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開發化學動力學的家庭實驗並評估其在普通化學實驗課程的可行性
Developing Home Experiments with Chemical Kinetics and Evaluating
Their Feasibility for General Chemistry Laboratory Curriculum

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中文摘要

開發化學動力學的家庭實驗並評估其在普通化學實驗課程的可行性
中文摘要普通化學實驗使用的藥品和器材絕大多數來自於制式的化學實驗室，鮮少使用家用產品進行實驗，其缺點是實驗過程過於理想化而不切實際，常常無法運用到複雜的自然世界，也無法真正的融入生活化學之中。本研究計畫的目的是為了開發適用於普通化學實驗課程的家庭實驗，以提高學生學習化學實驗的興趣，而且致力於微量實驗的開發，以落實綠色化學的理念。本計畫包含兩個主題的動力學之家庭實驗：第一主題為『利用家庭實驗來測定碘離子和過氧化氫反應的級數和活化能』，此屬於氧化還原反應；第二主題為『利用家庭實驗來測定檸檬酸和碳酸氫鈉反應的級數和活化能』，此屬於酸鹼反應。每一個主題均分為大量實驗和微量實驗。在評估這些家庭實驗的可行性方面，研究資料採用量化分析為主，評估研究者試作的結果、評估學生實作的結果、比較研究者試作和學生實作的結果、比較學生實作化學家庭實驗（實驗組）和傳統實驗室實驗（控制組）的結果。在分析學生的學習成效和學習感受方面，研究資料採用量化分析和質性分析並重。本研究結果將撰寫成為包含學生教材和教師指引的文章投稿於化學教育期刊，此些教材可以立即使用於國內外的大學普通化學實驗課程，並且期望編入普通學實驗教科書之中。

關鍵字：普通化學實驗；酸鹼反應；氧化還原反應；化學動力學；消費者化；家用產品；家庭實驗；微量實驗；實驗設計

Abstract

Developing Home Experiments with Chemical Kinetics and Evaluating Their Feasibility for General Chemistry Laboratory Curriculum Abstract

Students rarely exercise chemical experiments using household products in general chemistry laboratory. The requirements including pure chemicals and device-specialized equipment for the laboratory are mostly obtained from chemical stock room. The shortcomings for this are too idealized to be realistic with the nature so that student exercises are not in connection with chemistry in life. The purpose of this proposal is to develop two topics of innovative chemical home experiments integrated into general chemistry laboratory curriculum for increasing student interest in learning chemistry. Furthermore, these experiments will be designed with the microscale approach to implement the idea of green chemistry. The first of two topics is entitled "Using Home Experiments to Explore Chemical Kinetics involving Oxidation-Reduction Reaction" and the second one "Using Home Experiments to Explore Chemical Kinetics involving Acid-Base Reaction." Developed experiments with the macroscale and microscale approaches in this project totally will have four home experiments. The teaching material of each experiment will contain both students' handout and instructor's note. For the feasibility of these experiments, the data will be quantitatively analyzed to evaluate researchers and undergraduate student experimental results, respectively, using the two approaches, as well as to compare both of experimental results. For the student achievements and student feedbacks, the data will be quantitatively and qualitatively analyzed. The performance of this proposal will be written as research articles. Expectedly, these articles can be outreached to domestic and overseas university after they are published in journals of chemical education. Furthermore, they can be compiled in textbooks of general chemistry laboratory.

Key words : General chemistry laboratory; Acid-base reaction; Oxidation-reduction reaction; Chemical kinetics; Consumer chemistry; Household product; Microscale experiment; Home experiment; Experimental design