

Design of Aqua Silencer - Future Pollution Control Device

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Abstract

Silencer, a component of the vehicle which controls the unwanted-sounds and also harmful-emission of gases coming through the Internal Combustion motors. The silencer is a major part of any vehicle which runs on fuel because a large portion of locomotives uses petrol for running on roads right now. After consuming, petrol delivers high amount of carbon gasses and also numerous different poisons. Due to these toxins the air is polluted and this causes a negative impact to the people as well as their health and furthermore the climate. Due to the emission which takes place by burning of fuel the air is polluted. To keep away from these gases from mixing in open-air, we attach this silencer to our vehicles. The location of the silencer is at end of pipe from which emissions are released. Silencer attached to all engines controls these harmful gases from having a major effect in the air and safeguards people's health. An Aqua silencer is intended to minimize the use of regular conventional silencers on automobiles. Aqua silencer provides a negligible 'impact' and also streamlines the whole engine framework to produce less sound.

Keywords: Carbon gasses; Harmful-Emission of gases; Silencer and Aqua silencer; less emission; less sound; Toxins.

1. Introduction

The This Automobiles are not only sources of air pollution, other sources such as electric power generating stations, domestic fuel consumption, industrial processing, etc. also contribute heavily to the contamination of our environment, so serious attempts must be made to conserve the environment from degradation. An aqua silencer is an attempt and the main idea is to control the emission and noise. An aqua silencer is fitted to the exhaust pipe of the engine. The sound produced under water is less hearable than it is produced in the environment. This mainly because of small sprockets in water

molecules, with charcoal layer and outer layer applying thermal conducting material, using backpressure process thus lowering its amplitude and lowers the sound level. Because of this property of water is used in this silence, hence the name is AQUA SILENCER. The noise and smoke level are considerably less than the conventional one, it is cheaper, no need for a catalytic converter, and easy to install. Serious attempts must be made to conserve the earth's environment from degradation. An aqua silencer is an attempt in this direction. Silencer, a component of the vehicle which controls the

unwanted-sounds and also harmful-emission of gases coming through the Internal Combustion motors.

1. The silencer is a major part of any vehicle which runs on fuel because a large portion of locomotives uses petrol for running on roads right now. After consuming, petrol delivers high amount of carbon gasses and also numerous different poisons. Due to these toxins the air is polluted and this causes a negative impact to the people as well as their health and furthermore the climate. Due to the emission which takes place by burning of fuel the air is polluted. To keep away from these gases from mixing in open-air, we attach this silencer to our vehicles. The location of the silencer is at end of pipe from which emissions are released. Silencer attached to all engines controls these harmful gases from having a major effect in the air and safeguards people's health.
2. An Aqua silencer is intended to minimize the use of regular conventional silencers on automobiles. Aqua silencer provides a negligible 'impact' and also streamlines the whole engine framework to produce less sound.
3. Also, a catalytic converter is not needed in the aqua silencer (Patel & Gajjar, 2014). But it can also be fitted with the catalytic converter at the tailpipe of a vehicle's exhaust system (Girish Raj & Nelmangala Chandrashekhar, 2021) the perforated tube consists of sets of drilled holes of different diameters. The purpose of distinct size holes is to break up gas mass to form smaller gas bubbles.
4. A wide variety of contaminants with the potential to cause harm to humans and animals can make their way into the environment. They can be found in the air, water and soil and may come from sources such as industrial waste, landfill sites, pesticides and pharmaceutical drugs. Identifying these contaminants is challenging because of the huge variety of potential compounds with varying chemical compositions.

