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Design and Development of Light Motor Vehicle Exhaust System for Emission Control and Noise Reduction

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Abstract: ***The ideal of this work is to develop a silencer that can amend dangerous exhaust discharge and noise produced in this conventional silencer. The health and hygienic policy depend upon the term air pollution. Weakened air causes physical ill-goods and decides undesirable aesthetic and physiological goods. Air pollution can be defined as an inclusion to atmosphere of any material solid or gases which will have a various effect on life. The main adulterants contribute by machines are unburned hydrocarbon (UBHC), oxides of nitrogen (NOx), carbon monoxide (CO), and Lead. This research work is an attempt and contribution in this direction; it's substantially dealing with the comb of emission and noise. This system is fitted to the exhaust pipe of the machine. This type of silencer is used to reduce emission, and Noise and also reduces its dangerous goods with the help of actuated outland, lime water. As the Sound produced under lime water is less audible than it produced in the atmosphere. This is because of small sprockets which are present in water motes, which lower their breadth and lower the sound position. Hence water is used in this silencer. These silencers are used to reduce the noise and control the emissions of dangerous feasts and release much lower weakened feasts to the terrain and it's easy to install.***

Keywords: Exhaust system, Emission Control, Noise Reduction, Light Motor Vehicle, Design

I. INTRODUCTION

The main reason that contributes to air pollution is machine deals and artificial machines release the feasts like carbon dioxide unburned hydrocarbons etc. in moment's life air pollution causes physical ill goods on mortal beings and also the terrain. Global warming is on our earth due to a major increase in pollution. Air pollution is a veritably serious problem on our earth the main element due to which the air pollution is adding is (CO), (Nox) and lead which are exposed from the vehicle and other sources like a big manufactory, electric power, generation factory, big diligence. Since hothouse gas emissions are frequently calculated as carbon dioxide coequals, they're called carbon emissions, when agitating global warming or the greenhouse effect. In diligence the burning of fossil energies has grown in high value, contemporaneously adding carbon dioxide situations in our atmosphere and therefore the rapid-fire increase of global warming. It has been long observed gasoline machine plays an important part in the transport assiduity, husbandry, mini and, numerous other diligences. To lower the noise pollution, the perforated tube can be used this substantially due to small holes present 'om' perforated tube which converts large mass burnt feasts into a small mass of burnt feasts. The sound produced under water is less audible than it produced in the atmosphere. This is because of small sprockets which are present in water motes, which lower their breadth and lower the sound position. The emission can be controlled by using the activated charcoal layer and it's largely pervious and possesses redundant free vacuities so it has a high immersion capacity. It absorbs the feasts from the machine and releases much lower position to the terrain. Therefore, the system can be called an aqua silencer due to the property of water.

II. PROBLEM DEFINITION

The moment our world is degraded by the environmental pollution initiated by different manufactories and vehicles as the main contaminating agents so, commodity that's anticipated from mortal beings to save this world is creating the result in whatever good and easy medium. Then in this study, its deal with emission reduction mechanisms due to the environmental pollution that's observed around my living area by introducing the machine element called a hybrid aqua silencer. The reason we choose an aqua silencer is because air pollution currently harms both our environment and living things physically. The main donation of the air pollution is exhausted from exhausted from automobile-like carbon dioxide, unburnt Hydrocarbon, etc. To avoid these types of feasts introducing this aqua silencer is veritably essential at this moment. To replace conventional single unit machine silencers on board structures, an aqua silencer system is designed. With a kindly feather light and slender design, it offers a minimum target

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point while optimizing the entire exhaust system for low noise and keeping back pressure as it is. It's used to control the noise and emission in IC engines. It's fitted to the exhaust pipe of the engine. The sound produced under water is less hearable than it produced in the atmosphere. This is because water molecules include tiny sprockets that reduce their amplitude and, as a result, the sound level. The emissions can be controlled by using the actuated watercolor subcaste and it's largely pervious and possesses redundant free vacuities so it has a high immersion capacity. So, I'll try to reduce the size of the silent auto as much as possible and not affect the weight of the vehicle using some experimental chemicals inside the factors.

III.LITERATURE SURVEY

B.Jothi Thirumal (December, 2015) proposed the exploration paper on Noise Control System by using Aqua Silencer. In this case the blockish shell is used and the also especially design perforated is used which is by break- swerve manner so that when exhaust feasts are enters through perforated tube the feasts gets further water face area which leads to further immersion of unwanted exhaust feasts take place and cleaner air release into the atmosphere [1].

Akhil Anil Kumar (May 2016), did a complete exploration of how aqua silencer can affect the toxic emigration and noise reducing the capacity of machines and explained the operations of machines with an aqua silencer. A performance comparison between a simple silencer and a silencer with actuated watercolor and lime water was made. It's thermally effective and technically doable but certain advancements were made in the working of the aqua silencer to fit in the operation with the machine exhausting unit is essential [2].

Alen M., et al., (Aug- 2015) proposed an exploration paper on the fabrication and testing of a silencers. An aqua silencer is more effective in the reduction of emissions of dangerous feasts and adulterants from machine exhaust using the perforated tube, lime water result, and actuated watercolor. By using perforated tubes, the aft pressure will remain constant and the sound position is reduced. And by using the perforated tube the energy consumption remains the same as a conventional system by using water as a medium the sound and it can be lowered, and also by using actuated watercolor in water, it is possible to control the exhaust gas emissions to a lesser position. The water impurity is set up to be negligible in aqua silencers. It has smokeless and pollution-free emissions original to conventional silencers [3].

Shaikh L.T. et al., (April 2017) [4] proposed an experimentation on the design manufacturing and testing of the aqua silencer. Its construction is simple and has a slender design. Aqua silencer consists of a perforated tube and watercolor subcaste on it with a lime- water result placed inside an unrestricted vessel. The main difference is that two vessel chambers contain lime water result and they're connected with the help of a U-bend tube with anon-return stopcock with helps to reduce the reverse pressure.

Akhil Chowdary Belam, et al., (July 2016), proposed research work on the fabrication and testing of the aqua silencer. colorful tests were carried out also find out the performance of the aqua silencer. The bank test analyzer test was carried out along with the gas analyzer and noise test. The bank emigration of the aqua silencer is anatomized with the help of a gas analyzer which finds the quantum of CO and HC content. The reduction of adulterants in the exhaust gas is due to the actuated watercolor which absorbs about 74 of feasts. The exhaust pipe is connected to the bell mouth and it's connected to the tank. This tank is incompletely immersed in the lime- water result and the remaining exhaust gas goes out from the other end where the outlet is given [5].

Shaikh Hannan, et al., (July 2017), performed an emissions control using an aqua silencer. Not only the fabrication and design are necessary but also the chemical responses are important. The water in the scrubber tank itself plays an important part in absorbing the offensive products of combustion like the oxides of nitrogen. It serves to dissolve the unburned hydrocarbon (UBHC) which is present in petrol emigration, thereby serving to suppress the spark before it's emitted to the girding terrain. In the case of water, a weak lime- water result can be used which allows the chemical response to take place at faster rates responses of colorful adulterants are

$NO2\ H2O \rightarrow HNO2 + 2HNO3$ (Adulterated)

$Ca(OH2) + CO2 \rightarrow CaCO3 + H2O$

$CaCO3 + H2O + CO2 \rightarrow Ca(HCO3) + 2Ca(OH)2 + SO3 \rightarrow CaSO3 + H2O$

Some of the responses were explained in the paper [6].

Steffin John Eapen, et al., (2016), [7] performed an overview of actuated carbon and zeolite in water treatment. They delved actuated watercolor which is a veritably well- known adsorbent due to its largely advanced porosity, large face, variable specific of face chemistry, and a high degree of face reactivity. Whereas zeolite is used to remove the most common cations in water affecting mortal and beast health was NH4. It can be removed by swapping with biologically respectable cations similar as Na, K, Mg2, Ca2, or H abiding on the swapping side of zeolite. Author conducted the same test for actuated watercolor as well as zeolite and set up out that they both have their advantages and disadvantages.

IV. METHODOLOGY

The exhaust gas from the machine cylinder enters the aqua silencer through the perforated tube. Through the perforated tube gas first enters the primary sludge of the silencer. A perforated tube is a special tube having different periphery sections. So, the perforated tube converts high mass bubbles into low mass bubbles. In the primary sludge, the calcium hydroxide reacts with poisonous feasts and reduces attention. After that, they pass to the secondary sludge conforming of watercolor which again purifies the feasts. Watercolor is largely pervious and contains redundant free valances. So, it has a high adsorption capacity. Eventually, the exhaust feasts flow through the opening into the atmosphere. The aqua silencer is effective in using a water and limestone admixture for reducing emigration feasts from the machine exhaust gas. By using a water and limestone admixture the reverse pressure will remain constant and the sound position is reduced. The sound can be lowered by using water and by using limestone in water, it is crucially able to control exhaust emissions. In binary sludge silencers the water impurity is set up to be negligible due to the quantum of acidity position in aqua silencers is lower than the dangerous acidity position. It gives smokeless and pollution-free emissions and is also veritably cheap. Hence, an aqua silencer reduces both noise and pollution

TABLE I: Components

Serial Number	Part	Material	Quantity
1.	Outer Tube	M.S.	1
2.	Perforated tube	M.S.	1
3.	Mesh	S.S.	150mmx80mm
4.	Filler Plug	M.S.	1
5.	Exhaust Pipe	M.S.	1
6.	Drain plug	M.S.	1
7.	Flange	M.S.	2
8.	Nut Bolt Washer	M.S.	5

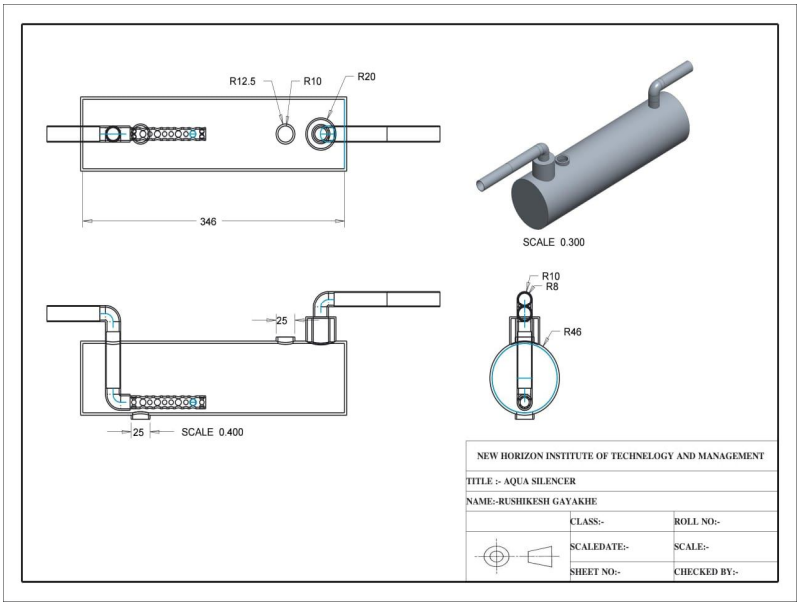


Fig.1. 3D- MODEL (USING CREO PARAMETRIC 3.0 FOR TWO WHEELER)

