

# Review Paper on Aqua Silencer

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## ABSTRACT

An Aqua Silencer is used for control of emission and noise in automobile exhaust. By using activated charcoal, perforated tube and outer shell it is constructed. Or in other words Aqua Silencer is a modified version of a conventional silencer aimed at the reduction of toxic emission from the exhaust of an IC engine into the atmosphere and also to reduce the noise that is produced by damping methods which involves water and hence the name. Day by day the Air pollution is going on increasing. The main source of the pollution is Exhaust from automobiles and industries. Hence to reduce these pollutants from Exhaust of Engine a new technology is introduced called Aqua silencer. An Aqua silencer is a device used to filter the pollutants produced from automobiles such as CO, UBHC, NOx and Lead. It uses the charcoal layer, perforated tube and water for its working. Due to water, the noise is also getting reduced than open environment. Because of this it gets named as AQUA SILENCER.

**Key Words:** Aqua silencer, Charcoal, Perforated tube, Water, Pollutants, emission control, noise, CO, UBHC, NOx and Lead

## 1. INTRODUCTION

We all know that the automobile industry plays a major role in causing air pollution, so for reducing air as well as noise pollution we are using Aqua Silencer. The exhaust gases released from engine are carbon monoxide (CO), carbon dioxide (CO<sub>2</sub>), Nitrous Oxide (NO<sub>x</sub>), Sulphur Dioxide (SO<sub>2</sub>), Unburnt Hydrocarbons (UBHC). These toxic gases are very harmful for environment, human health. Aqua Silencer is used to reduce emissions and noise and also reduces its harmful effects with the help of activated charcoal, lime water. The main contributor of air pollution is automobiles releasing gases like carbon dioxide, unburned hydrocarbons, etc. In order to cut down on emission of these gases, we can use an aqua silencer. It is fitted to the exhaust pipe of the engine. Sound produced under water is less audible than in atmosphere. This is mainly due to presence of small sprockets in water molecules, which lowers its amplitude and 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 possess extra free valences so it has high absorption capacity and lime water chemically reacts with the exhaust gases from the engine and release much less polluted gases to the environment. The noise and smoke level are considerably less than the conventional silencer; there's no need of a catalytic converter and it is easy to install.

## 2. LITERATURE REVIEW

**Allen. M. A [1]** A lot of effort is being made to reduce the air pollution from petrol and diesel engines and regulations for emission limits are also imposed. Furthermore, developments in petrol and diesel engines, combined with improvements in the vehicles, will make fuel consumption reduction of 40% or more in the future cars. One such development is improvement of the silencer unit of an engine. This is where an Aqua Silencer comes into play. An Aqua Silencer mainly deals with control of emission and noise in engine exhaust. It basically consists of a perforated tube which is installed at the exit of the exhaust from the engine, which may have holes of variable diameters. This is done to divide the gas molecules of large proportions to form gas molecules of smaller diameter. Theoretically, four or more sets of holes are made on the perforated tube using drilling. The other end of the perforated tube is sealed using a plug. A small coating of activated charcoal is provided all around the perforated tube using an inner cylinder which holds the charcoal in place and separates

the charcoal and lime water from the water in the Aqua Silencer. This unit is then placed in a container in which water is filled to a certain level. A small opening is provided on the lid of the inner box which carries the exhaust from it to the outside using a small diameter pipe. A U-bend of pipe is constructed at the end of perforated tube which doubles as a nonreturn valve which prevents the back flow of engine exhaust or lime water back into the engine. After passing over the charcoal layer, a portion of the gases dissolve into the water and finally the exhaust gases escape through the opening to the atmosphere. "Emission" is a term that is used to describe the totality of undesired gases and particulates which are released into the air or emitted by numerous sources some of the examples are CO, CO<sub>2</sub>, NO<sub>x</sub>, and Hydrocarbon and the main contribution of air pollution comes from automobiles and industrial engines releasing gases like carbon dioxide and not burnt. Hydrocarbons. In addition to heat and water vapor, the pollutants formed in engine exhaust are, Carbon monoxide (CO), Carbon dioxide (CO<sub>2</sub>), Oxides of Nitrogen (NO<sub>x</sub>), Sulphur dioxide (SO<sub>2</sub>). Particulate and Unburned Hydrocarbons (UBHC), Respirable combustible Dust (RCD). The above polluting contents in the engine exhaust are to be controlled by the Aqua Silencer.

