



**CALIFORNIA STATE SCIENCE FAIR  
2009 PROJECT SUMMARY**

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<b>Project Title</b> <b>Ethanol Sources and Yields: An Analysis of Raw vs. Processed Sources and How Temperature and Enzymes Affect Yield</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> The purpose of our experimentation was to find the source of ethanol, cellulosic or non-cellulosic, that provided the greatest yield of ethanol content after fermentation. Variables, such as temperature, time, and enzymes were used to find the most productive source. Seen as a potential alternative fuel of the future, the discovery of a viable source of ethanol is a key step in fighting global warming.</p> <p><b>Methods/Materials</b> In experiment one, the control experiment, one liter solutions of raw ethanol sources, including corn kernels, husks, sugarcane, and alfalfa, were blended and ground finely. The solutions were heated to kill bacteria, inoculated with yeast, and measured for ethanol content with a hydrometer. Experiment two used the same raw sources which were autoclaved rather than heated and treated with amylase and cellulase enzymes. The solutions were accurately measured for ethanol content using a spectrophotometer to determine absorbance. Experiment three repeated the steps in experiment two, except store-bought processed ethanol sources were used. These included corn starch, brown sugar, and glucose.</p> <p><b>Results</b> Experiment one without enzymes yielded negligible ethanol content using the hydrometer as a measurement tool. Experiment two yielded relatively small, but noticeable ethanol production, especially when allowed to ferment at 37C as opposed to room temperature. Experiment three, using processed sources, produced large concentrations of ethanol, with non-cellulosic sources such as glucose and brown sugar producing the greatest amount of ethanol.</p> <p><b>Conclusions/Discussion</b> In general, higher temperature and more time led to a greater net yield of ethanol production. The results showed that non-cellulosic sources such as glucose and brown sugar provided the greatest net yield. Store-bought processed sources produced far more ethanol than raw sources which were broken down by hand. Experimentation showed that ethanol production is negligible without the adding of specific enzymes to accommodate the fermentation.</p>	
<b>Summary Statement</b> An experiment directed towards discovering the source that provides the greatest net yield of ethanol and an analysis of the factors affecting yield.	
<b>Help Received</b> Professor Stephens provided a lab and research guidance.	