CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

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Project Number

33074

Project Title

Catching the Greenhouse Culprit II, Extraditing the Culprit: Building and Recycling a Carbon Dioxide Filter at Home

Abstract

Objectives/Goals

The purpose of this project is to build an environmental friendly CO2 filter that is safe and economical for home use, and a CO2 absorbent recycling machine that is capable of recycling the CO2 absorbent so that the CO2 filter can be made reusable many times, as well as finding a way to utilize the extracted carbon dioxide from the recycling process so that it will have an overall negative carbon dioxide impact on the environment.

Methods/Materials

By adjusting carbon dioxide level to 1,000 ppm, the CO2 absorption rate of equal molar of CaO, MgO, and ZnO absorbents were determined and compared via a CO2 monitor and a timer. Then the experiment was conducted with the constructed filter machine so as to determine the efficacy of the machine for improving the CO2 absorption rate. For the recycling process, 10g of MgO was heated to 550 degrees Celsius for 2 min and weighed; then the procedure was repeated by increasing 2 min interval for 60 min.

Results

From experiment 1, ZnO was eliminated as absorbent material (too slow) and the Molar Equivalency Ratio of 1.56 was found for MgO. From experiment 2, the average efficacy percentage (20 min interval) are 343% for 1 mole of CaO, 436% for 1.5 mole of MgO, and 727% for 2 mole of MgO; also, by using 1.65 mole of MgO, the curve approximate well with that of 1 mole of CaO. From experiment 3, the rate of MgO production is obtained (Graph 3b) and an equation to describe the curve is found; for 80 min, at least 90% of the MgO was regenerated from MgCO3.

Conclusions/Discussion

The main conclusions from this project are that MgO can be used as a CO2 absorbent material and that the machine is efficacious in increasing the CO2 absorption rate of the absorbents. Also the absorbent recycling machine is effective in converting MgCO3 back to MgO. Despite the CO2 absorption rate of MgO is slower than that of CaO, it is more suitable for home use due to its safety. In fact, when increase the amount of MgO to its Molar Equivalency Ratio, its CO2 absorption rate can match that of CaO. Our filter is environmental friendly because the by-product, MgCO3, can be reusable and recyclable by our recycling machine as demonstrated; also there are also many other uses of MgCO3, such as in fire proofing and extinguishing materials and medicines.

Summary Statement

This project is to build an environmental friendly CO2 filter that is suitable for everyday use at home and build a recycling machine to regenerate the absorbent material.

Help Received

Teacher taught us the exponential decay function; Father helped us with the safety of all experiments; Mother helped purchase the necessary materials. We would like to thank Mrs. Anderson and Ms. McKay for their support.