CO_2 EMISSION RECTIFIER BY USING POTASSIUM CARBONATE AND POTASSIUM HYDROXIDE

Vijayaraghavan P[1], Sheril S[2], Thalaimalaiyan[3]

[1] *Assistant Professor,Mechanical department,Prince Shri Venkateshwara Padmavathy Engineering College, Chennai, India.*

[2] *Assistant Professor,Mechanical department,Prince Shri Venkateshwara Padmavathy Engineering College, Chennai, India.*

[3] *Assistant Professor,Mechanical department,Prince Shri Venkateshwara Padmavathy Engineering College, Chennai, India*

ABSTRACT

The main aim of this project is to reduce or minimize the CO_2 emission by designing and fabricating a dissolver solvent setup which comprises of the chemical solvent. In which the design setup is dumped with the chemical Potassium Hydroxide inside in it. The design setup which is constructed is fitted over to the tail pipe thus, the flue gas passes through it. Such that the CO_2 present in the high concentration enters in it so that the level of co_2 in it is reduced to considerable amount. This need is met in our project titled"CO_2 EMMISION RECTIFIER BY CHEMICAL SYSTEM". Because Carbon dioxide (CO_2) makes up the largest share of "greenhouse_gases". The addition of man-made greenhouse gases to the Atmosphere disturbs the earth's radiative balance. This is leading to an increase in the earth's surface temperature and to related effects on climate, sea level rise and world agriculture.

Key words: *United Nations Framework Convention on Climate Change (UNFCCC), vehicular emissions.*

---

1. Introduction

The main aim of this project is to reduce or minimize the CO_2 emission by designing and fabricating a dissolver solvent setup which comprises of the chemical solvent.The design setup which is constructed is fitted over to the tail pipe thus, the flue gas passes through it. Such that the CO_2 present in the high concentration enters in it so that the level of CO_2 in it is reduced to considerable amount.As we all know that Carbon dioxide(CO_2) is the major components of a 'Green house effect' which causes a disaster criteria called 'Global warming'. The greenhouse gases released from car emissions will remain in the atmosphere for years before their levels decrease, so its effect on global warming will remain for some time.Global warming is caused by the emission of greenhouse gases . 72% of the totally emitted greenhouse gases is carbon dioxide (CO_2), 18% Methane and 9% Nitrous oxide (NO_x). Carbon dioxide emissions therefore are the most important cause of global warming. CO2 is inevitably created by burning fuels like e.g. oil, natural gas, diesel, organic-diesel, petrol, organic-petrol, ethanol. The emissions of CO_2 have been dramatically increased within the last 50 years and are still increasing by almost 3% each year.

The various effects of climate change pose risks that increase with global warming (i.e., increases in the Earth's global mean temperature). The IPCC has organized many of these risks into five "reasons for concern:" threats to endangered species and unique systems, damages from extreme climate events, effects that fall most

heavily on developing countries and the poor within countries, global aggregate impacts (i.e., various measurements of total social, economic and ecological impacts), and large-scale high-impact events. The above "burning embers" diagram was produced by the IPCC in 2001. A later revision of the diagram, published in 2009, but not approved by the IPCC, shows increased risks.

The effects of global warming are the ecological and social changes caused by the rise in global temperatures. Evidence of climate change includes the instrumental temperature record, rising sea levels, and decreased snow cover in the Northern Hemisphere. Most of the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in human greenhouse gas concentrations. Projections of future climate change suggest further global warming, sea level rise, and an increase in the frequency of some extreme weather events. Parties to the United Nations Framework Convention on Climate Change(UNFCCC) have agreed to implement policies designed to reduce their emissions of greenhouse gases to avoid dangerous climate change.

Data Collection

Observations show that there have been changes in weather. As climate changes, the probabilities of certain types of weather events are affected.

Changes have been observed in the amount, intensity, frequency, and type of precipitation. Widespread increases in heavy precipitation have occurred, even in places where total rain amounts have decreased. Authors of the IPCC Fourth Assessment Reportconcluded that human influences had, more likely than not (greater than 50% probability, based on expert judgement), led to an increase in the frequency of heavy precipitation events.

Potassium hydroxide(figure 1) is an inorganic compound with the formula KOH, commonly called caustic potash.Potassium carbonate (K_2CO_3)(figure 2) is a white salt, soluble in water (insoluble in alcohol), which forms a strongly alkaline solution. Complementary to its reactivity toward acids, KOH attacks oxides. Thus, SiO_2 is attacked by KOH to give soluble potassium silicates. KOH reacts with carbon dioxide to give bicarbonate.These two chemicals has been used in the project for the better outcome of result.

The first Indian emission regulations were idle emission limits which became effective in 1989. These idle emission regulations were soon replaced by mass emission limits for both gasoline (1991) and diesel (1992) vehicles, which were gradually tightened during the 1990's. Since the year 2000, India started adopting European emission and fuel regulations for four-wheeled light-duty and for heavy-duty vehicles. Indian own emission regulations still apply to two- and three-wheeled vehicles.

