CATALYTIC REDUCTION OF CO2 USING ACTIVATED CARBON

Mr. C.MANIVANNAN.,ME
Department of Mechanical Engineering
Gnanamani College of Technology
Pachal, Namakkal-637408, Tamilnadu

Mr. G.VIJAYASEKARAN.,ME
Assistant Professor
Department of Mechanical Engineering
Gnanamani College of Technology
Pachal, Namakkal-637408, Tamilnadu

Abstract: CO_2 is one among the greenhouse gases responsible for enhanced greenhouse effect. Fossil fuel combustion produces maximum amount of CO_2. Reduction of CO_2 from internal combustion engines is mandated to control CO_2 emission. As a part of our continued effort to control atmospheric CO_2, we have undertaken a study of CO_2 absorption using modified charcoals.

Keywords **– Fossil fuel, Wooden Charcoal, CO_2 emission.**

OBJECTIVES

Our aim is to find out the best method of reduction of CO2 gas from the vehicle exhausts by:

1) Narrowing down on the most economic process that is best suited for:
    a. Reduction in the volumetric output of CO2 gas
    b. Regeneration of the catalyst at a given temperature and pressure condition.
2) Finding a catalyst for the selected process that can offer the maximum efficiency
3) The setup should be designed so as to allow a change or replacement of catalyst
4) To show a comparative study of the performance of different compounds through graphical output

CARBON DIOXIDE MANAGEMENT

ABSORPTION

It is a physical or chemical phenomenon in which the atoms, molecules, ions, enter some bulk phase in a gas, liquid or solid phase.

PHOTO CATALYSIS

Photolysis is chemical reaction in which a chemical complex is smashed down by photons. It is well-defined as the interface of one or more photons with one goal molecule. Photolysis can be accelerated using catalysts and the process is called photo catalysis.

ADSRPTION

It is a process of adhesion of molecules, atoms, ions of gas liquid or dissolved solids to a surface.

IDENTIFICATION OF PROCESS

SORPTION

Sorption is a physical and chemical process by which one substance becomes attached to another. Sorption is classified into three types

- **Absorption -** the inclusion of a substance in one state into other state of a different phase.
- **Adsorption -** the physical adherence or bonding of ions and molecules onto the surface of another phase
- **Ion exchange -** an exchange of ions between two electrolytes or between an electrolyte solution and a complex

GAS ABSORPTION

The combination of a material in one state into another state is mentioned as absorption. For example gas absorbed by liquid and liquid captivated by solid. In chemistry, absorption is a chemical or physical phenomena where the atoms, molecules, ions in gaseous condition. It is not synonymous with adsorption where some other substance seizes something. Nernst partition law emphasis on absorption being a physical process is not accompanied by other processes. The ideal gas law regularly emphasis the gas absorption. In other words partial pressures are restrained rather than concentration. Technologically chemical process swaps physical process of absorption.

GAS ADSORPTION

Gas adsorption can provide a convenient, cheap and reusable method for fluid purification. Thus the attraction of various molecules on the surface, as well as the total surface area of the catalyst is extremely important properties of potential catalytic materials.

- **Chemisorptions** : Because of covalent bonding physiognomies
- **Physisorptions** ：Because of van der waals weak force physiognomies

MATERIALS IDENTIFIED

Commercial Activated Carbon (wooden charcoal) is chosen as potential materials for Carbon dioxide adsorption. Porous material is used as adsorbents in laboratory conditions. Charcoal being a porous material has higher surface area and melting point which are essential requirements of our system. Charcoal is cheaper and we can find a cost effective system for carbon dioxide reduction in diesel engines. Charcoal also adsorbs harmful gas. Increasing the efficiency of this system decreases the overall carbon emission to a certain extent.

COMMERCIAL ACTIVATED CARBON (WOODEN CHARCOAL)

Activated carbon is a light black rest consisting of carbon, and any remaining ash, obtained by removing water and other explosive constituents from dry wooden substances. Charcoal is usually produced by slow pyrolysis, the heating of wood or other substances in the absence of oxygen. It is usually an impure form of carbon as it contains ash; however, particularly if it is not made by heating but by a dehydration reaction with sulfuric acid to minimize introducing new impurities, as impurities can be detached from the sugar in advance.

