CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

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Project Number

S1122

Project Title

Biochar: Reducing and Removing Atmospheric CO(2) and Improving Soil

Abstract

Objectives/Goals

The rapid rise of unnatural carbon dioxide is beginning to negatively impact our planet and will continue to do so. Biochar is a solution. The purpose of my project is to make my own biochar out of commonly used materials and determine which biochar is the most efficient, sequesters the most carbon, and has the most positive impact on plant growth. I hypothesized that the biochar made from orange peels will be the most efficient biochar overall by producing the largest ratio of biochar to biomass, will retain the largest amount of carbon from the air, and having the most positive effect on plant growth.

Methods/Materials

My project has 3 parts.

Making the Biochar: I designed and constructed my own Biochar kiln and got a working design on my third attempt. I pyrolized Apple, Cherry, Hickory, Pecan, and Mesquite Woods, Orange Peels, and Corn Husks in my kiln. I also burned the biochar under 4 different air settings (none, natural, low, and medium air flows) which circulated through the bottom of the kiln and out the chimney. I recorded the date, time taken to pyrolize, and the color and mass before and after burning.

Carbon Retention Test: After my homemade test did not work, I conducted a butane retention test. I recorded the mass of the test tube with ground biochar. I then let the biochar soak in butane gas for 45 minutes and recorded the mass of the test tube with biochar and butane. Then I calculated the butane retention using a formula.

Effect on Plant Growth: I mixed soil, biochar, and manure in the ratio 2:1:1 for each experimental plant. I then grew brassica juncea plants for each type of biochar and I grew control plants without biochar. I monitored and recorded their height for 10 days to determine the tallest plants.

Results

The Hickory wood biochar helped the plants grow the tallest, but the orange peels biochar had a greater number of seeds that sprouted. The cherry wood burned under low air setting had the highest butane retention value.

Conclusions/Discussion

Overall, the biochar produced by the hickory wood was the most environmentally efficient because it had a high biochar to original biomass ratio, improved plant growth the most, and had above average carbon retention rates. This disproves my hypothesis.

In the future, I want to analyze the gas given off by this process and use it as an energy source that could power a factory or a machine. I also want to commercialize this process.

Summary Statement

The purpose of this experiment is to determine which Biochar, out of the selection that I produced, is the most environmentally efficient depending on carbon sequestration levels and impact on plant growth.

Help Received

Ms. Taylor Thomlinson, Communications Director of the International Biochar Initiative gave me suggestions through emails about the best Biochar kiln design. Mr. Frank Shields allowed me to come to Control Laboratories Inc. in Watsonville and perform a butane retention test. My dad drove me to the