On October 6, 2003, the National Auto Fuel Policy has been announced, which envisages a phased program for introducing Euro 2 - 4 emission and fuel regulations by 2010. The implementation schedule of EU emission standards in India is summarized in following table 1,2 ,3&4 respectively.

Model Building

Models can be physical models or mathematical models. Mathematical models use symbolic and mathematical equations to represent a system. The system attributes are represented by variables , and the activities are represented by mathematical functions that interrelate the variables.In the context of the above, models were proposed to be built to study the effect of the various components of traffic plying on urban roads Neural networks are nonlinear sophisticated modeling techniques that are able to model complex functions. They can be applied to problems of prediction, classification or control in a wide spectrum of fields such as finance, cognitive psychology/neuroscience, medicine, engineering, and physics.Neural networks are used when the exact nature of the relationship between inputs and output is not known. A key feature of neural networks is that they learn the relationship between inputs and output through training. There are three types of training in neural networks used by different networks, supervised and unsupervised training, reinforcement learning, with supervised being the most common one.

This is the construction of our project which has been designed.This is made up of iron and given lining with rubber inside it. The schematic diagram for the design setup (i.e.) the rectifier is shown in figure.3.The setup consists of hollow pipe (acrylic) such that the flue gases pass through it in which no. of holes has been already drilled. The gap inside the rectifier setup is filled up with potassium hydroxide, which is the main absorbent of the carbon di oxide.Also 3-D exploded view of CO_2 rectifier setup is shown in figure 4.

Since the gases N2 & H2O won't cause much effect to the atmosphere our main aim is to reduce or completely precipitate the flue CO2 using the amine-based solvent, by fabricating the mechanical system based chemical

dissolver setup.

The main aim of this project is to reduce the major atmospheric pollutant which is so adverse in it's high concentrations named carbon di oxide(CO2). This is the project which is simple mode of absorbing of carbon-di-oxide from the automobile exhaust emission. In which the design setup which is dumped with the chemical inside in it. The design setup which is constructed is fitted over to the tail pipe thus, the flue gas passes through it. Such that the co2 present in the high concentration enters in it so that the level of co2 in it is reduced to considerable amount. The chemical thus used continuously and requires periodic replacement as like filters.

This is the compact setup which can be installed inside the exhaust manifold itself so that space requirement may not be a constraint. It controls the level of co2 emitted outside so that the serious disaster for our Earth "Global warming" may be reduced to some extent. The exhaust flue gases from the automobile passes first to the catalytic converter then to the muffler/silencer and then to our setup. As the exhaust entering in the catalytic converter consists of the flue gases like CO, HC, NO_x which is rectified to the form of CO_2, N_2, H_2O.As the co2 level is considerably high compared to other gases, it is going to be minimized to lower levels.

Then the gas passes to our setup where the co2 along with the other gases reacts with the potassium hydroxide. So that it forms,

$$2KOH + CO2 \rightarrow K2CO3 + H2O$$

Therefore the net output result is potassium carbonate.

Emission results with set up and without set up has been tabulated in table 5 & table 6. Based on parameters involved regulation limit and actual value is shown as results.

Table 1 Indian Emission Standards (4-wheel vehicles)

Indian Emission Standards (4-Wheel Vehicles)			
Standard	**Reference**	**Date**	**Region**
India 2000	Euro 1	2000	Nationwide
Bharat Stage II	Euro 2	2001	NCR*, Mumbai, Kolkata, Chennai
		2003.04	NCR*, 11 Cities†
		2005.04	Nationwide
Bharat Stage III	Euro 3	2005.04	NCR*, 11 Cities†
		2010.04	Nationwide
Bharat Stage IV	Euro 4	2010.04	NCR*, 11 Cities†
* National Capital Region (Delhi) † Mumbai, Kolkata, Chennai, Bangalore, Hyderabad, Secunderabad, Ahmedabad, Pune, Surat, Kanpur and Agra			

Table 2 Emission Standard For Light duty Vehicles

Emission Standards for Light-Duty Vehicles, g/km						
Year	**Reference**	**CO**	**HC**	**HC+NOx**	**NOx**	**PM**
Diesel						
1992	-	17.3-32.6	2.7-3.7	-	-	-
1996	-	5.0-9.0	-	2.0-4.0	-	-
2000	Euro 1	2.72-6.90	-	0.97-1.70	-	0.14-0.25
2005†	Euro 2	1.0-1.5	-	0.7-1.2	-	0.08-0.17
2010†	Euro 3	0.64 0.80 0.95	-	0.56 0.72 0.86	0.50 0.65 0.78	0.05 0.07 0.10
2010‡	Euro 4	0.50 0.63 0.74	-	0.30 0.39 0.46	0.25 0.33 0.39	0.025 0.04 0.06
Gasoline						
1991	-	14.3-27.1	2.0-2.9	-	-	-
1996	-	8.68-12.4	-	3.00-4.36	-	-
1998*	-	4.34-6.20	-	1.50-2.18	-	-
2000	Euro 1	2.72-6.90	-	0.97-1.70	-	-
2005†	Euro 2	2.2-5.0	-	0.5-0.7	-	-
2010†	Euro 3	2.3 4.17 5.22	0.20 0.25 0.29	-	0.15 0.18 0.21	-
2010‡	Euro 4	1.0 1.81 2.27	0.1 0.13 0.16	-	0.08 0.10 0.11	-
* for catalytic converter fitted vehicles, † earlier introduction in selected regions, ‡ only in selected regions						

