



**CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY**

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Project Title Biomass to Natural Gas: An Alternative Energy Solution	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals My objective was to determine what type of biomass: acidic, basic, or neutral mixed with cow manure will improve the production of biogas. I hypothesized that neutral biomass mixed with cow manure will improve the production of biogas.</p> <p>Methods/Materials I built 25 identical biogas generators using 2 liter soda bottles, Mylar balloons, corks, T-adapters, and vinyl tubing. Five of the generators were filled with cow manure + broccoli (pH 7.5 basic) + distilled water (test #1), five generators were filled with cow manure + cauliflower (pH 7.0 neutral) + distilled water (test #2), five generators were filled with cow manure + quince (pH 3.1 acidic) + distilled water (test #3), five were filled with cow manure + quince + broccoli + distilled water (test #4), and five were filled with cow manure + distilled water (control). I placed the biogas generators in a room with a constant temperature of 35 degrees C for 26 days. I measured the circumference of each balloon in cm every day and checked the flammability of the biogas produced by each generator.</p> <p>Results My control, with cow manure only, produced the most amount of biogas and the gas produced was flammable. Test #2 (neutral) was second and the gas produced was flammable. Test #3 (acidic) was third and the gas produced was not flammable. Test #4 (basic + acidic) was fourth and the gas produced was not flammable. Test #1 (basic) was last and the gas produced was flammable. My control, test #1 and test #2 were successful because the pH level of the slurries were not too basic or acidic. Test #3 and test #4 were not successful because the slurries were too acidic.</p> <p>Conclusions/Discussion Acidity is a major factor in anaerobic decomposition. If the mixture of the slurry is too basic or acidic the fermentation slows down. Test #3, cow manure + quince, and test #4, cow manure + broccoli + quince stopped producing biogas during the second week because the high acidity stopped the methane producing bacteria from producing methane and the gas produced was mainly carbon dioxide. Anaerobic decomposition is a two stage process. In the first stage, acidic bacteria dismantle the complex molecules into simpler compounds and mainly carbon dioxide is produced. In the second stage methane producing bacteria convert simpler compounds into methane. My control, test #1, and test #2 were successful because they produced biogas throughout the 26 days and the gas produced was flammable.</p>	
Summary Statement Organic materials from animals and plants, through an anaerobic decomposition, can be transformed into useful energy (methane gas) that can be used for cooking and heating.	
Help Received My father helped me build my biogas generators. Paul Harris from the University of Adelaide helped me with some complications that I had.	