

GAS EMISSION CONTROL SILENCER

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Abstract -Automobile silencer is a part designed for reduction of noise and exhaust gases produced. The silencer performs important function in the overall working of internal combustion engine. During removal of exhaust gases this system produce various pollutant gases like oxides of nitrogen (NO_x), unburned hydrocarbon (HC), carbon monoxide (CO). These pollutant gases are mainly responsible for air pollution in all over the world. Humans may get affected by these pollutant gases and suffer with various diseases related to nose, brain, asthma, cancer etc. So Gas Emission control silencer is our attempt for finish and suggesting an effective solution on air pollution causing by automobile.

Keywords: oxides of Nitrogen (NO_x), unburned hydrocarbon (UBHC), Carbon mono-oxides (CO), Lead (Pb), Activated charcoal layer.

I. INTRODUCTION:

Now a day the numbers of vehicles on the road are increasing day by day. By the survey of Indian government in 31 March 2015 there are 154.3 million bikes, 28.6 million cars, 2 million buses, 9.3 million goods carrier vehicles registered and present on the road. These figures of vehicles are huge in numbers as India was the 4th largest motor vehicle/car manufacturer in the world in 2016. But these large numbers of vehicle are producing various problems related to health (human health) and environment.

The exhaust system of old vehicles is producing more pollutant gases. These gases are extremely dangerous. The pollutant gases are causing various diseases to humans. The hot gases are increasing the environmental temperature. They also contribute a major role in depletion of ozone layer surrounding the atmosphere. So we choose our project as to reduce the exhaust emission.

II. MAJOR POLLUTANT GASES

1. Carbon Monoxide (CO): CO is a colorless gas so it is difficult to detect in the primary stages. It gets mixed in the blood and creates various impurities by damaging the blood cells. When higher amount of CO is inhaled through breathing it causes headache, and nausea, further major effect causes death.
2. Nitrogen of Oxide (NO_x): It is a irritant gas, which at high concentrations causes inflammation. NO_x is responsible for producing smoke and acid rain, also NO_x forming a fine particles which is affect in ozone layer.
3. Unburned Hydrocarbons: It is toxic gas released due to improper combustion which causes the adverse effect on human health like irritation in the eye and lungs respiratory diseases.
4. Carbon Dioxide: It is harmful gas produce due to incomplete combustion of fuel, which cause adverse effect on human health like vision damage, lung congestion, central nervous system injuiry, abrupt muscle contraction blood pressure problem and shortness of breath, vomiting, headache.

III. COMPONENTS USED

- 1) **Perforated Tube:** The perforated tube consists of number of holes of different diameters. It is used to convert high mass bubbles to low mass bubbles. The charcoal layer is pasted over the perforated tube. Generally 4 sets of holes are drilled on tube. Other end of the tube is closed by plug.
- 2) **Charcoal :** charcoal is a porous substance, it is mainly composed of carbon as the primary substance. Charcoal have a special ability to absorb pollutant like CO, CO₂ and other unburned hydrocarbons. Charcoal layer is wrapped on the perforated tube and kept in first compartment.
- 3) **Outer Shell:** The whole setup was kept inside the outer shell. It is made up of iron or steel. The water inlet, outlet and exhaust tube was provided in the shell itself.
- 4) **Netted steel plates:** Netted steel plates are connected to each other for producing a layer of them. The urea in liquid form is sprayed on the nets. Liquid urea is dried for some times and then these plates are set in the outer shell
- 5) **Urea :** Urea in powder form is used for this project. 1kg urea powder is dissolved in 1 liter of water to create concentrated solution. This solution was kept for 1 hour in the atmosphere. This solution was sprayed on the netted steel plates and dried.

IV. EXPERIMENTATION:

ENGINE SPECIFICATION:

Type: 4 Stroke, Single Cylinder, Air-cooled,
 Displacement: 102cc
 Max Power: 7 bhp @7000 rpm
 Transmission: V-Matic
 Oil Capacity: 0.8 Ltr
 Ignition: Self & Kick
 Engine provides decent fuel efficiency

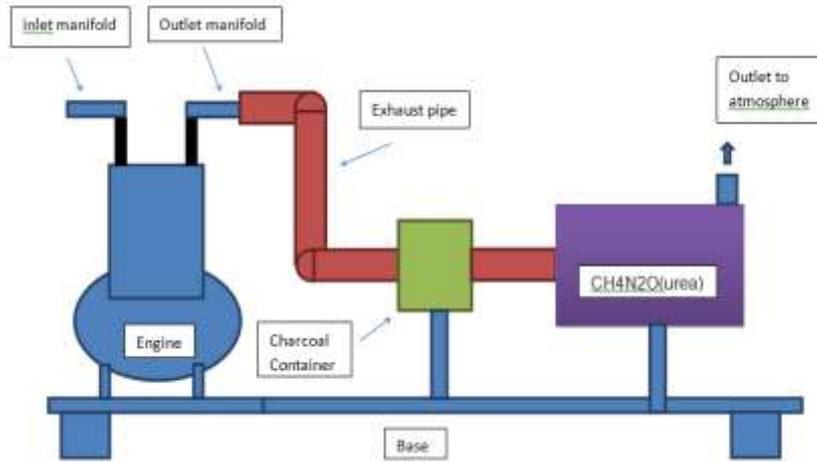


Fig No 1

Assembly:

