CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
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Project Number
J1024

Project Title
Catching the Greenhouse Culprit at Home: Building a Safe and Effective Filter to Capture Carbon Dioxide at Home

Abstract

Objectives/Goals
The purpose of this project is to build an environmental friendly carbon dioxide filter that is safe and economical for home use, as well as to determine its efficacy with different carbon dioxide absorbent materials.

Methods/Materials
By adjusting carbon dioxide level in an airtight container to 1,000 ppm, the rate of carbon dioxide absorption of equal molar of calcium oxide (CaO), magnesium oxide (MgO), and zinc oxide (ZnO) were determined and compared via a carbon dioxide monitor and a timer. The next experiments were conducted with and without the filter machine running so as to determine the efficacy of the filter machine to improve the rate of carbon dioxide absorption (efficiency) of the absorbent materials.

Results
From experiment 1a & 1b, ZnO was eliminated as an absorbent material for our carbon dioxide filter (too slow) and the Molar Equivalency Ratio of 1.56 was found for MgO. From experiment 2a, 2b, & 2c, the average efficacy percentages (20 min interval) of the filter machine were 343% for 1 mole of CaO, 436% for 1.5 mole of MgO, and 727% for 2 mole of MgO. From Graph 2d & 2e, by using 1.65 mole of MgO, the carbon dioxide absorption curve approximate well with that of 1 mole of CaO.

Conclusions/Discussion
The main conclusions from this project are that MgO can be used as a carbon dioxide absorbent material and that the filter machine is efficacious in increasing the rate of carbon dioxide absorption of the absorbents. Despite the rate of carbon dioxide absorption of MgO is slower than that of CaO when comparing on an equal molar basis, it is more suitable for everyday use at home or school due to its safety and higher carbon dioxide absorption capacity. In fact, when increase the amount of MgO to (or beyond) its Molar Equivalency Ratio, its rate of carbon dioxide absorption can match (and exceed) that of CaO. Our filter is environmental friendly because the by-product, magnesium carbonate, can be reusable and recyclable by converting back to magnesium oxide, as well as there are many other uses, such as in fire proofing and extinguishing materials and medicines.

Summary Statement
This project is to build an environmental friendly carbon dioxide filter that is suitable for everyday use at home or school.

Help Received
Teacher taught us the skills in building devices; Father helped us with the safety and accuracy of all experiments; Mother helped purchase the necessary materials. We'd like to thank Mrs. Anderson and Mr. Oliver for their support.