

Preparation, Distillation and Spectroscopic Identification of 2-Chloro-2-methylpropane

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Experiment Overview

This experiment is the last experiment that the students do in the CHEM1020 course experiment. It describes the synthesis of 2-chloro-2-methylpropane from 2-methyl-2-propanol and the subsequent isolation and purification of the product by distillation. Characterisation of the starting material and product are then confirmed by examination and analysis of the IR, ^1H NMR and ^{13}C NMR spectroscopy.

This experiment introduces the concept of synthetic chemistry to the students and is the first time they have handled synthetic glassware. Furthermore, this is the first time they have isolated and purified a compound by distillation. As such it gives the students a taste of the types of techniques and syntheses they will encounter at 2000 level. The experiment also provides the students with real and relevant IR, ^1H NMR and ^{13}C NMR spectra for analysis. The experiment complements the concurrent lecture course which at this point is covering introductory organic synthesis (in particular functional group transformations of which alcohol to chloride is one example) and low level analysis of IR, ^1H NMR and ^{13}C NMR spectra. As such the experiment reinforces the lecture material and the lecture material provides an excellent resource for the report write-up.

Learning Experience

This experiment tested well under surveying of our student body during semester 2 of 2009 using the ASELL survey. In particular, students enjoyed it as a first taste of the use of synthetic glassware and felt that it complimented the lecture notes, on both functional group transformation and analysis of spectra, well.

Aims and Objectives

The experiment aims to introduce the use of synthetic glassware to the students. In particular, they are required to perform distillations – a procedure that they have only dealt with theoretically in lectures. The experiment also reinforces concurrent lecture material which introduces the idea of functional group transformations by providing an example of this synthetic tool. As such it both develops new practical skills and supports theoretical learning.

Level of Experiment

CHEM1020 Introductory Chemistry II – 1000 level course

Keyword Descriptions of the Experiment

Domain

Organic Chemistry

Specific Descriptors

Distillation, Functional Group Transformation, Spectral Analysis

Course Context

The course objectives are as follows:

- ☐ to introduce basic concepts in chemistry relevant to the professional practice of chemistry, environmental science, biotechnology, biomedical science and engineering
- ☐ to develop an understanding of the breadth, established knowledge base and applicability of chemistry
- ☐ to establish an appreciation of the central role of chemistry in science and technology
- ☐ to develop an understanding and knowledge of basic key concepts central to chemical science
- ☐ to provide an understanding of the elements of chemical language, representations, structures and symbolism
- ☐ to provide introductory experience of the scientific methods employed in chemistry
- ☐ to develop elementary skills in laboratory methods applied in analytical and experimental tasks involving chemistry
- ☐ to develop skills in the scientific method of conducting, reviewing and reporting experiments
- ☐ to develop some understanding of the safe practice and responsibilities residing in scientific and chemically-based work/ol>

As such this experiment directly builds upon objects 1, 4 and 6-9.

Prerequisite Knowledge and Skills

No prior laboratory skills required. Expectation of familiarity with CHEM1020 lecture notes, especially the introduction to functional group chemistry and spectral analysis sections.

Time Required to Complete

Prior to Lab: 30 minutes

In Laboratory: 3 hours

After Laboratory: 1.5 hours

Experiment History

The experiment has been a part of the 1000 level course for in excess of 20 years. Within the last five years the spectral analysis has been added by Dr van Altena.