

Identification of Unknown Organic Compounds: Experiment Report

4 pages | 907 words

Abstract

The main objective of this lab was to identify two unknown organic compounds, one solid and one liquid, using various methods including melting point (M.P), boiling point (B.P), Infrared spectroscopy (I.R), elemental analysis, and the determination of the Index of Hydrogen deficiency (IHD). The physical properties of the compounds, such as color, odor, melting point, and boiling point, were also examined to gain insight into their characteristics.

Introduction

Identification of unknown organic compounds is a fundamental task in chemistry. It is crucial to determine the composition, structure, and functional groups present in these compounds. In this lab, we employed several techniques to achieve this goal, including melting point and boiling point determination, Infrared spectroscopy, elemental analysis, and calculation of the Index of Hydrogen deficiency (IHD). The functional group of a compound can be determined using Infrared spectroscopy, which provides a spectra based on the chemical bonds present in the compound. The Index of Hydrogen deficiency (IHD) helps determine the degree of saturation in a compound, indicating the presence of double bonds, triple bonds, or rings. Elemental analysis is a powerful method for determining the molecular formula of a compound by analyzing its elemental composition. Additionally, the boiling point and melting point of a compound are crucial physical properties that can confirm its hypothetical structure.

Materials and Methods

The following equipment and materials were used in the experiment:

Equipment and Materials	Quantity
Electric melting point apparatus	1
Mini scale setup (heating mantle, test tube, thermometer)	1
NICOLET iS5 FT infrared spectrometer	1
Capillary tubes	Multiple
Acetone	As needed

Experimental Procedure

Two unknown organic compounds, one solid and one liquid, were provided for analysis. The following procedures were performed:

- For the solid compound:
 - A sample of the crystalline solid was taken in a bulb of a capillary tube.
 - The capillary tube was inserted into the electric melting point apparatus.
 - The temperature was increased at a rate of 1-2°C/min.
 - The initial temperature was noted when the first tiny drop of liquid appeared.
 - The final temperature was noted when all the crystals had completely melted.
- For the liquid compound:
 - 0.5-1.0 ml of the liquid was taken in a clean test tube.
 - The test tube was clamped and held on top of a heating mantle.
 - A thermometer was placed 2 cm above the liquid with another clamp.
 - The initial temperature was recorded when the first bubble appeared, and the final temperature was recorded when there was vigorous movement in the liquid.
- Both the solid and liquid samples were scanned using a NICOLET iS5 FTIR spectrometer. The surface was cleaned thoroughly with acetone, and the background spectrum was collected before the sample spectra.

Results

The results of the analysis are summarized in the following table:

Compound	Empirical Formula	IHD	Experimental Melting Point (°C)	Reference Melting Point (°C)	Experimental Boiling Point (°C)	Reference Boiling Point (°C)
Solid	C ₇ H ₆ O ₂	5 (4 double bonds, 1 ring)	116.7	122.41	N/A	N/A
Liquid	C ₅ H ₁₀ O	1 (1 ring...)				

Identification Of Unknown Organic Compounds

Mark Steyvers



Identification Of Unknown Organic Compounds:

The Systematic Identification of Organic Compounds Christine K. F. Hermann, Terence C. Morrill, Ralph L. Shriner, Reynold C. Fuson, 2023-03-08 The Systematic Identification of Organic Compounds A comprehensive introduction to the identification of unknown organic compounds Identifying unknown compounds is one of the most important parts of the study of chemistry From basic characteristics such as melting and or boiling point to more complex data generated through cutting edge techniques the range of possible methods for identifying unknown organic compounds is substantial The utility of a research reference which compiles known techniques and characteristics of possible compounds is clear The Systematic Identification of Organic Compounds provides such a reference designed to teach a hands on approach in the chemistry lab It takes readers step by step through the process of identifying an unknown compound and elucidating its structure from infrared nuclear magnetic resonance and mass spectra in addition to solubility characteristics melting point boiling point and classification tests The result is an essential overview for advanced chemistry students looking to understand this exciting area of laboratory work Readers of the ninth edition of The Systematic Identification of Organic Compounds will also find A detailed chapter on safety personal protection equipment chemical storage safety data sheets and other safety concerns New NMR IR and mass spectra with detailed explanations on interpretation Questions at the end of each chapter designed to facilitate and reinforce progression keyed to a companion website for instructors Tables of known compounds including data relevant for identification Companion website with structural problems from experimental data for students to practice how to reason and solve The Systematic Identification of Organic Compounds is a useful reference for advanced undergraduates and graduate students studying organic chemistry organic spectroscopy and related subjects A Method for the identification of pure organic compounds by a systematic analytical procedure based on physical properties and chemical reactions ... v. 1, 1911 Samuel Parsons Mulliken, 1904 The Systematic Identification of Organic Compounds Ralph Lloyd Shriner, 1980 Step by step instructions on identifying organic compounds The steps described include elemental analysis solubility infrared spectra nuclear magnetic resonance spectra mass spectra classification tests and preparation of a derivative Most directions for experiments are described in a micro or mini scale and clean up directions are given at the end of each procedure Emphasizes the systematic approach to identifying unknowns Offers a review of spectroscopy Discusses infrared nuclear magnetic resonance and mass spectroscopy and includes examples of spectra Discusses chromatography distillations and the separation of mixtures **A Method for the Identification of Pure Organic Compounds by a Systematic Analytical Procedure Based on Physical Properties and Chemical Reactions ...** Samuel Parsons Mulliken, 1916 **Laboratory experiments on the class reactions and identification of organic substances** Arthur Amos Noyes, 1897 **A Method for the identification of pure organic compounds by a systematic analytical procedure based on physical properties and chemical reactions ... v. 2, 1916** Samuel Parsons Mulliken, 1916 **The**

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