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Fabrication and Testing of Eco-Friendly Silencer

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ABSTRACT: Air is an inexhaustible natural resource which is very essential for the survival of all the living organisms on earth. But Industrialization and urbanization with increased emissions have resulted in a profound deterioration of air quality. Air pollution not only degrades the public health but also effects the earth's environment. Although increasing number of countries enforces stricter regulations to prevent further emissions of air pollutants, there is still a lot to do on an individual level. So here we made an attempt to fabricate a eco-friendly silencer for the vehicle which deals with the reduced emissions and noise. This silencer is generally attached to the exhaust of an IC engine. In this silencer both Limestone and charcoal are used to absorb the emitted gases like HC and CO from the engine exhaust. The final emission is analyzed using an automobile gas analyzer to measure the percentages of reduction of gases HC and CO.

KEYWORDS: Air Pollutants, Silencer, Emissions, eco-friendly.

I. INTRODUCTION

In recent years, the influence of automobile emissions and noise on the environment has become an increasingly serious problem. The Un-burnt Hydro Carbon (UBHC), (NO_x) main pollutants contributed by automobiles are (CO), and Lead etc. Other sources which cause pollution are electric power generating stations and Industries. So it is imperative that serious attempts should be made to conserve earth's environment from degradation. These substances called pollutants can occur naturally or they can be produced by human activities.

Natural pollutants include dust, pollen, salt particles, smoke from forest fires, and gases from organic waste. Most of the pollution caused by human activities is directly or indirectly the result of burning of fuels in furnaces or engines. Petrol and diesel engines are widely used for commercial and individual transportation due to their good fuel efficiency and durability for 2-Wheeler, 4-Wheeler Motor Vehicles. However, Engine emissions are harmful to human health and to the environment. Emission control regulations have been introduced in all industrialized countries in order to reduce the emissions of vehicles powered by internal combustion engines. The pollutants that to be limited are Hydrocarbons (HC), carbon monoxide (CO) oxides of nitrogen (NO_x) and particulate matter (PM). Additional reduction in these emissions is mandatory to comply with upcoming stringent emission standards, such as EUROV (Europe), US 2010(U.S.A), BS4 (India).in Fig 1.1.

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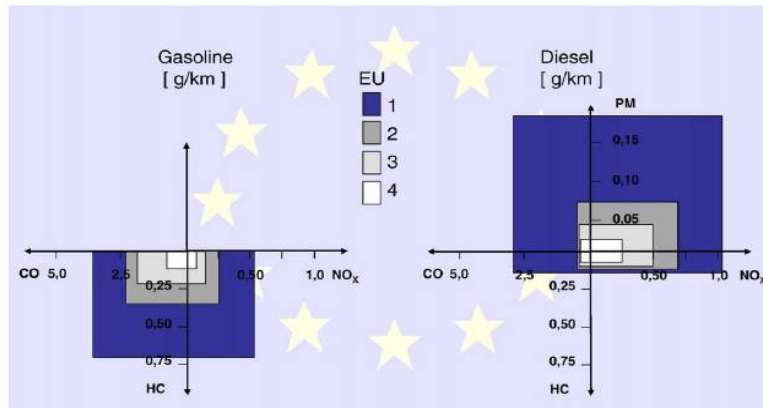


