



**CALIFORNIA STATE SCIENCE FAIR  
2013 PROJECT SUMMARY**

<b>Name(s)</b> <b>Anchit Narain</b>	<b>Project Number</b> <b>S0516</b>
<b>Project Title</b> <b>Preparing for Biofuels: Finding Alternative Sources for Cellulosic Ethanol (Year 2)</b>	
<b>Abstract</b> <b>Objectives/Goals</b> To validate that agricultural extraction process waste streams (such as that of the paprika oleoresin production process) contain extractable amounts of glucose for ethanol production in biofuels. Then the effect of varying cellobiase enzyme concentrations on the waste stream will be measured to quantify a hypothesized net gain in glucose for greater ethanol yield. <b>Methods/Materials</b> Materials: Bio-Rad Biofuel Enzyme Kit (cellobiase enzyme), Paprika Oleoresin Waste Stream (called Mud), 99.9% Anhydrous Glucose, Fehlings A and B Solutions (prepared), Standard Lab and Titration Equipment. Methods: Standardization experiment with 2% anhyd. glucose solution was used to reduce 10mL of Fehlings Solution via Lane and Eynon Titration. Results were used to calculate the grams of 100% glucose needed to reduce 10mL Fehlings. 5% Mud solution before enzyme hydrolysis was used to reduce 10mL of Fehlings. Results calculated percentage of glucose present in Mud before enzyme hydrolysis. 3 different concentrations of cellobiase(10,20,and 40mL) were reacted with 5% Mud Solution and then used to reduce 10 mL Fehlings. Results were used to quantify the hypothesized increase in glucose concentration due to presence of enzyme. <b>Results</b> Average titer value for 2% anhyd. Glucose test was 7.5mL and average amount of 100% glucose needed to reduce 10mL Fehling#s was calculated to be 0.150g. Average titer for 5% Mud prior to enzyme hydrolysis was 24.7mL and average glucose concentration by mass was 12.15%. Average titer for Mud reaction with 10mL enzyme solution was 18.4mL and average glucose concentration was 24.47%. Average titer for reaction with 20mL enzyme was 14.7mL and average glucose concentration was 30.61%. Average titer for reaction with 40mL enzyme was 13.9mL and average glucose concentration was 32.40%. <b>Conclusions/Discussion</b> Agricultural extraction process waste streams with similar compositions to that of the Paprika Oleoresin Waste Stream(Mud) can be utilized by the biofuel industry as potential sources for ethanol production due to their present glucose content. The addition of cellulases such as cellobiase can increases the yield of glucose present, thus increasing overall ethanol yield. Further experimentation regarding optimum levels (pH, temp, enzyme concentration) for maximum glucose yield is currently being conducted to further validate hypothesis.	
<b>Summary Statement</b> This project tries to identify an alternate class of sources for cellulosic ethanol (agricultural wastes), thus reducing the dependence on food crops (esp. corn) for biofuel production.	
<b>Help Received</b> Bio-Rad provided enzyme. Parents helped construct project board. Mr. Siva Subramanian guided me through Advanced Biochemistry conducted in project. Mr. Bowns and the Science Dept.from Clovis North High School contributed by providing me lab space and equipment as well as clarified my doubts.	