Teaching Resources: Old and New

Dr Kevin Jones

Nigel Botting Teachers’ Meeting
1st June 2018
Overview

Project #1
Isolation of Trimyristin

Project #2
Double-Click Chemistry
Overview

**Project #1**
Isolation of Trimyristin

**Project #2**
Double-Click Chemistry
Introduction
Experimental Procedure

2 g ground nutmeg + 20 ml solvent
Swirl beaker periodically over 15 minutes
Isolation and Purification
Benefits

- Non-Specialist Equipment
- Inexpensive
- Quick
A Low-Cost Alternative

- Vial Filled with Ice = Condenser
- Syringe = Soxhlet Chamber
- Plastic Tubing = Siphon
- Two-necked Flask = Still Pot
An Easily-Assembled Soxhlet Extractor to Demonstrate Continuous Extraction

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ABSTRACT: The construction of a Soxhlet extractor from readily available laboratory equipment is described. The apparatus can be used to demonstrate the concept of continuous extraction and was used in the isolation of tropane alkaloids from morning glory seeds.

KEYWORDS: High School/Introductory Chemistry, Post-Year Undergraduate/General Analytical Chemistry, Hands-On Learning/Aplications

INTRODUCTION

The Soxhlet extractor is a classic piece of laboratory equipment that is used to extract sparingly soluble material from a solid sample. Several experiments based on the concept have been published in this journal, including the isolation of caffeine from beverage plants and pyrrolizidine alkaloids from milk thistle. Soxhlet extractions are a classic piece of laboratory equipment, making them both novel and relatively expensive. The cost of such equipment can be considerable, especially for schools and laboratories with limited budgets. In this paper, we describe the construction of a Soxhlet extractor from readily available equipment and demonstrate its use in the extraction of tropane alkaloids from morning glory seeds.

AN EASILY-ASSEMBLED VARIANT

Our version of the Soxhlet extractor is shown in Figure 1. The Soxhlet chamber is constructed from a 50 mL syringe barrel, a glass Büchner funnel, and a glass stand made from a length of tubing that serves to periodically empty the chamber, allowing the solvent to be pumped into the chamber. The material to be extracted is placed in a folded filter paper and mounted into the chamber. The extraction chamber is connected to a two-neck flask with a length of wide-diameter plastic tubing and a 3 mL syringe barrel. Full details on how to construct the Soxhlet extractor and cross-sectional line drawings of a traditional all-glass Soxhlet extractor compared with our easily assembled variant can be found in the Supporting Information.

EXPERIMENTAL SECTION

To demonstrate the effectiveness of our apparatus, we examined the extraction of tropane alkaloids from morning glory seeds according to the following procedure: Ground morning glory seeds were placed on a filter paper and mounted into the Soxhlet chamber, followed by a glass-ware containing ice/water. Dichloromethane (90 mL) was added to the two-neck flask, followed by three or four boiling times. The flask was heated to reflux and allowed to stand for 1 h. The content within the condenser was periodically replaced with a syringe/pump to maintain a temperature capable of condensing the solvent vapor. After 1 h the reaction vessel was removed from the heat and allowed to cool to room temperature. The boiling chips were removed by filtration, and the resulting solution was reduced to dryness on a rotary evaporator, to afford a yellow oil that solidified on cooling (12 g). The yellow solid was recrystallized from ethanol to afford a white solid (0.17 g, 8% yield based on the mass of morning glory, 17% by weight). Full details can be found in the Supporting Information.

SAFETY RECOMMENDATIONS

Although in principle alternative solvents could be used in this version of the Soxhlet extractor, the authors strongly recommend that dichloromethane be used as the extraction solvent. Dichloromethane is nonflammable and has a low boiling point, making it an ideal solvent for this demonstration.

EXPERIMENT TESTING

Next, we wished to determine whether our protocol could be reproduced in students’ hands. Twenty undergraduate students carried out this experiment as part of an extramural lab course.
Abstract/Aim:
To investigate the influence of solvent on the extraction of trimyristin from nutmeg

Introduction:
Esters, Fats and Oils (structure, synthesis, hydrolysis)
Soaps, Detergents and Emulsions
Citable webpages; easily found on Google

Procedure/Results:
Two techniques – Extraction of substance and recrystallisation
Results can be tabulated and processed
Project #2

Double-Click Chemistry
New Collaborations

University of St Andrews + Abertay University

Division of Games and Arts Department
Voted Best Institution in Europe
Contacted Iain Donald at Abertay about a collaboration

Iain suggested we organize a “Game Jam”
Game Jam Process

Provide students with a project outline

Small teams of students rapidly produce a prototype in two days (~20 hours)

Present their efforts at the end of the event
Graphic Novels
Jack and Harry
Outlook

Develop a set of experiments to be used in outreach events

&

Explore the possibility of VR health and safety training
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