Fig 1.1:-Emission control regulations for passenger cars in the European Union

II.LITERATURE REVIEW

D. Agrawal, et al., (2006) [1] has showed that engine operated with rice bran oil (RBO) biodiesel while employing EGR results in NO_x reduction without compromising engine performance and emissions. It was found that with increase in load exhaust gas temperature also increases, and temperature of exhaust gas was found to be lower in case of EGR-operated engine. A.K. Agrawal et al., (2008) [2] worked to observe the effect of EGR on exhaust gas temperature and exhaust opacity in CI Engines. It was observed that, as EGR rate increases exhaust gas temperature decreases significantly. However, this result also concludes that NO_x can be decreased by increasing EGR rate. The reason for decreasing exhaust gas temperature was stated as considerable decrease in oxygen content in recirculation of exhaust gas to fresh air/charge. P.V Walke et al., (2008) [3] had given emphasis to control oxides of nitrogen (NO_x). Experiments were conducted on computerized single cylinder four-stroke diesel engine fitted with EGR cooler and control valve to regulate rate of EGR. It was found that smoke emission increases with increase in EGR rate for different torque and concentration of NO_x decreases with increasing rate of EGR. D.T. Hountalas et al., (2008) [4] had established effect of EGR temperature for various EGR rate on HDDI engine, performance and emission. They have examined the effect of cooled EGR and hot EGR on EGR rate for turbo-charged HDDI diesel engine using multi-zone combustion model, computational investigation. Author stated that EGR influences diesel engine combustion in three different ways thermal, chemical and dilution. Alahmer A et.al (2010) [5] has worked on Emulsions of diesel by adding water at different percentages of about 5% and 30% by volume and found that, at high amount of water addition, the nitrogen oxide decreases. And the disadvantage is that the diesel emulsion fuel emits more CO₂ than that of pure diesel. SudamPadhan et.al (2013) [6] has studied on SO_x emissions when high sulphur content fuel is burnt. In his study the lime stone is used which is used to desulfurize the sulphur oxide emissions. And also said that in order to desulfurize first we have to calculate the amount of calcium oxide. Lower the Calcium Oxides (CaO) will increase the Lime stone consumption. Sakhrieh et.al (2013) [7] Experimental Study On Exhaust Gas After Treatment Using Limestone, In this study a simple low-cost exhaust gas after-treatment filter using limestone was developed and tested on a four cylinder DI diesel engine coupled with dynamometer under variable engine running conditions. Limestone was placed in cast iron housing through which exhaust gases passes. The concentration of both carbon dioxide and nitrogen oxides were measured with and without the filter in place. It was found that both pollutants were decreased significantly when the filter is in place, with no increase in the fuel consumption rate. HorgniesMatthieu et.al (2014) [8] has conducted experiments on the nitro oxides (NO_x) which is released from the automobiles. His study shows that concrete doped with activated charcoal can absorb NO₂ and could be used to limit the pollution peaks in confined spaces. Nouby. M et al., (2014) [9] has studied on various causes and how to reduce the noise that was caused by muffler of an exhaust system. The author has studied different journals, papers and conferences and published an over view of current trends. Prof.AnupM.Gawande et.al (2016) [10] worked on Aqua Silencer which is fitted to exhaust pipe of engine. It reduces the emission gases from engine using lime water, charcoal layer and perforated tube with the use of perforated tube

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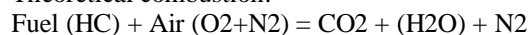
back pressure always remains constant and sound level of exhaust reduces. The disadvantage of it is frequent water filling is required. Shaik Sameer et.al (2016) [11] has worked to reduce the emission and control of carbon dioxide percentage form automobiles, theoretical and practical methods of adsorption of carbon dioxide using activated charcoal (carbon) in diesel operated engines is conducted. In this experiment emission of carbon dioxide from the diesel operated engines, which is about 9.266% of the overall emission from a vehicle is controlled successfully. Mylaudy S. Rajadura et.al(2016) [12] has worked on Exhaust Gas Flow Control Parameters to Control CO₂Emission with the Aid of Pre-heated ZSM-5 Zeolite Supported by Lime Water Testing describes Carbon dioxide emission control from automobiles termed to be the vast activity and various techniques were under research to overcome this problem. One of the way to reduce the CO₂from automobile is implementation of ZSM-5 Zeolite in the exhaust flow chamber. Here the zeolite was preheated to increase its porosity and ability to capture the carbon emission through exhaust. Mudssar M .Bagwan et al., (2016) [13] has studied on effect of exhaust gas recirculation (EGR) on CI engine parameters (i.e. performance and emission parameter). Here the literature is done on CI Engines fitted with EGR using diesel and bio diesel was carried out. It was noticed that bio diesel is better than pure diesel and also found that by using EGR system the NO_x emission reduces effectively. Kannan P et al., (2016) [14] has worked on corrosion of Automobile silencers. They have taken Stainless steel, Carbon fibre and Glass fibre. These materials are analyzed in Ansys where there Stress, Strain and Deformation were analyzed and the results proved that the existing mild steel material can be replaced with optimized carbon fiber material because of its low deformation and elastic strain values. S.Raffek et al., (2017) [15] has done their work on Aqua Silencer which is mainly dealing with control of emission and noise in automobile exhaust. It is constructed by using activated charcoal, perforated tube and outer shell. The results shows that the emissions and noise are reduced effectively.

