

Preparation of biodiesel from waste vegetable oil

by Kieran Lim

Experiment Overview

This experiment synthesises biodiesel fuel by the transesterification of used vegetable oil via an acid catalyzed reaction. The product biodiesel is characterized by simple viscosity and flammability tests. This experiment was first used at Cornell College, Iowa, and reported in Journal of Chemical Education in early 2011.

Learning Experience

Reactions of acid derivatives, such as esters are a standard part of university chemistry curricula. This transesterification reaction is an example of “green chemistry” which both reduces waste (used vegetable oil) and produces a useful produce (fuel) from a renewable feedstock

Aims and Objectives

Reactions of acid derivatives, such as esters are a standard part of university chemistry curricula. The primary aim of this experiment is to transesterify used vegetable oil by an acid catalyzed reaction. The product biodiesel will be characterized by simple viscosity and flammability tests.

There are a number of secondary aims. By the end of this exercise, students should be able to:

- Perform a reaction at reflux
- Separate mixtures using a separating funnel
- “Wash” a solution (remove excess reactant and other impurities from the liquid)
- Fold fluted filter paper
- Perform a gravity filtration using fluted filter paper
- Perform a flammability test
- Perform a viscosity test.

Level of Experiment

First-year chemistry

Keyword Descriptions of the Experiment

Domain

Organic chemistry; Synthetic chemistry

Specific Descriptors

Green chemistry; Transesterification; Biodiesel fuel

Course Context and Prerequisite Knowledge and Skills

Students have previously studied acid-base reactions, reaction kinetics and catalysis. They are doing this experiment as part of the 2nd semester "block" of 1st-year undergraduate organic chemistry. In previous laboratory work, students have used microscale equipment, but are not using microscale for this experiment so that they can get some visible product.

The associated lectures are finishing the section on the reactions of esters and other carboxylic-acid derivatives as the students begin the 2-week cycle for this experiment.

Time Required to Complete

Prior to Lab: 1 hour reading and pre-lab work

In Laboratory: 3 hours

After Laboratory: none

Experiment History

This experiment was first used at Cornell College, Iowa, and reported in

Don Bladt, Steve Murray, Brittany Gitch, Haylee Trout, and Charles Liberko, *Journal of Chemical Education*, 2011, **88** (2), pgs 201-203.

The journal article describes both base-catalyzed preparation of biodiesel and the acid-catalyzed preparation of biodiesel, but only the latter is used here.

This experiment is being implemented at Deakin University in 2011.

Comments

A longer laboratory session could also utilise the base-catalyzed preparation of biodiesel, and/or NMR analysis of the starting materials and final products.