

Hong Kong Student Science Project Competition 2022

Template of Extended Abstract (Investigation)

Team Number: SBBC063

Project Title: Biodiesology - Investigation of Biodiesel

Project Type: Investigation

To our best knowledge and after thorough literature research, as at 26/12/2021, there are similar works. If there are, the reference links are as below:

 Biodiesel Reference Report.pdf

The enhancement our project has made for the existing related products or research is summarized as below:

More different oil samples were used to produce biodiesel.

***Please delete if not applicable. HKSSPC values the originality of works. Students must conduct literature research thoroughly to ensure that their works are unique, and to list relevant reference materials to complement the research or invention.**

I. Background

Waste pollution is a dire problem in Hong Kong, with cooked waste oil being a salient one. They can cause serious environmental problems without proper disposal. Yet, they are recyclable. Therefore, our report wishes to provide an alternative to recycle waste oils – converting them to biodiesel. By converting them to biodiesel, they can be used in car engines as fuel. In this report, the journal of Chemical and Pharmaceutical Research, 2016 has been taken as reference. We tried on different oil samples to produce biodiesel in order to fill the research gap.

II. Objectives

The project produces biodiesel from waste cooking oil. The following properties of biodiesel samples are compared.

- Viscosity
- Enthalpy change of combustion

The target is to find out which biodiesel has the highest energy content.

III. Hypothesis

Triglycerides in waste oil can be converted to biodiesel and give a fuel with substantial energy content. This can be tested by determining the enthalpy change of combustion of biodiesel samples.

IV. Methodology

Chemicals: Potassium hydroxide (solid), methanol, ethanol, propan-1-ol, propan-2-ol, peanut oil, olive oil, corn oil

Experiment A: Production of biodiesel

Biodiesel was produced by adding cooking oil to a mixture of potassium hydroxide dissolved in alcohol. The mixture was then placed in room temperature to allow biodiesel to be produced by transesterification

Experiment B: Comparing the viscosity of biodiesel

A plastic bead was placed from the top of the measuring cylinder containing biodiesel samples. The time required for the plastic bead to drop to the bottom of the cylinder was measured as the viscosity.

Experiment C: Comparing the enthalpy change of combustion

Biodiesel was first blended with ethanol in three ratios (1:2,2:1,1:1). The blended samples were then burned. The heat produced was used to heat a can of water and the temperature rise was measured.

V. Results

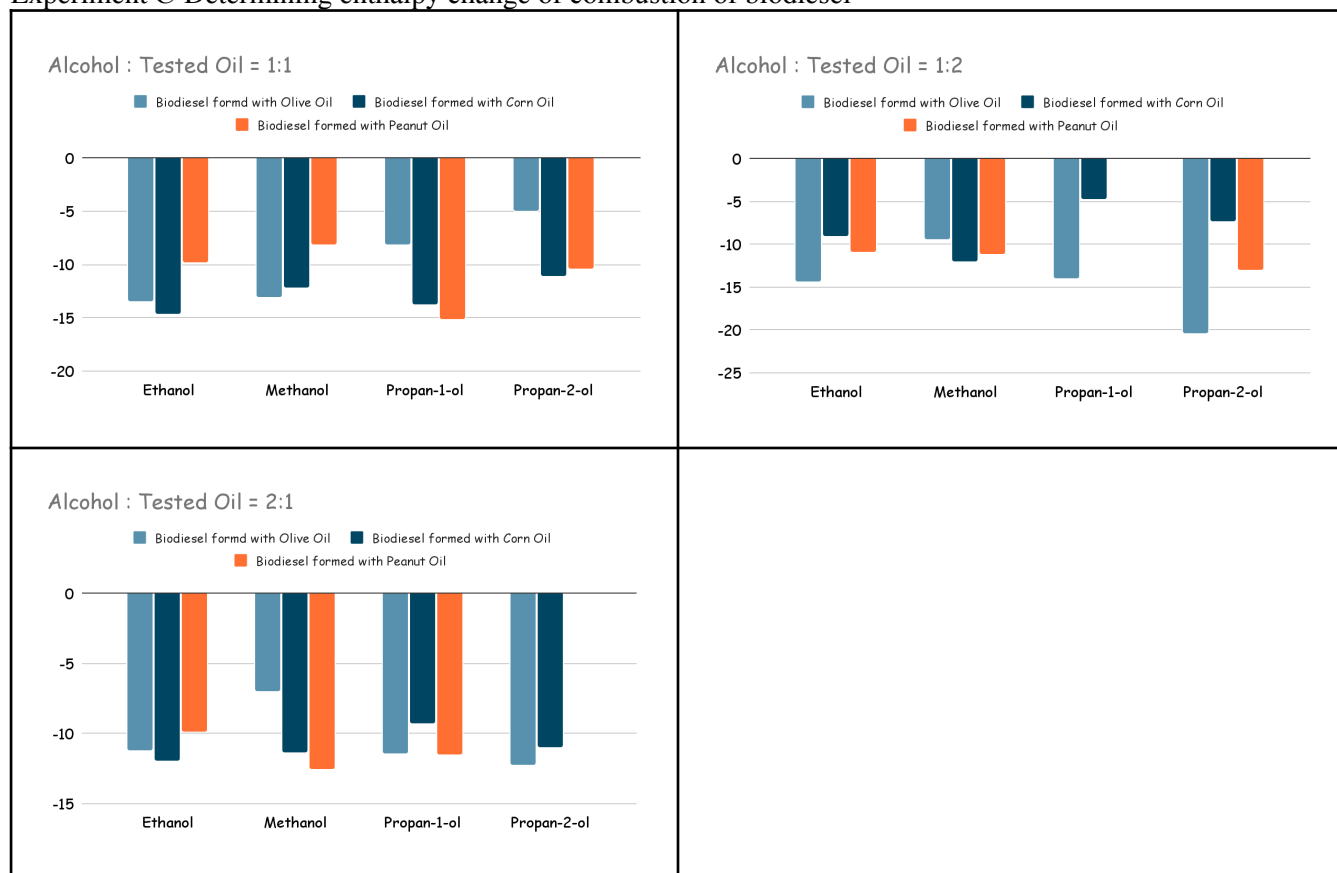
Experiment A

In the reaction of transesterification, a layer of biodiesel (fatty acid methyl ester) was separated.

Experiment B-Viscosity (cm/s) of each biodiesel made with different oil and alcohol

	Olive oil	Corn oil	Peanut oil
Methanol	8.89	8.59	5.56
Ethanol	3.70	3.15	3.53
Propan-1-ol	4.10	2.88	2.81
Propan-2-ol	3.85	3.09	2.92

Experiment C-Determining enthalpy change of combustion of biodiesel



VI. Conclusion

12 samples of biodiesel were produced from 3 types of waste oils and 4 alcohols.

Biodiesel samples were also blended with ethanol to reduce mass of soot produced during combustion. Three blending ratios were studied, which is 1:1, 1:2, 2:1.

Among the biodiesel prepared,

- the increasing order of viscosity is: Biodiesel formed by peanut oil < Biodiesel formed with by corn oil < Biodiesel formed by olive oil
- the increasing order of exothermicity of combustion follows the order of: Biodiesel formed by corn oil < Biodiesel formed by peanut oil < Biodiesel formed by olive oil

Overall, biodiesel formed by propan-2-ol and olive oil with blending ratio: 1:2 is considered as the best biodiesel to replace diesel as it releases the highest energy in burning.

□ Our project is developed based on our school's previous project and the enhancement is as below:

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