# WHICH BIOMASS IS BEST?

NAME \_\_\_\_



In order to keep up with projected energy needs while remaining environmentally responsible, particularly in the transportation sector, we need sustainable fuel options. Biofuels are believed to be the most practical commercial solution in reducing carbon emissions in the transportation sector.

A biofuel is a renewable form of fuel that is created from biomass, recently living organisms (like plants) or their metabolic by-products (like manure from cows). Today's most widely used transportation biofuels are ethanol and biodiesel. Ethanol is produced from a process of basic fermentation of carbohydrates by yeast cells. Fermentation is an energy-yielding process that cells carry out in the absence of oxygen. After fermentation, the ethanol is distilled from the mix and blended with gasoline to create a mixture than can be used in your car!

In this experiment, you will use a basic fermentation process to test the efficiency of several different types of biomass.

#### **YOU WILL NEED:**

- 2-3 different types of biomass, such as corn kernels, soybeans, sugar, fruit, potatoes, paper, cooking oil, etc.
- 2-3 20 oz. soda bottles
- Yeast, 2 grams per bottle
- Balloons, one per bottle
- Calculator
- Measuring tape
- Scale
- Grinding instrument (such as a mortar and pestle)

#### Step One:

- 1. With group members, select 2-3 different types of biomass to test.
- **2.** Label one bottle for each of the different biomass types. For example, if you are using corn kernels, write "corn kernels" on one of your bottles.
- 3. Measure and place 2 grams of yeast into each bottle.
- 4. For each type of biomass, use your grinding instrument and a scale to measure 15 grams.
- 5. Place the 15 grams of biomass in each respective bottle.
- **6.** Add warm water into each balloon until it starts to expand slightly. Place the balloon on top of the soda bottle so that the warm water goes into the soda bottle and the balloon forms a seal on top. Repeat for each bottle.

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- 7. Mix the ingredients around in each bottle by shaking slightly.
- 8. Place the bottles in a warm place.
- 9. Record the size of each balloon with measuring tape.
- 10. Let the fermentation begin!

#### **Step Two:**

1. The fermentation process may take several days. Each day, observe the bottles and record what you see. You can visually observe the expansion of each balloon or measure each day. You can also record other observations like gas bubbles or differences in the liquid.

## **Step Three:**

- 1. After about a week, record your final observations for each biomass. Note that the balloon expansion comes from a mix of carbon dioxide and ethanol. To use the by-product for fuel, you would have to distill the actual ethanol, but the expansion of the balloon gives you some idea of the amount of ethanol being produced by the fermentation of each biomass.
- 2. Compare the ethanol production of each biomass.
- 3. Draw conclusions about which biomass is most efficient, given all you know.

Biomass	Date	Balloon Expansion Measurement	Additional Observations

### **Step Four:**

Based on this experiment and what you have learned throughout the lesson, which biomass type would you
choose if you were building a refinery in your state, and why?