The most commonly used catalysis is titanium dioxide because of its high reactivity and low cost. Enzymes for enzymatic hydrolysis to be carried out. Photocatalytic pretreatment is a process using UV light and a catalysis. Important to find a good source for biofuel. In 2019 more than 7.2 billion pounds of canola were harvested in the United States. Biofuels are less expensive than fossil fuels. Creating and using biofuels can also increase Earth's temperature. Converting to biofuel is one solution that can be done to combat climate change.

The hypothesis for this research was to investigate the effectiveness of a photocatalytic pretreatment on canola stalk as a source of biofuel. Is canola stalk a viable source for glucose to produce biofuel? If so is titanium dioxide a viable source for glucose to produce biofuel? If so is titanium dioxide with UV irradiation efficient?

Introduction / Background Research
According to President Maria Fernanda Espinosa Garcilazo of Ecuador there is only 10 years left to stop the irreversible consequences that is climate change. Earth's greenhouse effects an important piece in maintaining the climate of the Earth but it also has the potential to change Earth's climate. Converting to biofuel is one solution that can be done to combat climate change. Biofuels is a fuel source that is made from living materials which makes it a better alternative to fossil fuels for many reasons. Ozonizing fossil fuels is about as harmful for the environment as it is to use them. Burning has been linked to dangerous air pollutants that are harmful for the environment and human health. It is very important to find a good source for biofuel. In 2019 more than 7.2 billion pounds of canola was harvested in the United States alone. Canola grows in different geographical regions because it is known for its ability to tolerate higher temperature changes. A previous study revealed theoretical calculations that a 100 acre canola field could produce 5,000 L of biodiesel. The success of biofuels is only variable due to being experimented with, there is a constant need for a more effective pretreatment. A pretreatment is necessary to decompose the lignins exposing the hemicellulose and cellulose in the enzyme for enzymatic hydrolysis to be carried out. Photochlorophyll/pretreatment process using UV light and a catalyst. The most commonly used photocatalysts is titanium dioxide because of its high reactivity and low cost.

Materials / Methodology
The canola stalks were harvested into 0.5 cm strands and stored in separate plastic bags. Different pretreatments were implemented such as chemical, photothermic and a combination with physical, chipping.

Results
Using 0.04g of canola stalks with no pretreatment had an average of 30.03 mL ± 1.35 mL of CO₂ was produced. Using 0.04g of canola stalks with titanium dioxide as a pretreatment had an average of 42.87 mL ± 9.1 mL of CO₂ was produced.

Table 1: Average CO₂ volume in milliliters with standard deviation.

<table>
<thead>
<tr>
<th>Pretreatment (72hr)</th>
<th>HCL(1M)</th>
<th>NAOH(1M) w/ chipping</th>
<th>HCL(1M) w/ chipping</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO₂ Volume (mL)</td>
<td>30.53</td>
<td>39.90</td>
<td>21.50</td>
</tr>
<tr>
<td>SD</td>
<td>16.99</td>
<td>25.31</td>
<td>12.69</td>
</tr>
<tr>
<td>Average</td>
<td>0.40</td>
<td>0.40</td>
<td>0.08</td>
</tr>
<tr>
<td>Canola Mass (g)</td>
<td>0.04</td>
<td>0.04</td>
<td>0.08</td>
</tr>
<tr>
<td>SD</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Discussion
The hypothesis for this research was to investigate the effectiveness of a physical pretreatment on canola stalk as a source of biofuel. The hypothesis was accepted because CO₂ was produced using canola stalks. Using 0.4 g of canola stalk with a 1M HCL pretreatment yielded a theoretical 0.06 g of ethanol. Using 0.4 g of canola stalk with a 1M NaOH pretreatment yielded a theoretical 0.07 g of ethanol.

Future Study
The same pretreatment will be explored with lower molarities to reduce costs such as .5 M and .25M. The amount of time will also be reduced such as; 24 hr, 12 hr, 6 hr, and 1 hr pretreatments. Other pretreatments will also be explored such as 24 hr, 12 hr, 6 hr, and 1 hr pretreatments. The same pretreatments will be explored with lower molarities to reduce costs such as .5 M and .25M. The amount of time will also be reduced such as; 24 hr, 12 hr, 6 hr, and 1 hr pretreatments. Other pretreatments will also be explored such as 24 hr boiling pretreatment to test heats affect on the cellulose-lignin.

Literature Cited / References

Figure 1: Metric tons of carbon produced by fossil fuels.
Figure 2: The cellulose and hemicellulose behind the wall of lignin.
Figure 3: The cellulose and hemicellulose behind the wall of lignin.
Figure 4: Canola stalks were harvested into 0.5 cm strands and stored in separate plastic bags. Different pretreatments were implemented such as chemical, photothermic, and a combination with physical, chipping.
Figure 5: The samples were pretreated using titanium dioxide with 0.5 hours of UV irradiation.
Figure 6: The canola underwent enzymatic hydrolysis. Hemicellulose, sodium citrate buffer, and the enzymes Beta glucosidase and xylanase were used to convert the cellulose to glucose.
Figure 7: The enzymes were deactivated by raising the temperature to 90°C.
Figure 8: Fermentation was done by adding 5g of yeast to the trials. The CO₂ produced was captured using balloons that were secured with paraffin.
Figure 9: The CO₂ produced was measured using a eudiometer and equilibrated. The volume of CO₂ was placed into Ideal Gas Law (Equation 1) to convert to mols, then stoichiometry (Equation 2) was used to calculate theoretical glucose and ethanol production.
Figure 10: Carbon Dioxide Production of Fermentation using Pretreated Canola.