Table 5 Emission result without setup

PARAMETERS	REGULATION LIMIT	ACTUAL VALUE

CO (% BY VOL.)	**3.5**	**1.85**
HC (PPM)	**4500**	**187**

Table 6 Emission result with setup

PARAMETERS	REGULATION LIMIT	ACTUAL VALUE
CO (% BY VOL.)	**3.5**	**1.85**
HC (PPM)	**4500**	**187**

Fig. 1. structure of Potassium hydroxide

Fig. 2. Structure of Potassium Carbonate

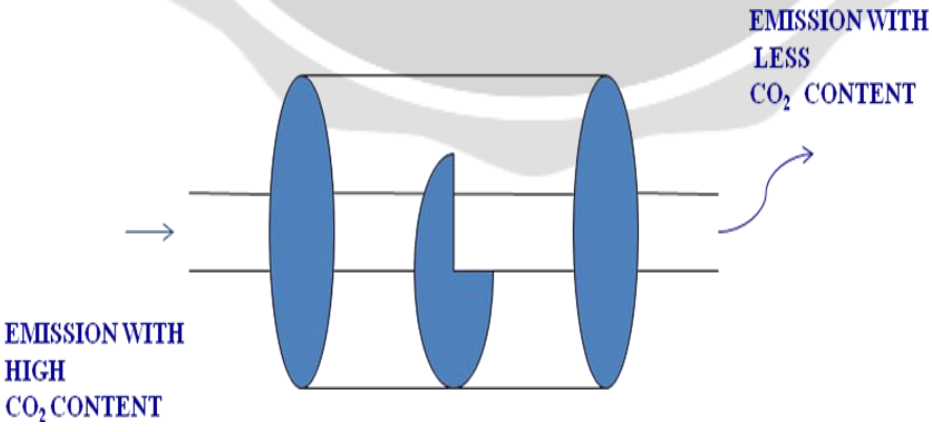

Fig. 3. Design Setup

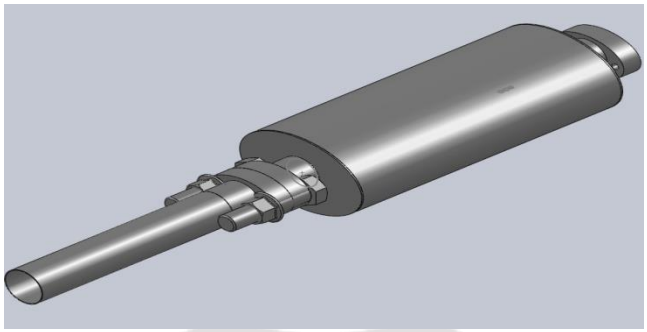

Fig. 4. 3-D exploded view of CO2 rectifier setup

CONCLUSION

Thus we successfully designed a chemical setup which can be implemented in all the two and four wheelers as well as in the heavy duty vehicles with the variation in the chemical quantity so thereby reducing the quantity of carbon di-oxide released into the atmosphere. We have manipulated the calculations as well as used the help of the software "PRO-E " for designing the 3-D modal of the project. Thus the project process was done with consciousness as much as possible. Finally our project became into the real model of what we are witnessing at the present with an immense and drastic change in the amount of carbon content released into the atmosphere. Thus by contributing something to our Planet Earth.

REFERENCE

Enting, I.G., 1987: Interannual variation in the seasonal cycle of carbon dioxide concentration at Mauna Loa. Journal of Geophysical Research 92:D5, 5497–5504.

Toxicity of Carbon Dioxide Gas Exposure, CO2 Poisoning Symptoms, Carbon Dioxide Exposure Limits, and Links to Toxic Gas Testing Procedures By Daniel Friedman – InspectAPedia

"Carbon Dioxide as a Fire Suppressant: Examining the Risks". U.S. Environmental Protection Agency:

Greenwood, N. N.; Earnshaw, A. (1997). Chemistry of the Elements (2nd ed.). Butterworth-Heinemann.ISBN 0080379419.

M. Aresta (Ed.) "Carbon Dioxide as a Chemical Feedstock" 2010, Wiley-VCH: Weinheim. ISBN 978-3-527-32475-0

Colin Finn, Sorcha Schnittger, Lesley J. Yellowlees, Jason B. Love "Molecular approaches to the electrochemical reduction of carbon dioxide" Chemical Communications 2011, 0000.doi:10.1039/c1cc15393e

"Phase change data for Carbon dioxide". National Institute of Standards and Technology. Retrieved 2008-01-21.