

Project Research Plan

Biofuels -

Rationale:

To determine if using a sugar substitute will produce equitable amounts of ethanol to the current method of using corn. Currently 420 square miles of corn is used for ethanol production each year that could be rerouted for various other needed products.

Research Question/Hypothesis(es)/Engineering Goal(s):

Question/Problem: How can ethanol production be maintained with alternative methodologies to reduce corn usage?

Hypothesis: Using yeast fermentation with a saccharin based sugar substitute, the ethanol production will be comparable to that of the current methodologies of using corn kernels.

Expected Goals: The carbon dioxide gas produced will displace the water showing amount of ethanol expectation for the reaction as the carbon dioxide/ethanol ratio is 1:1.

Materials and Procedures:

Materials:

Quantity Materials

85 grams Yellow Substitute (Splenda)
85 grams Blue Substitute (Equal)
85 grams Pink Substitute (Sweet N Low)
105 grams Active Dry Yeast (Fleischmann)
9,750 mL Tap Water

Procedures:

1. Set one of the clear bottles to the left, this is the "Reaction Bottle" and insert the single rubber stopper into this bottle
2. The other clear bottle is in the middle with the double tube connection. This is the "reservoir bottle"
3. The graduated cylinder is to the right and will collect the displaced water. Tape the tube from the reservoir bottle to the graduated cylinder so it doesn't fall out.
4. Fill the reservoir bottle with about 400ml colored water.
5. Add 7g of Rapid Rise yeast to reaction bottle
6. Add 17g of sugar\food source to the reaction bottle
7. Pour 250ml of 115o F water into reaction bottle
8. Cap reaction bottle and make sure everything is sealed. Check reservoir bottle for firm seal to make sure no gas can escape. Start timer for 21 min and swirl for 30 sec to mix.
9. Measure the volume of water displaced into the graduated cylinder, recording every minute. Record on data table and graph Volume vs Time.
10. Calculate. Determine the lag time and reaction rate for your bioreactor.
11. After you are done determining the reaction rate rinse the bottle with hot water and dump out the bottles in the sink, then rinse with hot water again
12. Set them upside down on a towel to air dry until your next experiment.

Risk Assessment:

Water at 115 degrees Fahrenheit can be a potential burn risk to individuals who are not taking the proper precautions. Use of thermal protective gloves is needed when handling the beaker of hot water.

Data Analysis:

A graph will be created to show a comparison of water displaced by each of the sugar substitutes.

Bibliography:

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Wallander, S., Claassen, R., & Nickerson, C. (2011). The Ethanol Decade: An Expansion of U.S. Corn Production, 2000-09. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.2131399>

What part of the corn plant, stalk or grain, is the most likely to be used for biofuels? – Farm Energy. (2019, April 3). *Extension.org*. <https://farm-energy.extension.org/what-part-of-the-corn-plant-stalk-or-grain-is-the-most-likely-to-be-used-for-biofuels/>

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Additional Project Information: