"DESIGN AND ANALYSIS OF AN AQUA SILENCER"

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ABSTRACT

The aim of this project is to control emission It is a well-known fact that the toxic gases Emitted in diesel engines are less than the engines. Due to the high cost of petrol; diesel engines are more in use. Anticipating the use of diesel engines, even more in the near future; this system developed can be used to control the toxic gases, coming out of the diesel engines. These toxic gases are harmful not only to the atmosphere, but also to the human & animal race. The objective of this project is to design & fabricate a simple system, where the toxin levels are controlled through chemical reaction to the more agreeable level. This system acts itself as a silencer; there is no need to separate the silencer. The whole assembly is fitted in the exhaust pipe; it does not give rise to any complications in assembling it. This system is very cost effective and more economical.

Keywords: *Aqua silencer, perforated tube, lime powder, charcoal layer, noise.*

1. INTRODUCTION

Now a days Air pollution is major problem. The main pollutants contribute by automobiles are(CO),UBHC,(Nox) and Lead etc., Other sources such as electric power generating stations, Industrial and domestic fuel consumption, refuse burning, industrial processing. So it is imperative that serious attempts should be made to conserve earth's environment from degradation. An aqua silencer is an attempt in this direction; it is mainly dealing with control of emission and noise. An aqua silencer is fitted to the exhaust pipe of engine. Diesel engines are playing a vital role in Road and sea transport, Agriculture, mining and many other industries. Considering the available fuel resources and the present technological development, Diesel fuel is evidently indispensable. In general, the consumption of fuel is an index for finding out the economic strength of any country. In spite, we cannot ignore the harmful effects of the large mass of the burnt gases, which erodes the purity of our environment every day. Air pollution is most important from the public health of view, because every individual person breaths approximately 22000 time a day, inhaling about 15 to 22 kg of air daily. Polluted air causes physical ill effect decides undesirable aesthetic and physiological effects. Air pollution can be defined as addition to our atmosphere of any material, which will have a dexterous effect on life upon our planet. The main pollutants contribute by automobile are carbon monoxide (CO), unburned hydrocarbon (UBHC), oxides of nitrogen (NOx) and Lead. Automobiles are not the only sources of air pollution, other sources such as electric power generating stations, industrial and domestic fuel consumption, refuse burning, industrial processing etc. also contribute heavily to contamination of our environment so it is imperative that serious attempts should be made to conserve of our environment from degradation.

Aqua silencer:

Perforated metal, also known as perforated sheet, perforated plate, or perforated screen, is sheet metal that has been manually or mechanically stamped or punched to create a pattern of holes, slots, or decorative shapes. Materials used to manufacture perforated metal sheets include stainless steel, cold rolled steel, galvanized steel, brass, aluminium, tinplate, copper, Montel, Inconel, titanium, plastic, and more. The perforated plate converts high mass bubbles into low mass bubbles, when exhaust gases enters the Aqua silencer. After that they pass through activated charcoals which again purify the gases. It is highly posses and porous extra free valences so it has high

adsorption capacity. Some of the gases may dissolve in to the water and remains passes through the activated charcoals and finally opening it exhaust gases escape throughout the atmosphere. Hence aqua silencer reduces large amount of toxic gases and noise. The main function of the perforated tube is to suppress the sound and increase the performance. Number of holes is provided on the surface of the tube. It is used to convert high mass bubbles to low mass bubbles. The charcoal layer is pasted over the perforated tube. The exhaust gas from the engine cylinder is passed through these holes so large gas bubbles are converted to smaller gas bubbles. Hence the noise is reduced. Perforated tube is an essential part of an twin filter silencer.

2. LITERATURE REVIEW

Sarath Raj: In this extract the researcher has given special attention towards performance and the cost analysis of aqua silencer. Aqua silencer is tested with different engines. General study is made on aqua silencer irrespective of them being used with engine or any other noise and toxic emission reducing devices. The effect of aqua silencer with different engine (petrol, diesel) on the engine efficiency and the cost of the overall work are properly analyzed. Perforated tube with activated charcoal layer for absorbs toxic gases and dissolve into water is the experimental setup for this study. Engine's exhaust toxic gases reduction rate is calculated for this value of engine efficiency gain. On the basis of the value of different results of toxic gases reduction rates and the noise reduction rate, the final conclusions are drawn. In this experiment adsorption method is used.