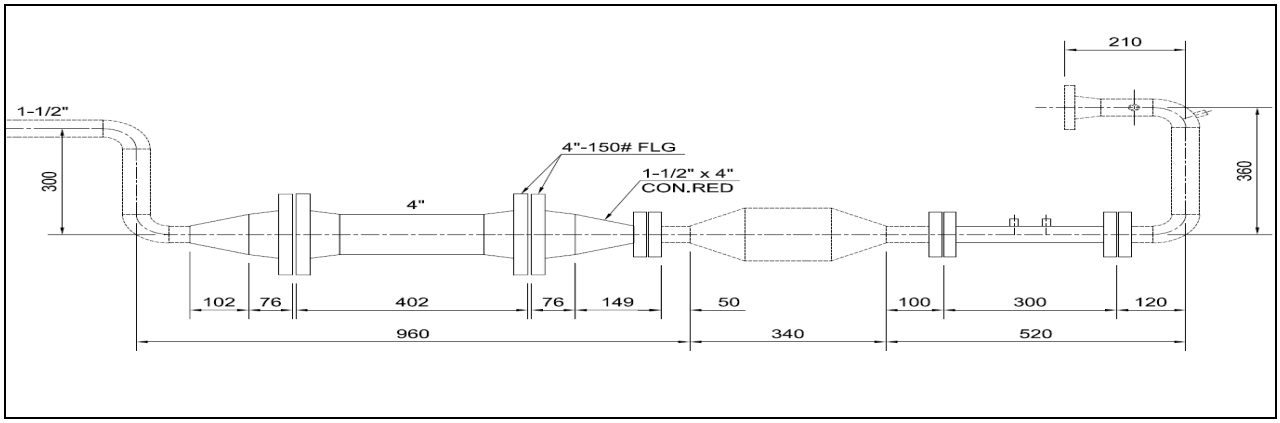
POTASSIUM HYYDROXIDE

KOH is notable as the precursor to most soft and liquid soaps as well as abundant potassium-containing chemicals.

MATERIAL SOURCING

Wooden charcoal is impregnated with KOH in laboratories. The samples can be purchased at cheaper cost. Wooden charcoal is easily available in market. These two materials are used for our tests.

EXPERIMENTAL SETUP TWO-DIMENSIONAL VIEW OF PROJECT



CONCLUSION

FINDINGS

The main objective of this project is to investigate if Wooden charcoal can be used as a surface adsorbent to adsorb carbon dioxide and we have found out that it can be used to reduce the percentage output of CO2.From this project we can find that wooden charcoal can adsorbs even at higher temperatures and relatively high pressure. The performance of the system can be improved if we have less back pressure.

LIMITATIONS

The main limitation encountered in this project is the back pressure of the exhaust gas after connecting the chamber. When the gases pass through the chamber they create back pressure in the tailpipe which results in over heating of engine. The system needs to withstand the temperature of the engine

REFERENCES

1. K. Rajalakshmi, Photocatalytic reduction of carbon dioxide in conjunction with decomposition of water on oxide semiconductor surfaces, journal of electroanalytical chemistry, 396, 21-26, (2012).
2. Cheng-Hsiu Yu and Chih-Hung Huang, Chung-Sung Tan, A Review of CO2 Capture by Absorption and Adsorption, Aerosol and Air Quality Research,12 (2012).
3. Jian-Rong Li a and Yuguang Mab, Carbon dioxide capture-related gas adsorption and separation in metal organic frame works, Coordination Chemistry Reviews, 255 (2011).
4. Bo Guolt, Liping Chang and Kechang Xiel, Adsorption of Carbon Dioxide on Activated Carbon, Natural Gas Chemistry, 15 (2006).
5. M.Aulice scibioh and P.V Ragini, Reduction of CO2 by nickel macrocycle catalyst at HMDE, Chem. Sci , 4 (2001).
6. Slamet and Hosna W. Nasution, Photocatalytic reduction of CO2 on copper-doped Titania catalysts prepared by improved-impregnation method, Catalysis Communications, 6 (2005).
7. Carlo Perego and Pierluigi Villa, Catalyst preparation methods, catalysis today, 34 (1997).
8. Cristian Contescu and Adriana Contescu, Methods for Preparation of Catalytic, Syracuse University.
9. Aslı Ertan, CO2, N2 and Ar Adsorption on Zeolites, M.Sc Dissertation in chemical Engineering.
10. Durairajan, A.Kavitha and T. Rajendran, A Control in automobiles for green environment, Indian J. Innovations Dev., Vol. 1, No. 5 (May 2012).
11. Tim Johnson, Diesel Engine Emissions and Their Control, corning environmental technologies.
12. Ralph H. Gonzales, Diesel Exhaust emission system temperature test, San Dimas Technology and developmnt center. (2008).
13. B Pawelec, J L G Fierro, Charactarisation of catalysts: Bulk and texture, Instituto de catalysis.
14. Istadi , N.A.S. Amin, Catalytic-Dielectric Barrier Discharge Plasma Reactor For Methane And Carbon Dioxide Conversion, Bulletin of Chemical Reaction Engineering & Catalysis, 2 (2007).
15. Dr. S. Rajadurai and R. K. Anulatha, Carbon Dioxide Fixation – The Must and The Path, International Journal of Science and Advanced Technology, 164 - 171,Vol. 2, No 5 (2012).