2. Construction

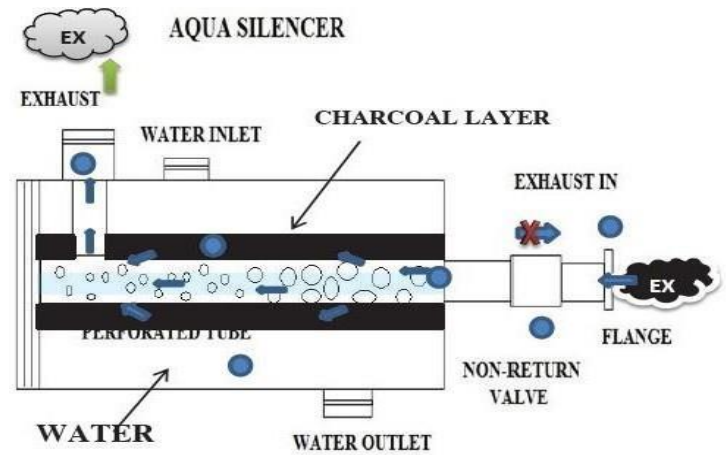


Figure 1 Proposed Construction of Aqua Silencer

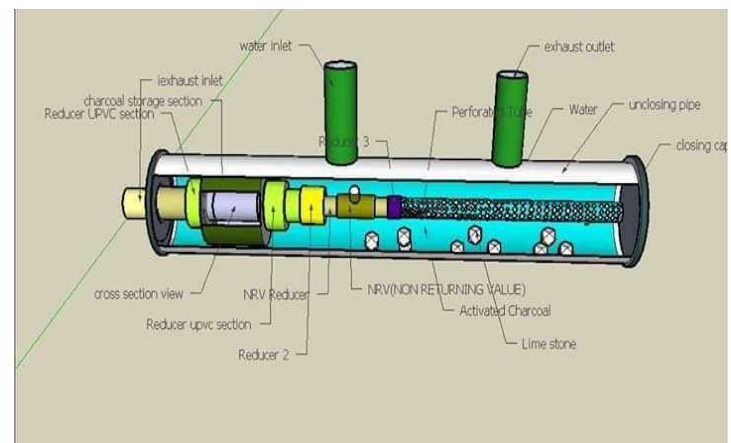


Figure 2 Practical / Actual Construction of Aqua Silencer

2.1. Materials

Proposed Construction of Aqua Silencer is shown in Figure 1. Practical / Actual Construction of Aqua Silencer is shown in Figure 2. Basically an aqua 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 a water 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. At the inlet of the exhaust pipe a non-return valve is provided which prevents the back flow of gases and water as well. [1]

2.2. 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 applied over the perforated tube. They stand as the frame to hold the charcoal layer that is added to the aqua silencer. They are made up of Stainless steel. They are weightless compared to other metals. They have melting point of 1500°C. This helps to with stand the temperature of hot gas. [2]



Figure 3 Perforated Tube

2.3. Activated Charcoal

Activated charcoal readily adsorbs a wide range of organic compounds dissolved or suspended in gases and liquids. In certain industrial processes, such as the purification of sucrose from cane sugar, impurities cause an undesirable color. The charcoal layer has more absorbing capacity because it has more surface area. This charcoal is called as activated charcoal. It is produced by heating the charcoal above 1500°C for several hours in a burner. Its surface area gets increased. Charcoal may be activated to increase its effectiveness as a filter. The Charcoal layer has pores and hence is highly porous and also has free valance electrons. Therefore, it should be very effective. Which can be removed with activated charcoal. It is also used to absorb odours and toxins in gases, such as air. [3]



Figure 4 Activated Charcoal

2.4. Non-Return Valve

The non-return valve is a mechanical device a valve, which normally allows fluid (liquid or gas) to flow through it in only one direction. They have two ports, one as an inlet for the media and one as the output for the media. Since they only allow media flow in one direction, they are commonly referred to as one-way valves or non-return valves. The main purpose of a check valve is to prevent backflow in the system. [4]



Figure 5 Non-Return Valve

2.5. Flange

A flange is a device where pipes are connected, and two connecting pipes are joined together generally with the use of bolts. Its main purpose is attaching aqua silencer to the engine-exhaust via exhaust pipe



Figure 6 Flange

2.6. Outer Shell

The whole setup was kept inside the outer shell. It is made up of steel. The water inlet, outlet and exhaust tube was provided in the shell itself. Material selection of the outer shell is the crucial parameter because of the consideration of heat conductivity, corrosiveness and cost. Requirement of good shell material: [5]

- It should be heat conductive.
- The thermal conductivity of material must not be high enough so that it will liberate all of its heat and will cause less effective temperature for necessary reactions.
- The material should have good resistance to corrosiveness and erosion.



