CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

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Project Number

S0606

Project Title

Development of a Novel High Efficiency Chemical Sequester for CO(2) Reduction from Automobile Exhaust

Abstract

Objectives/Goals

The objective is to create a carbon dioxide sequester that reduces the carbon dioxide emissions from automobile exhaust in a cheap and efficient manner.

Methods/Materials

CO(2) concentration was measured using an infrared carbon dioxide sensor. The CO(2) concentration was reduced by chemically reacting it with the bases, NaOH and Ca(OH)(2), inside a sequester reactor. There were 3 design prototypes that differed in terms of reacting surface area and retention efficiency of the CO(2) in the reacting solution. The first prototype was a "filter" design where a rectangular metal duct was attached to the tailpipe and a sponge soaked with the basic chemicals would be placed in the duct. In the second prototype, a vessel with the chemical solutions(NaOH or Ca(OH)(2)) was made so that all the exhaust gas from the car would have to pass through the solution. The design was made such that the gas would have to bubble through the solution. Sponges were placed at the top of the vessel to increase the retention rate of the gas. The final prototype had a similar vessel design as prototype 2 but had sponges arrayed in a multi-chamber configuration compromising of porous solid and liquid zones.

Results

The first prototype showed a low sequestering efficiency of less than 10% decrease in CO(2) concentration. The second prototype decreased CO(2) concentration by an average of 78%. The final prototype design reduced CO(2) concentration by an average of 82%.

Conclusions/Discussion

The proposed sequestering approach is based on reacting the CO(2) with commonly available bases such as Ca(OH)2 and NaOH. Since Ca(OH)2 is a cheaper and safer chemical and showed the same sequestering ability as NaOH, Ca(OH)2 appears to be a far more appealing and viable candidate than NaOH for practical application. In addition, the byproduct of the reaction, CaCO(3) is a naturally occurring material that has several practical applications. For real life application, the sequester could be made to the size of a gas tank such that the high volume of chemicals would react longer and probably more efficiently due to the higher surface area as well.

Summary Statement

This project involved creating a novel carbon dioxide sequester for automobiles that can decrease CO(2) concentration in emissions by 82 percent using chemical reactions with NaOH and Ca(OH)(2) in a cost effective manner.

Help Received

My Dad helped make sure I used the proper safety equipment while handling chemicals.