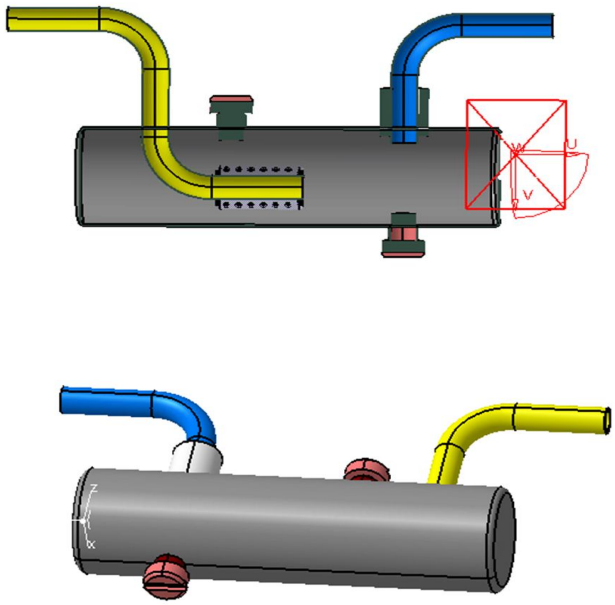


Fig.2. 3D- MODEL (USING CATIA V5 FOR FOUR WHEELER)

V. MERITS & DEMERITS

A. Merits

It reduces the emission of carbon monoxide and unburnt hydrocarbons. It has the basic and easy construction. It can be used in any gasoline engine. Level of noise can be reducing

B. Demerits

Need additional space for placement. It's required to fill the lime water twice in year. More heavy than conventional silencer

VI. RESULTS AND DISCUSSIONS

In comparison to a conventional silencer, the aqua silencer reduces the occurrence of exhaust gases carbon monoxide by roughly 50% and hydrocarbons by 95%, according to the results table above. The aqua silencer tends to boost oxygen and carbon dioxide emissions from the exhaust.

TABLE 2: Results

Conventional Silencer Test (Simple Silencer)		Aqua Silencer Test (Activated charcoal + lime water)		Percentage Reduction
CO	3.016%	CO	1.509%	49.97%
HC	3040 PPM (parts per million)	HC	149 PPM (Parts per million)	95.1%
CO2	1.2%	CO2	1.4%	14.28% (increase)
O2	15.40%	O2	17.23%	10.62% (increase)

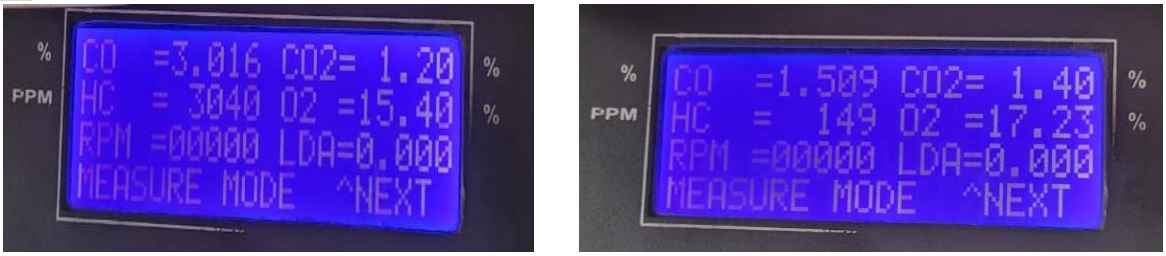


Fig.3. Actual Test Reading Conventional Vs Aqua Silencer Test

VII. SCOPE FOR FUTURE RESEARCH

This system could be implemented in all the stationary and moving engines so that it can reduce the harmful emission from the engine exhaust without affecting the aerodynamic properties of engine. Other fluid can be use which has the high absorb capacity.

