

Students' learning about chemical kinetics - a case study of real-time graphs

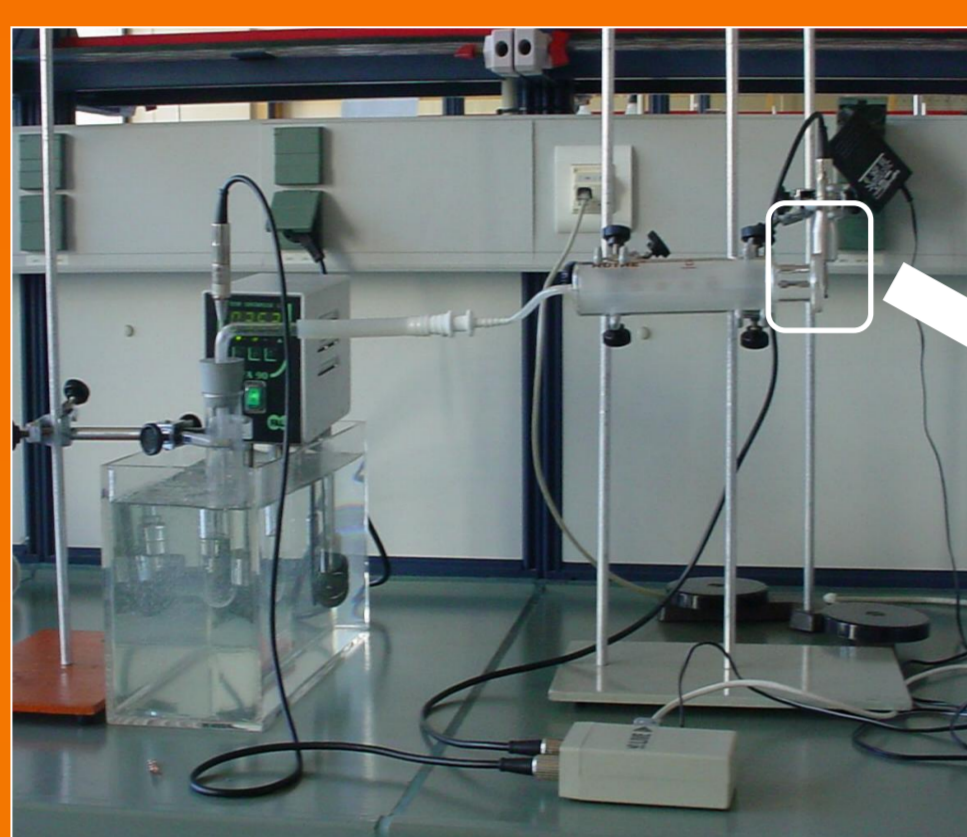
Fernanda S. Esteves¹, M. Gabriela T. Cepeda Ribeiro¹

1) REQUIMTE, Departamento de Química, Faculdade de Ciências da Universidade do Porto.
Rua do Campo Alegre, 687 4169-007 Porto, Portugal.

Introduction

The transformations that take place in the world that surround us are mainly chemical transformations. Some of them are instantaneous, while others take thousands of years to happen.

Chemical kinetics studies systems whose properties change along time. This study is mainly experimental and involves the rate of chemical reactions, their mechanisms and the factors that influence them. These aspects are of great importance in some activities. For example, in the industrial production it is not enough to understand the stoichiometry and thermodynamics of a reaction. We must also understand the factors that govern the rate of the reactions involved. This study was developed in two parts.



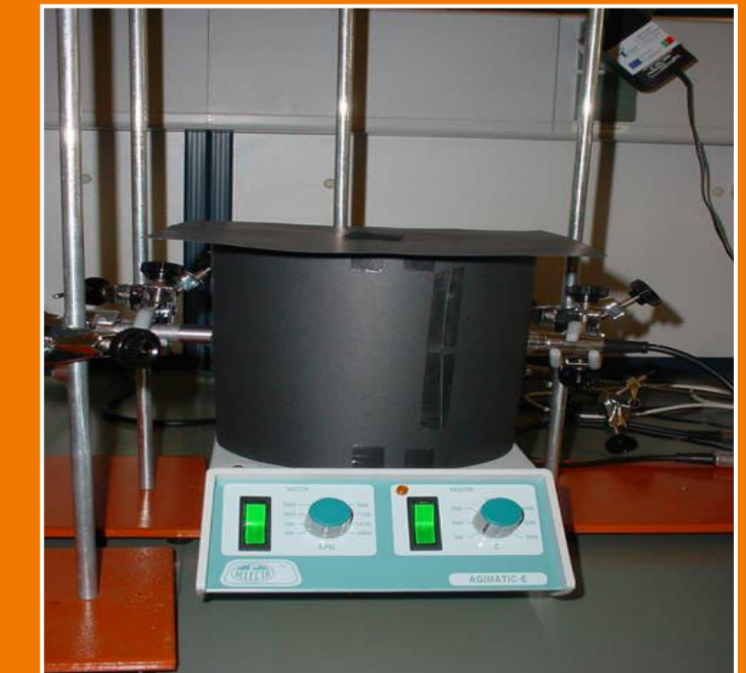
Part 1

1. Objective:

Study the chemical kinetics of several chemical reactions, using data-logging and real time graphs.

2. Chemical reactions:

The chemical reactions chosen involved different scientific evidences and different sensors were used. The effect of initial reactants concentration on the rate of the chemical reaction was studied on the chemical reaction between sodium thiosulphate and hydrochloric acid - a light sensor was used to monitor the precipitate formation. The effect of temperature and surface area on the rate of chemical reactions were studied on the chemical reactions between metallic magnesium and hydrochloric acid and between Alka-Seltzer and water - a position sensor was used to monitor the gas evolution. The effect of catalysts on the rate of the reaction was studied on the chemical reaction between potassium permanganate and oxalic acid - a colorimeter sensor was used to monitor the changes in the colour of the solution.



3. Conclusions:

The chemical kinetics of these reactions, using these experiments, was in accordance with the results obtained by other methods.

It was possible to verify the dependence between the rate of reaction and the factors that influence it (initial reactants concentration, temperature, surface area and catalysts).

Part 2

1. Objective:

To evaluate the adequacy of the experiments to enhance student' learning about chemical kinetics.

2. Sample:

Seventeen students, aged 14-16 years old, were involved.

3. Methodology:

Four experiments were used. Students had to plan investigations, analyze data and to formulate conclusions based on calculations and on the analysis of real-time graphs. To evaluate students' learning, data were collected using several instruments: questionnaires, observation, group interviews, group discussions and participants' reflections about the work developed.

4. Conclusions:

The results suggested that these experiments strongly enhanced students' understanding of chemical kinetics and improved students' experimental and investigative skills in using ICT in chemical laboratory.