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◆ Project Title

Converting Waste Cooking Oil into Biodiesel: A Renewable Energy Demonstration

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◆ Aim

To demonstrate how waste cooking oil can be converted into biodiesel through a simple transesterification process and to test its efficiency compared with conventional diesel.

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◆ Background (short for chart/report)

- Used cooking oil is often thrown into drains → pollutes water, clogs sewage.
- Instead, it can be chemically converted into biodiesel, a renewable alternative to fossil diesel.
- Reaction principle: Transesterification
- Vegetable oil (triglycerides) + Alcohol (methanol/ethanol) → Biodiesel (methyl/ethyl esters) + Glycerol (by-product).
- Catalyst: Sodium hydroxide (NaOH) or Potassium hydroxide (KOH).

Equation:

Triglyceride + Alcohol → Biodiesel + Glycerol

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## ◆ Materials Required

(For small safe demo, quantities scaled down)

- Waste cooking oil (filtered, 200 ml).
- Methanol (or ethanol – safer but less efficient).
- Sodium hydroxide (NaOH pellets, a few grams).
- Beakers, measuring cylinders, glass stir rod.
- Conical flask with stopper (or screw-cap bottle).
- Funnel, filter paper.
- Hot plate / water bath (optional for mild heating).
- Protective gear: gloves, lab coat, safety goggles.
- Labels, chart papers for science fair display.
- (Optional testing) 2 small candle lamps or toy engines to compare diesel vs biodiesel flame.

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## ◆ Safety Precautions

- Always wear goggles + gloves.
- Work in a well-ventilated place (methanol fumes are harmful).
- Handle NaOH with care (corrosive).
- Do not ingest or spill biodiesel/methanol.
- Dispose glycerol safely (not in sink).


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## ◆ Procedure (Step-by-Step Demonstration Model)

Stage 1: Preparation of Oil

1. Collect used cooking oil (cool, filter with muslin cloth to remove food particles).

#### Stage 2: Making the Catalyst

2. In a small beaker, dissolve 1 g NaOH pellets in 25 ml methanol. (This forms sodium methoxide).
  - Stir until clear.
  -  Exothermic reaction: handle carefully.

#### Stage 3: Transesterification

3. In a conical flask, add 100 ml of filtered waste oil.
4. Pour the prepared sodium methoxide solution into the oil.
5. Close the flask tightly and shake/stir for 15–20 minutes.
6. Leave the mixture to settle (in science fair, you can keep one sample already prepared overnight).

#### Stage 4: Separation

7. Within a few hours, two layers form:
  - Upper layer → Biodiesel (yellowish, lighter).
  - Lower layer → Glycerol (dark, heavier).
8. Use a funnel to separate the two layers. Collect biodiesel in a clean beaker.

#### Stage 5: Washing (optional for clarity)

9. Wash biodiesel gently with warm water (to remove soap/NaOH traces).
  10. Allow to dry (evaporate water).
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## ◆ Testing the Product

1. Compare flame test: burn a small amount of biodiesel in a wick lamp vs normal diesel.
    - Observe: biodiesel flame burns cleaner, less soot.
  2. Density test: compare density of oil, biodiesel, and diesel using a hydrometer.
  3. Viscosity test: pour biodiesel and diesel through a glass tube → biodiesel flows faster (lower viscosity).
  4. Efficiency check (optional): Run a toy engine with both fuels (if available).
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## ◆ Observations & Data (tables you can prepare)Sample

Colour

Layer Separation

Density (g/ml)

Burning nature (smoky/clean)

Cooking oil

Brownish

Single layer

~0.91

Smoky

Biodiesel

Yellow

Clear top layer

~0.87

Clean flame

Diesel (ref.)

Pale yellow

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~0.85

Moderate soot