

The influence of ionic strength on the rate constant for the reaction of crystal violet with hydroxide ion

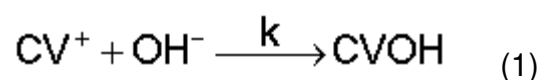
Author: Dr David J McGarvey, School of Chemistry & Physics, Keele University

Practical:

Abstract

Introduction

In this mini-project the influence of ionic strength (I) on the rate constant (k) for the reaction between a cationic dye (called crystal violet (CV)) and hydroxide ion is investigated (equation 1).



CV is used as a biological stain (in the gram staining technique) for differentiating bacteria. Bacteria may be differentiated into two major groups, gram-positive and gram-negative, based on their reactivity in the gram stain.

Intended academic level

Second Year University Level

Duration

10 hours

Outcomes

- Be able to use a search engine to obtain information from the WWW.
- Be able to design an experiment to achieve specified objectives.
- Be able to identify strengths and weaknesses in experimental design and make appropriate modifications.
- Be able to perform appropriate kinetic analysis of experimental data with the support of IT resources (eg Excel).
- Be able to apply Debye-Huckel theory via the primary kinetic salt effect to kinetic data.
- Be able to relate kinetic salt effect data to reaction mechanism.
- Be able to use a chemical structure drawing package to draw organic structures and curly arrow mechanisms.

The aim of the experiment is to provide experience with:

- Working in a team
- Designing, planning and carrying out an experiment

- Plotting graphs and extracting information from graphs using Excel
- Information retrieval using a variety of resources, including the WWW
- Preparing and presenting a poster.

Objectives

- Establish the rate law for the reaction.
- Determine the reaction rate constant over a range of ionic strengths.
- Establish whether your experimental results support the reaction mechanism by appropriate analysis of your experimental data.
- Suggest a molecular mechanism for the reaction.

Materials

To be discussed with lecturer as part of the overall project

Costs

Equipment and materials are standard in most teaching laboratories. Crystal violet from Aldrich

Further comments

The following skills are introduced or enhanced in this laboratory exercise:

- Working in a team
- Planning your work
- COSHH risk assessment
- Recording and analysing experimental data
- Plotting and extracting information from graphs using Excel
- Extracting information from literature sources
- Communication skills
- Critical reflection.

Reading

1. P W Atkins, *Physical Chemistry*, 7th Edition, Chapters 10, 25 & 27, Oxford University Press, 2002. ISBN: 0-198-79285-9.
2. K J Laidler, J H Meiser and B C Sanctuary, *Physical Chemistry*, 4th Edition, Chapter 9, Houghton Mifflin Company, 2003. ISBN: 0-618-12341-5.

Contact Details

Dr David J McGarvey
School of Chemistry & Physics
Keele University