III.METHODOLOGY

In the present paper, a method has been proposed to absorb the emission gases from the exhaust. This silencer is an updated version of a normal silencer. As the exhaust gases enter into the proposed design silencer, emission gases is chemically react with it and pass through the charcoal layer which purify the gases. The gases like HC, CO is absorb from the emission. In this project a limestone, which is a very common sedimentary rock of biochemical origin, is uses as a main agent to reduce emissions such as NO_x, and CO_x caused by diesel and petrol engines.

The emissions of particulate matter PM₁ are effectively reduced by kaolin or limestone addition during O₂/CO₂ coal oxy-fuel combustion, because kaolin captures alkali metal compounds, while limestone reacts with sulfur effectively. The following are the equation described the difference between the formation of carbon-dioxide by theoretical and practical application.

Theoretical combustion:



Practical combustion:



The charcoal is highly porous and possesses extra free valences so it has high absorption capacity. The purified gases are then released into atmosphere.

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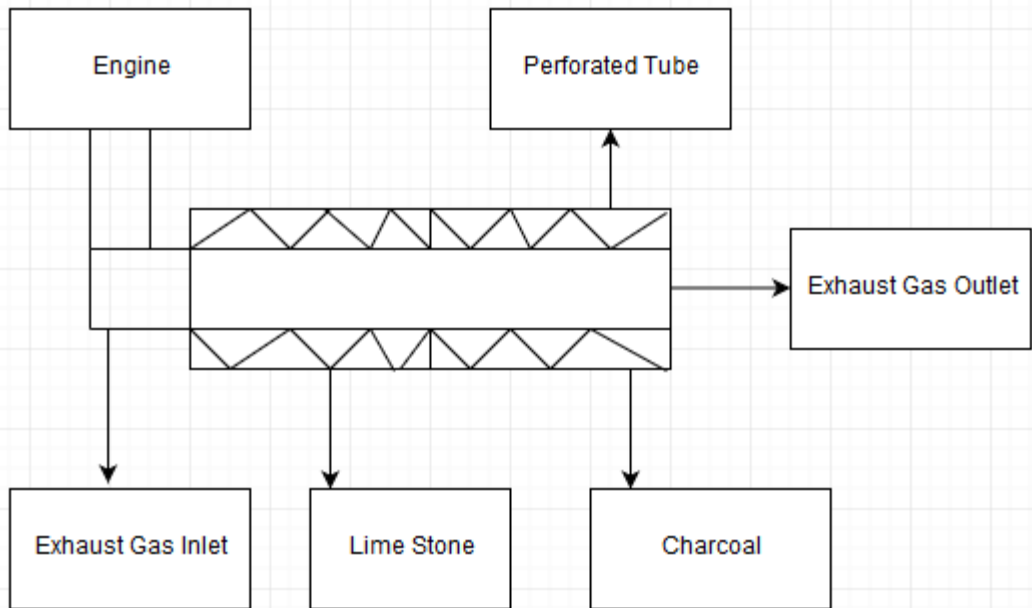