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3. OBJECTIVES

There has been an increasing concern in recent years over the increasing of transportation and discharge of industrial waste waters into environment. The engine emission contains air pollutants and other species. Almost all pollutants are toxic in nature. Some of the examples are CO, CO2, NOX, and Hydrocarbon [5]. Hence, removal of these pollutants was selected as the primary concern. There are several expensive techniques available in developed countries. Though in developing countries (for instance, India), adsorption technique which is less expensive and economically feasible is used. It has been selected for the present study using some cheap cost chemicals as an effective adsorbent. Therefore the objective of the present work is to test the ability of an Aqua Silencer in removing air pollutants and reduce noise of emission from engine.

An aqua silencer is used to control the noise and emission in IC engines. The reason why we go for aqua silencer is, in today life the air pollution causes physical ill effects to the human beings and also the environment. The main contribution of the air pollution is automobiles releasing the gases like carbon dioxide, unburned hydrocarbons etc. In order to avoid this type of gases we can use aqua silencer. It is fitted to the exhaust pipe of the engine; Sound produced under water is less hearable than it produced in atmosphere. This mainly because of small sprockets in water molecules, which lowers its amplitude thus, lowers the sound level. The emission can be controlled by using the activated charcoal layer and Lime water. Activated charcoal layer is highly porous and posse's extra free valences so it has high absorption capacity along with this lime water chemically reacts with the exhaust gases from the engine and release much less pollution to the environment. The noise and smoke level is considerable less than the conventional silencer, no need of catalytic converter and easy to install. Now-a-days the automobiles are very essential needs of human beings. The world without automobiles is unimaginable at today. But the major problem corresponding to the automobiles are undesirable emissions from the engine exhaust. The unwanted emission contains CO, CO2, HC, SOX, NOX, etc. Control of these gases is very needful now, because it leads to harmful injuries to environment and also living beings. So, we are going to introduce one method to reduce these exhaust emissions in the silencer part.

4. METHODOLOGY

1. Selection of project topic.
2. Introduction about aqua silencer.
3. Introduction of components.
4. Observation of effect of polluted air.
5. Assembly of components.
6. Noise and pollution experiment.
7. Modification
8. Experimental results.
9. Future scope.
10. Conclusion

5. STUDY OF AQUA SILENCER

Perforated Tube

The main function of the perforated tube is to suppress the sound and increase the performance. Number of holes is provided on the surface of the tube. It is used to convert high mass bubbles to low mass bubbles. The charcoal layer is pasted over the perforated tube. The exhaust gas from the engine cylinder is passed through these holes so large gas bubbles are converted to smaller gas bubbles. Hence the noise is reduced. Perforated tube is an essential part of an twin filter silencer.

5.1 AQUA SILENCER

MATERIAL: MILD STEEL

Basically an twin filter silencer consists of a perforated tube which is installed at the end of the exhaust pipe. The perforated tube may have holes of different diameters. The very purpose of providing different diameter hole is to break up gas mass to form smaller gas bubbles the perforated tube of different diameter .Generally 4 sets of holes are drilled on the perforated tube. The other end of the perforated tube is closed by plug. Around the circumference of the perforated tube a layer of activated charcoal is provided and further a metallic mesh covers it. The whole unit is then placed in awater container. A small opening is provided at the Top of the container to remove the exhaust gases and a drain plug is provided at the bottom of the container for periodically cleaning of the container. Also a filler plug is mounted at the top of the container.

Chemical Reactions

Effects of dissolved gases on water: The water is a best absorbing medium to use in silencer for dissolve toxic gases in water and reduce it completely. After these gases dissolved in water they form acids, carbonates, bicarbonates etc.