Figure 7 Outer Shell

3. Working Principle

After the harmful gases enter the prototype, high mass air-bubbles are changed in the low mass air-bubbles because of perforated tube, and because of the activated-charcoal layer pasted over it, will destroy sulfur and other pollutants. After that the gases exit the perforated tube and comes in contact with water, the gasses react with water. As a result, some gasses get dissolved here and then they pass-through the water in the open cavity above and then exits the silencer through the exhaust outlet.

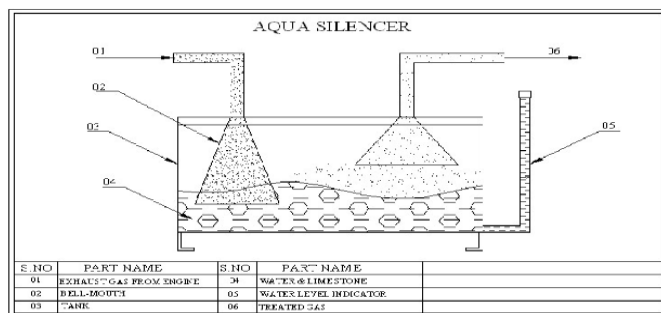


Figure 8 Labelled Sketch

3.1. Working

The Aqua silencer comprises of a perforated cylinder which has openings (holes) of various diameters. This perforated tube which is linked to end of exhaust pipe by a flange. The other end of the cylinder is shut due to a seal. So, after that a layer of activated charcoal is pasted over the Perforated cylinder. To hold this charcoal layer in place a wire is placed over it. Then this unit is positioned in a Casing. At the top of the outer shell a little opening is given to eliminate the exhaust gasses. And likewise, a plug is given at the lower end of the aqua silencer to clean the shell and for taking out the contaminated water. After the harmful gases go into the Aqua silencer, high mass air bubbles are converted into low mass air bubbles by the perforated tube. Thereafter the gasses react with the layer which decontaminate gasses due to the activated charcoal being highly porous as well as having free valence electrons. So, a high assimilation limit can be seen by the charcoal layer. Also, after passing through the activated charcoal layer, some of the gases may dissolve into the water. Lastly, the exhaust gases escape through the exhaust outlet in environment. This is how we can say that aqua silencer decreases unwanted sound and Contamination.

4. Result and Discussions

In Aqua Silencer the main goal is to reduce the air pollution which is rising at an alarming rate. For this the harmful emissions emitted by automobiles need to be brought down considerably. So, we decided to fabricate this model according to a real-world perspective.

5. Future Scope

There has been an increasing concern in recent years over the increasing of transportation and discharge of industrial waste through air and waters into environment. The engine emission contains air pollutants and other poisonous elements. Almost all pollutants are toxic in nature. Some of the examples are CO, CO₂, NO_x, and Hydrocarbon. Among the air pollutants, all are most effective pollutants. Hence, the removal of pollutants was selected for the present study. Several expensive techniques are available in developed countries. But in developing countries like India is not applicable since adsorption technique is less expensive and economically

feasible, it has been selected for the present study using some cheap cost chemicals as an effective adsorbent. But if more advanced research is undertaken and if this is produced not only for the industries but also for the consumers then we will be able to see a massive shift in the Air quality index (AQI) of the air. This will also help in reducing Air pollution.

Conclusion

Our main objective is to make an aqua silencer with low cost. In order to make the aqua silencer more sustainable stainless steel was used. It is found that aqua silencer is effective in reducing the harmful emissions coming from engine via exhaust pipe. We find that sound is less hearable in water and also to control exhaust emission activated charcoal is used. The water pollution which is happening is very low in Aqua silencer. Aqua silencer is cheap and also an effective way to lessen the smoke and pollution in atmosphere. Not only can the Aqua silencer be implemented in automobiles (Two as well as four wheelers) but it can also be implemented for industries.

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