

# An Oscillating Chemical Reaction

by Sian Howard

## Experiment Overview

The purpose of this experiment is to set up and observe the well-known oscillating reaction involving the manganese-catalysed decomposition of hydrogen peroxide by iodate. The various reagents required are prepared at the required concentrations from the bulk chemicals. The oscillations produce a cyclic colour change in a starch indicator, allowing the reaction to be followed photometrically using simple equipment. A basic analysis of some kinetic features of the reaction is carried out, using the photometric data recorded during the experiment.

The experiment is designed to impact on three main areas of first-year undergraduate chemical education:

- ☐ practice of basic preparative skills;
- ☐ analysing and demonstration of a simple redox couple; and,
- ☐ getting students to think about how to extract basic kinetic information from the data obtained.

## Level of Experiment

First year undergraduate

## Keyword Descriptions of the Experiment

### Domain

physical chemistry, inorganic chemistry

### Specific Descriptors

Belousov-Zhabotinskii reaction, redox couple, photometrics, kinetics

## Course Context

This experiment is designed to be suitable for students taking the second semester, first-year chemistry course CHEM 101 at the University of South Australia (which has a pre-requisite of the first-semester course CHEM 100). Both of these courses are undertaken by all students carrying out the four main programmes offered by the School of Pharmacy and Medical Sciences at UniSA, namely: Pharmacy; Medical and Pharmaceutical Biotechnology (both honours degrees); Food Science and Nutrition; and Laboratory Medicine (both bachelors degrees).

## Prerequisite Knowledge and Skills

The experiment requires:

- ☐ the preparative skills that would be associated with a good first-year undergraduate majoring in chemistry;

☐ an understanding of basic redox chemistry (including the ability to balance redox reactions in aqueous media); and,

☐ an appreciation of Beer's Law and reaction kinetics.

## Time Required to Complete

**Prior to Lab:** N/A

**In Laboratory:** 2.5 h

**After Laboratory:** N/A

## Experiment History

This is a new experiment which has not yet been carried out by undergraduates at UniSA (this is under consideration, pending the trial at the ACELL workshop). The reaction itself is of course well known, and various possible experimental arrangements for preparing and monitoring oscillating reactions have been discussed in the chemical education literature<sup>1-4</sup>. The photometric method used here to follow the reaction is a modified version of that suggested by Spice and Cox<sup>5</sup>.

## Comments

The author is very grateful to Mr Brian Wing for his help in identifying and preparing an appropriate oscillating reaction for this ACELL submission. Thanks also to Dr Cobus Gerber for a careful proof reading of this submission and some very useful suggestions for improvement.

## References

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2. Field, R. J. (1972). A reaction periodic in time and space: A lecture demonstration. *Journal of Chemical Education*, **49**, 308-311.
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4. Shakhashiri, B. (1985). *Chemical Demonstrations: A Handbook for Teachers of Chemistry*. Madison, Wisconsin: University of Wisconsin Press.
5. Spice, J. and Cox, G. (1983). *Education in Chemistry*, **20**, 52-53.