VIII. CONCLUSIONS

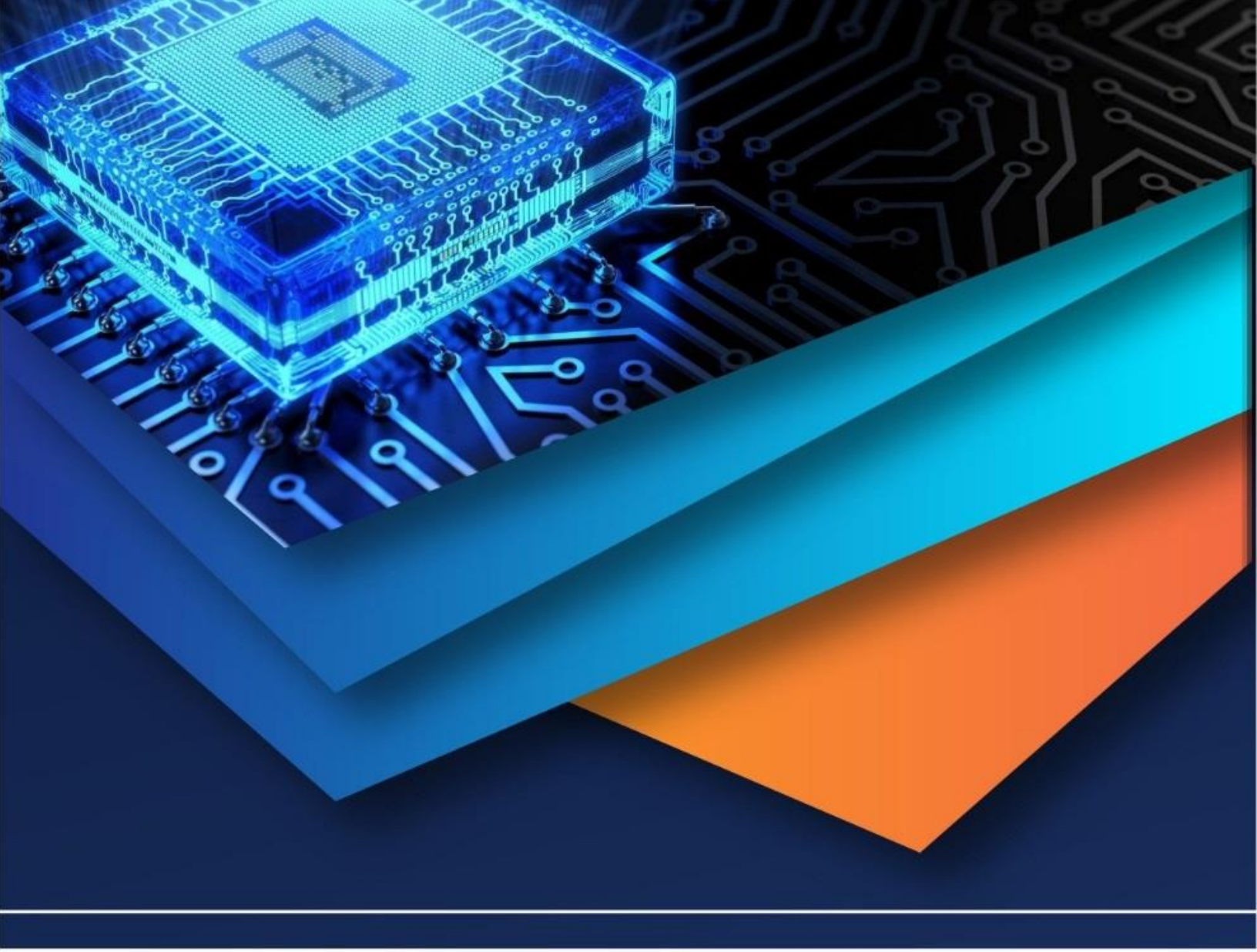
This system is another technology that can be used to control exhaust emission and also sound emitted. Since lime water or water is used as a medium the sound is lowered. Activated charcoal is used as a filtering agent to clean the contaminated water. Maintenance is done periodically. By using activated charcoal, the emissions of the exhaust have been reduced carbon monoxide CO by 50% (decreased), hydro-carbons HC by 95% (decreased), oxygen O2 increased by 11%, and carbon dioxide CO2 increased by 14%. An aqua silencer has more efficiency to reduce emission gases from the engine. The emission gases are controlled by lime water, charcoal layer, and perforated tube. The perforated tube back pressure always remains constant and the sound level of the exhaust reduces. This system has a pollution-free emission and is smokeless. This system is very cheap. This system can be easily used in four-wheelers and two wheelers.

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