimetry to determine the amount of iron present. This data coupled with other analytical data – microanalysis and thermal gravimetric analysis, enables the students to deduce the molecular formula for the complex.

Included in this exercise is a prelab – a set of questions for the student to complete before starting the exercise. These lead the students through the majority of calculations that are expected in the exercise. Thus, if the student has difficulty with these they have an opportunity to consult the demonstrator so they can complete the calculations for the exercise during the session.

Aims and Objectives

The expected outcomes for the students include:

- to be able to synthesise a complex
- to know how to use a colourimeter to measure absorbances of solutions at a certain wavelength
- to be able to construct a calibration curve
- to determine an unknown concentration using a calibration curve
- to be able to determine a molecular formula for a complex
- to determine the amount of structural water present by using a thermal gravimetric analysis plot

Level of Experiment

First year undergraduate

Keyword Descriptions of the Experiment

Domain

general chemistry

Specific Descriptors

colourimetry, thermal-gravimetric analysis, microanalysis, iron complex

Course Context

“You Hit the Nail on the Head” is aimed at first year chemistry students who have not synthesised complexes before or analysed compounds by colourimetry to determine the amount of an atom / component before. It could also be used to reinforce previous knowledge of these techniques.

Prerequisite Knowledge and Skills

Prior theoretical knowledge about empirical formulas and complexes would be a benefit to the students undertaking this exercise but not essential. Other knowledge about the analytical techniques used in this exercise is explained in the introduction of the student notes.

Time Required to Complete

Prior to Lab: 30 min

In Laboratory: 3 h

After Laboratory: N/A

Experiment History

This experiment was developed with the aid of the references (1) and (2).

The iron colourimetry analysis has been an integral part of the first year curriculum at Monash University for a number of years.

Comments

Through the use of this experiment last year it was found that two parts of the exercise could be optional depending on the group of students. These were the thermal gravimetric analysis section and the model of the complex. Both add extra dimensions to the exercise but the exercise can become confusing with too many themes.

References

1. Hatchard C. G. & Parker C. A. (1956). *Proceedings of the Royal Society of London, Series A, Mathematical and Physical Sciences*, **235**(1203), 518-536.
2. Johnson R.C. (1970). A convenient procedure for preparation of potassium trisoxalatoferate(III). *Journal of Chemical Education*, **47**(10), 702.