- *Action of dissolved SO_2:*When SO_x is mixed in water, it form SO_2, SO_3, SO_4, H_2SO_4 i.e. sulfur Acid (H_2SO_3), it forms Hydrogen Sulphide which causes carious egg smell, acidify and corrosion of metals.
- *Action of dissolved CO_2:* The dissolved carbon dioxide forms Carbonates and Bicarbonates at lower and higher pH. This levels in between 40-400 mg/lit. When carbon dioxide mixes with water it form Carbonic acid and it is corrosive to metals and also causes greenhouse effect.
- *Effect of dissolved NO_x:* The NOx in exhaust gas under goes Oxidation to form Nitrate, Nitrite, Nitric acid, ammonia. This synthesis of protein and amino acids is affected by Nitrogen. Nitrateusually occurs in trace quantities in exhaust gas.[

Technical Specifications of Aqua silencer

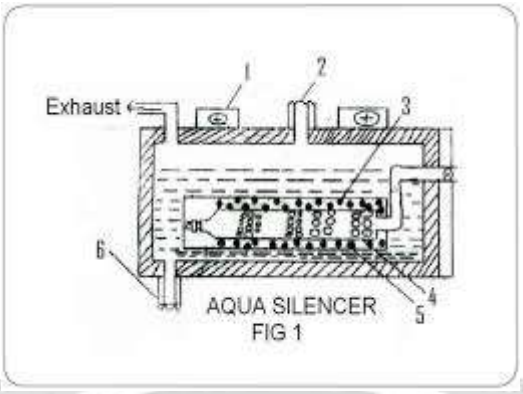

Fig 1 : aqua silencer

Material for aqua silencer:

The most commonly used materials for pistons of . engines are cast iron, cast aluminum, forged aluminum, cast steel and forged steel. The cast iron pistons are used for moderately rated engines with piston speeds below 6 m / s and aluminum alloy pistons are used for highly rated engines running at higher piston speeds. It may be noted

1. Since the coefficient of thermal expansion for aluminum is about 2.5 times that of cast iron, therefore, a greater clearance must be provided between the piston and the cylinder wall in order to prevent seizing of the piston when engine runs continuously under heavy loads. But if excessive clearance is allowed, then the piston will develop 'while it is cold and this tendency increases with wear. The less clearance between the piston and the cylinder wall will lead to seizing of piston.

2. Since the aluminum alloys used for pistons have high heat conductivity (nearly four times that of cast iron), therefore, these pistons ensure high rate of heat transfer and thus keeps down the maximum temperature difference between the center and edges of the piston head or crown. 3. Since the aluminum alloys are about three times lighter than cast iron.

Specifications (Splendor-Pro) Of aqua silencer

Parameters	Before Installation of Aqua Silencer	Considered After Installation of Aqua Silencer
Carbon Monoxide (CO)	**0.387 %**	**0.084 %**
Non-Methane Hydrocarbons (HC)	**524 PPM**	**239 PPM**
Vibrometer Reading (Avg.)	**113.66 db**	**99.33 db**

Chart 1: specification of piston

Method to reduce emissions

Fig 2 : aqua silencer

The aqua silencer system is design for replace commonly used single unit silencers in engine with its slender structure and less weight. It play an important role in control the noise and emission of gases from engines. Air pollution causes dangerous physical effect on the human body, animal and environment. The main reason to use aqua silencer is because now a day's air pollution is increasing rapidly. This system reduces the dangerous exhaust gases from the auto. These emission controlled by the activated charcoal layer around perforated tube and lime water. The charcoal layer having high capacity to absorb emission gases from engine. These type charcoal layer with lime water reacts chemically with emission gases and change the chemical structure of emission gases. The smoke or emission gases and noise level in aqua silencer is very less than the commonly used silencers.

Sheet metal

Sheet metal is used in automobile and truck (lorry) bodies, airplane fuselages and wings, medical tables, roofs for buildings (architecture) and many other applications. Sheet metal of iron and other materials with high magnetic permeability, also known as laminated steel cores, has applications in transformers and electric machines. Historically, an important use of sheet metal was in plate armor worn by cavalry, and sheet metal continues to have many decorative uses, including in horse tack. Sheet metal workers are also known as "tin bashers" (or "tin knockers"), a name derived from the hammering of panel seams when installing tin roofs.

Fig 3: Sheet metal

6. CONCLUSION

The aqua silencer is more effective in the reduction of emission gases from the engine exhaust using perforated tube and charcoal. By using perforated tube the backpressure will remain constant and the sound level is reduced. By using perforated tube the fuel consumption remains same as conventional system. By using water as a medium the sound can be lowered and also by using activated charcoal in water we can control the exhaust emission to a greater level. The water contamination is found to be negligible in aqua silencer. It is smokeless and pollution free emission and also it is very cheap. This aqua silencer's performance is almost equivalent to the conventional silencer. It can be also used both for two wheelers and four wheelers and also can be used in industries

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