Engine is mounted on the base support and fitted their by using nut and bolts.. Welding is also done On several parts to provide additional strength. The perforated tube is fitted in the outer shell and adjusted according to the requirements. The perforated tube's half part is covered by the layer of charcoal and it is fitted in the compartment number 1. Urea in powder form is converted into liquid with mixture of water to form concentrated solution. This solution is then sprayed on the netted plates and allowed to cool down for some time. After drying the plates are fitted to form a layer. The outer shell is closed by using a seal. A small opening is kept on seal to allow passing of exhaust gases.



Fig No 2: Assembly

2) PUC Test:**Pollution** Under Control test is used on the exhaust system of the GEC silencer to check the level of pollutant gases. This test results were compared with the conventional silencer of aviator engine. PUC test was taken for 2 loads on each system as follow

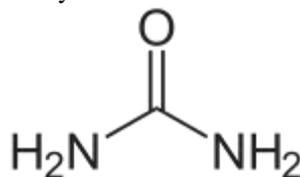
- 1) For conventional silencer system connected with silencer
- 2) Fabricated Gas emission control silencer..

The PUC test clearly showed the reduced amount of pollutant gases level with the tabular comparison.

V. Working Principle:The exhaust outlet is connected to GEC silencer as shown in fig No 2. The exhaust gas is 1st enter in compartment no 1 and pass through charcoal layer which lead to filter the CO and CO₂ contain in exhaust gas. After that the exhaust gas enters in second compartment, it reacts with urea which is spread on netted plates and amount of NO_x get reduced by chemical reaction which takes place between exhaust gas and urea. As like this pollutant gases gets reduced.

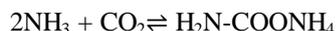
VI. CHEMICAL REACTIONS:Urea or carbamide is an organic compound with the chemical formulaCO(NH₂)₂. The molecule has two —NH₂ groups joined by a carbonyl (C=O) functional group. Urea serves an important role in the metabolism of nitrogen-containing compounds by animals, and is the main nitrogen-containing substance in the urine of mammals. It is a colourless, odourless solid, highly soluble in water, and practically non-toxic (LD₅₀ is 15 g/kg for rats). Dissolved in water, it is neither acidic nor alkaline. The body uses it in many processes, most notably nitrogen excretion. The liver forms it by combining two ammonia

molecules (NH₃) with a carbon dioxide (CO₂) molecule in the urea cycle. Urea is widely used in fertilizers as a source of nitrogen and is an important raw material for the chemical industry.

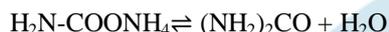


CHEMICAL STRUCTURE OF UREA

- The first is carbamate formation: the fast exothermic reaction of ammonia with gaseous carbon dioxide (CO₂) at high temperature and pressure to form ammonium carbamate (H₂N-COONH₄).



- The second is urea conversion: the slower endothermic decomposition of ammonium carbamate into urea and water:



The overall conversion of NH₃ and CO₂ to urea is exothermic, the reaction heat from the first reaction driving the second. Like all chemical equilibrium, these reactions behave according to Le Chatelier's principle, and the conditions that most favour carbamate formation has an unfavourable effect on the urea conversion equilibrium.

VII. Results & Discussions:

The result analysis on conventional silencer and Gas Emission Control silencer are compared by using table no 1 and 2.

Table No 1

LOAD 1	Petrol		Gas Emission Control Silencer	
	Pollutant	PPM	Pollutant	PPM
	CO	0	CO	0.000
	HC	8	HC	4
	CO ₂	1.10	CO ₂	0.60
	O ₂	22.11	O ₂	22.11
	LDA	0.000	LDA	0.000

Table No 2

LOAD 2	Petrol		Gas Emission Control Silencer	
	Pollutant	PPM	Pollutant	PPM
	CO	0	CO	0.000
	HC	8	HC	4
	CO ₂	1.10	CO ₂	0.10
	O ₂	22.16	O ₂	20.15
	LDA	0.000	LDA	0.000

The result of comparison shows the reduction in amount of pollutant gases. As per comparison amount of unburned hydrocarbons is reduced by 50%. The amount of Carbon dioxide is reduced by 45%. The amount of Oxygen contain in exhaust gas is remain unaffected

VIII. ACKNOWLEDGMENT

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