## Abstract

We attempted to create a more sustainable lawn mower that runs off of ethanol which has been created from grass clippings. We aimed to do this by creating cellulosic ethanol from grass, then using the ethanol to power a lawn mower. However, we were not able to produce significant concentrations of ethanol. As a result, we then used commercial denatured ethanol in our lawn mower and tested it with different modifications to the carburetor until we achieved optimal performance. Although we were not able to produce enough ethanol from grass, we were able to run the lawnmower off of ethanol.


This picture is of the lawn mower carburetor, which was one of our conditions in the experiment


This picture shows the molecular structure of ethanol $\left(\mathrm{CH}_{3} \mathrm{CH}_{2} \mathrm{OH}\right)$.

## Materials and Methods

Blend up 600 grams of grass with 900 mL of water into a fine paste. Add 600 mL of cellulase to the mixture. Set the mixture into an incubator at $37^{\circ} \mathrm{C}$ for a day, then $32^{\circ} \mathrm{C}$ for six days, separate the solids from the liquids using cheesecloth, measure the specific gravity using a hydrometer. Place solution into a two-liter bottle with 100 grams yeast. Seal the lid with an air-lock. Let the solution ferment for a week before measuring the specific gravity again for ethanol concentration change.
Remove the blade to the lawn mower, get a fire extinguisher nearby, and put on goggles and gloves for protection. Drain out any existing fuel from the fuel tank and lines. Make modifications to lawn mower, never using more than 200 mL of fuel at a time. The modifications and results of them are showed in the table to the right.

## Results

| Modifications | Results |
| :--- | :--- |
| Saturday |  |
| 1. Put ethanol in lawn <br> mower | Ran very Quietly |
| 2. Added air filter cover | Ran better, but surged |
| 3. Added wire clip to float <br> ball | Ran normally, except when <br> strained |
| Tuesday |  |
| 4. Clean Carburetor | Did not start |
| 5. Sprayed ethanol into air | Did not start |
| intake | Started but only ran for 10 <br> seconds |
| 6. Sprayed starter fluid <br> into air intake | 7. Removed wire clip from <br> float ball | | Did not start |
| :--- |
| Sprayed ethanol into air <br> intake |
| 8. Removed wire clip from <br> float ball <br> Sprayed starter fluid into <br> air intake |
| Started but only ran for 10 <br> seconds |
| ball <br> Sprayed ethanol into air clip to float <br> intake | | Did not start |
| :--- |
| 10. Added wire clip to float |
| ball |

## Discussion

In regards to our goal of creating a lawn mower that runs off of the grass it cuts, we did not achieve our goal. However, we were able to create a solution with a $1.4 \%$ ethanol concentration, and we were able to run a lawn mower off of denatured ethanol. This is a monumental success. Some of the weaknesses in our investigation:

- pH in the fermentation process
- corrosiveness of ethanol and its effects on lawn mowers
- the weather was inconsistent between lawn mower testing days
We plan on solving these problems in the future by adding buffers to the fermented solution before fermentation, using a metal tank, and performing all texts on the same day.


The picture to the top left is of the bottom of the lawn mower's carburetor

## Conclusion

We were able to successfully run our lawn mower off of ethanol. However, this was off of commercial brand ethanol from Duda Ethanol instead of pure $100 \%$ ethanol. In the future, we would like to create enough of our own ethanol to be able to make mowing your lawn a $100 \%$ self-sufficient task. This would not only lower fuel cost on the user, but it would also produce less greenhouse gases which could save the environment one fuel tank at a time.

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