



CALIFORNIA STATE SCIENCE FAIR 2013 PROJECT SUMMARY

Name(s) Dhuvarakesh Karthikeyan	Project Number S0509
Project Title Waste to Energy: Converting Cellulosic Waste into Fermentable Sugars for Bioethanol Production	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals To efficiently reclaim 20%-25% of the mass of the feedstock in glucose, when pretreatment methods are not incorporated. Then to efficiently reclaim 50-55% of the mass of the feedstock in glucose with pretreatment. Finally, to confine the cost of this method to 25\$-30\$/small-scale batch without compromising too much of the efficiency or practicality.</p> <p>Methods/Materials The procedure is designed to measure the glucose concentration produced from different paper-waste sources[office paper, binder paper, newspaper, cardboard] under different amounts of pretreatment[0hrs, 4hrs, 8hrs, 12hrs, 24hrs, 48hrs]in comparison to each other, followed by cellulolytic reactions of different incubation times [2hrs, 4hrs, 6hrs, 8hrs, 12hrs, 16hrs, 24hrs, 48hrs]. The pretreatment incorporated soil-based phenoloxidase sources. This enzyme breaks apart aromatic compounds, which are found in abundance in the lignin structure. The feedstock was then transferred into cellulase reactors and cellulolysis took place, producing the glucose monomers. The resulting glucose amount was ascertained via a combination of glucose test strips, Benedict's Quantitative Reagent, and DNS Assay.</p> <p>Results The data and calculations revealed that the pretreatment method was able to improve the digestibility of the lignocellulosic paper waste from an average of 34% substrate conversion, to an average of 70% substrate conversion.</p> <p>Conclusions/Discussion From this data, it is possible to conclude that the technique utilizing soil based microorganisms as a source of lignin-degenerating phenoloxidase activity is a highly effective, much less expensive way to pretreat lignocellulosic biomass for use in ethanol production. In addition, it was concluded that paper-based cellulosic waste substrates are excellent sources of lignocellulosic material. While this method was aimed towards third world countries, who lack a waste management, and sustainable fuel infrastructure, it is now felt that even modernized countries can be benefited by this novel and effective method.</p>	
Summary Statement This project is focused on employing cost-efficient methods of utilizing the phenoloxidase enzyme suite as lignin-degenerative pretreatment on the feedstock, paper-based lignocellulosic waste, for bioethanol production.	
Help Received All reasearch, design, experimentation, and analysis for the project was conducted by the team. Certain aspects were conducted under the supervision of the advisor.	