Synthesis of Biodiesel Based on Waste Cooking Oil

sead : stem

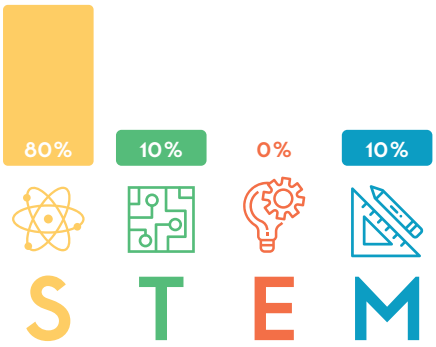
Subjects
Chemistry Biology

Topics
Regenerative Energy Recycling

Key Words
Biodiesel Renewable Energy Fuels Waste Recycling

Connection to SDG

STEM Chart



Time for Activity

4 hours

Introduction

In everyday life, fuel consumption has increased dramatically and leaves waste after use, resulting in serious environmental impact. Day after day, science advances, cutting-edge technology is created and used everywhere, in different forms: from traditional manual to autonomous machines. Concerns about environmental issues and the use of non-renewable energy sources have also arisen.

In fact, most Cambodians grow fruits and vegetables such as coconuts, beans, to produce coconut oil, which can also be used as a source of renewable energy. Vegetable and plant oils are ingredients that people use for cooking every day, but after use it turns into waste that may be harmful to the environment.

Nowadays, scientists have sought to investigate new, fuel-efficient and renewable energy sources. Among other things, the synthesis of biodiesel from biodegradable waste has been studied. In addition, major factories, Western universities and even individual citizens are also producing biodiesel for their vehicles.

Key Objectives

1. Understanding the synthesis of biodiesel from waste oil (i.e. sesame oil)
2. Determining the data derived from biogas synthesis from oils
3. Comparing the characteristics and qualities of synthetic diesel and biodiesel

Materials: Labor Equipment

1. Magnetic machine
2. Electronic scale
3. Weighing dish
4. Mortar and pestle
5. Pipette and bulb
6. Separating funnel
7. Flask
8. Test tube
9. Lighter or match
10. Graduated cylinder
11. Alcohol lamp

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Materials: Chemicals

1. Oil waste (sesame oil)
2. NaOH (sodium hydroxide)
3. Na_2SO_4 (sodium sulfate)
4. CH_3OH (methanol)
5. Water
6. Diesel
7. Aluminum foil

Safety

All chemical-related experiments require teachers and students to be careful since exposure to chemicals is often more or less severe or heavy, depending on the type of chemicals. In this experiment, there are also some harmful chemicals that can be harmful:

1. Please be careful not to swallow any of the material.
2. Should there be any spillage of chemicals on the skin (irritation), quickly rinse with running water and contact the teacher.
3. Some of the materials are corrosive.
4. Please handle the glass bottles with care.
5. Sodium hydroxide (NaOH): Highly soluble corrosive substances.
6. Methanol (CH_3OH): A highly susceptible to pre-ignition, highly explosive and highly toxic substance (keep away from fire). Experimenters need to be careful and stick to the laboratory rules, wear gloves, glasses and experimental clothing.

Guiding Questions

1. Does the waste oil material really be synthetic biodegradable?
2. What is the quality and yield of the synthesized biomass diesel?
3. Does the synthesized biomass diesel look the same or does it differ from regular fuel?

Teacher Tip

The synthesis of biodiesel uses principles of both chemistry and biology. This activity may also be suitable for middle school students.

Task

1. Put 0.5 g of the sodium hydroxide into an Erlenmeyer flask that contains 14 ml methanol (CH_3-OH) with a magnetic resonance cord. Wait 5 to 10 minutes for the powder to dissolve (at this stage, sodium chloride is produced–be careful).
2. Then, pour 60 ml of the oil into the above-mentioned methanol solution.
3. Boil the mixture between 20 to 30 minutes at a temperature of 35–50o C.
4. Let the mix cool. Use a separatory funnel to separate the components. Wait some time so that the mixture has time to separate. The biodiesel forms at the top, glycerin at the bottom. Remove the bottom liquid.

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5. Pour the above liquid in hot water. Wait some time and then separate the water from the liquid. Repeat this procedure four times.
6. Pour the remaining liquid into a die restliche Flüssigkeit in einen Erlenmeyer Kolben flask.
7. Pass this liquid through a filter.
8. The filtered liquid is the biodiesel.
9. Measure the volume of the biodiesel produced and calculate that percentage of the 60 ml waste oil used that was converted into biodiesel.

Result

Teacher Tip

In order to obtain specific results, the teacher and students must complete at least five experiments, record the mass of the petroleum biomass and obtain the average volume. We obtained average petroleum volumes of 40.14 ml, equivalent to 67%. As a result, the waste oil can also be synthesized as a biodiesel and obtain an acceptable yield.)

Assessment

Evaluation Criteria	4	3	2	1
Procedures	Procedures are listed in clear steps. Each step is numbered and is a complete sentence. The individual steps of the experiment were carried out independently and accurately.	Procedures are listed in a logical order, but steps are not numbered and/or are not in complete sentences. The individual steps of the experiment were mostly carried out independently and accurately.	Procedures are listed but are not in a logical order or are difficult to follow. The individual steps of the experiment were carried out with assistance.	Procedures do not accurately list the steps of the experiment The individual steps of the experiment were hardly carried out or not carried out at all, despite assistance.
Ability to explain the process of biodiesel production	Demonstrates clear understanding of biodiesel production.	Demonstrates clear understanding of biodiesel production but cannot explain it in detail.	Demonstrates superficial knowledge of biodiesel production.	Unable to demonstrate the process of biodiesel production.