Fig 3.1: Proposed Sectional view of Eco-friendly silencer



Fig 3.2: Fabricated silencer coated with limestone and charcoal

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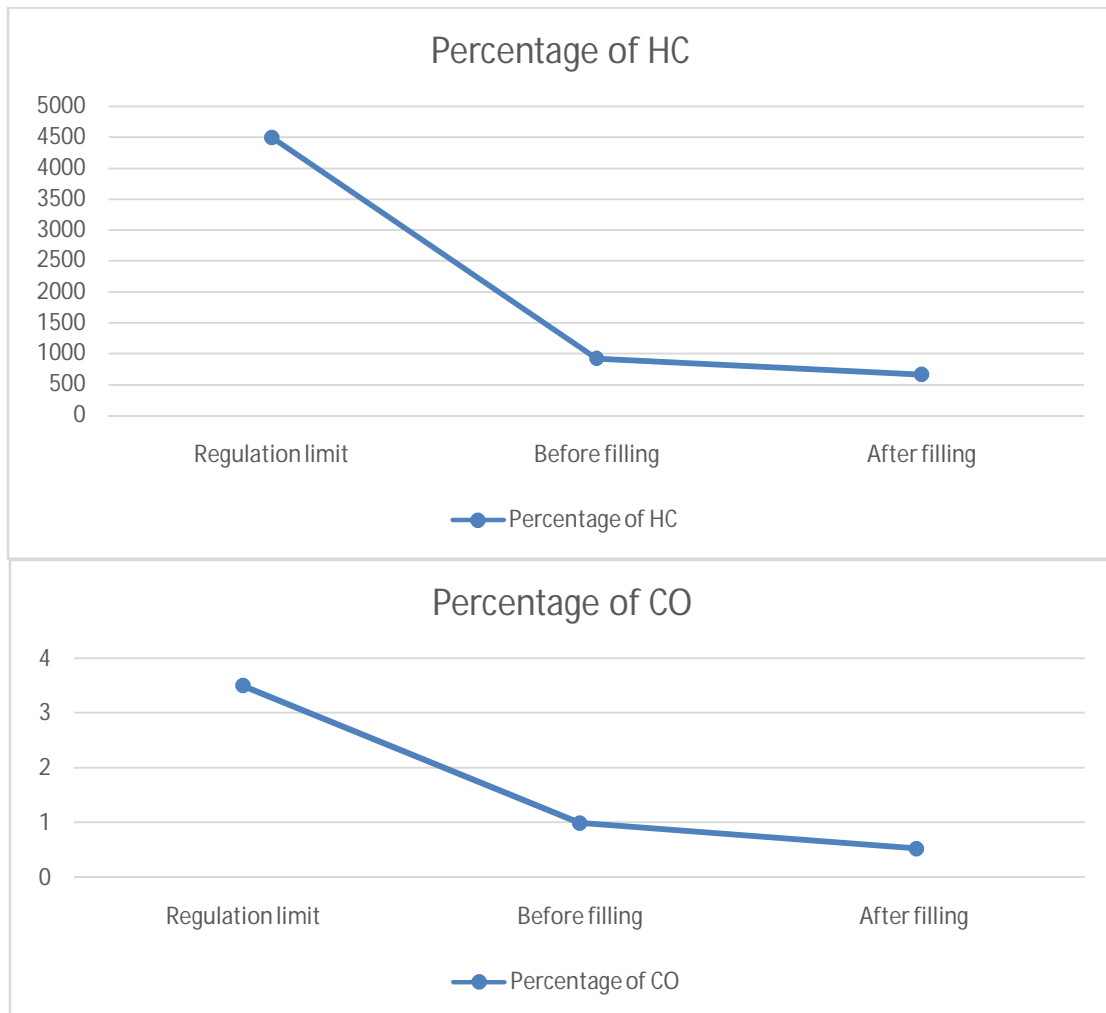
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IV.RESULT

From the following two graphs, it is clearly evident that, emissions are significantly reduced after filling with limestone and charcoal. we also observed that the engine is starting easily and no vibration during running of the engine in the exhaust system.



V.CONCLUSION

This eco-friendly silencer is more effective in the reduction of emission gases from the engine exhaust. The layers of limestone and charcoal on the perforated tube is absorbs the exhaust gases. These layers are also neutralizing harmful exhaust gases. After taking the pollution test, we observed a significant reduction in percentages of HC, CO when compared with conventional silencer. It is also observed that the fuel consumption remains same. As the materials used in the fabrication are naturally abundant and cheap, the total process will be cost-effective.

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