**Maruthi Prasad Yadav et. al. [2]** carried out research for the four stroke multi cylinder diesel engine with an aqua silencer. In most of application the final selection of an aqua silencer is based on an arrangement between the predicted acoustical, aerodynamic, mechanical and structural performance in conjunction with the cost of the resulting system then have performance and work in the model and get result. They conclude that load increases the contaminations gradually by using conventional silencer but by fitting with aqua silencer, the contaminations decreases. They found comparison of different silencer for sound characteristic of engine. In conventional silencer is sound level is 83db but in an aqua silencer is 75 db. without any load. Around 50% load in conventional silencer it gives 84.5db and in an aqua silencer give 76.5 db. load. In the fully loading condition the conventional silencer give 86 db. and in an aqua silencer is 78 db.

**Keval Patel et. al. [3]** designs the dimensions of aqua silencer for two stroke petrol engines. The exhaust pipe connects with shell and inner side of it perforated tube is arranged. The charcoal layer is pasted over the perforated tube. Bead Activated carbon is used as a charcoal layer. It is a process by which the carbonized product develops porous structure of molecular dimensions and extended surface area on heat treatment in the temperature range of 800 – 1000 °C in presence of suitable oxidizing gases such as steam and carbon dioxide (CO<sub>2</sub>). Bead activated carbon is made from petroleum pitch and supplied in diameters from approximately 0.35 to 0.80 mm. It is also noted for its low pressure drop, high mechanical strength and low dust content, but with a smaller grain size. Its spherical shape makes it preferred for fluidized applications. According to operational parameter they conclude that CO is reduced 60-70% compared to ordinary silencer. But it is big in size and more space is required. It is used in both two-wheeler and four-wheeler.

**P. Balashunmugam et. al. [4]** carried out the analysis in which the lime stones are originally intended to reduce the toxic ingredients of the exhaust, gas through chemical reaction. It is evidently affected the flow of resistance and hence the combustion characteristics of the engine will finally contribute the increased toxic ingredients of the exhaust gas. Because of the introduction of the scrubber, the net length of the exhaust gas flow path is also increased which is again, against the original intention according to his study they conclude that water in scrubber tank can itself play an important role in absorbing the obnoxious products of combustion like the oxides of nitrogen. NO is converted into NO<sub>2</sub> after emission which highly toxic is mainly absorbed in the water scrubber.

### 3. CONSTRUCTION

The main component of aqua silencer is perforated tube. It is fitted at end of exhaust pipe of engine. This perforated tube consists of different diameter holes to convert the increase in mass bubbles to decreasing mass bubbles on perforated tube contains. The activated charcoal layer covers are provided around circumference of perforated tube. The perforated tube lime water inside it which is chemically reacts with exhaust gas from the engine. These whole systems are then placed in the container which is fitted with water to remove exhaust/harmful gases. The small opening is providing at the top of the water container and at the bottom of the container These whole systems are then placed in the container which is fitted with water to remove exhaust/harmful gases.

**The parts / components which are used in aqua silencer are.**

- a) **Perforated tube:** It consist number of holes of various diameter mainly there are four sets of holes. It is used to convert the high mass of bubble to low mass and very important activated charcoal layer is pasted are it.



**Fig. perforated tube.**

- b) **Non-Return Valve:** It is an important part uses to avoid back flow of water and gases.



**Fig. Non-return valve.**

- c) **Outer Shell:** In outer shell whole system is kept inside it. It is mainly made up of steel or iron. Water outlet, inlet also the exhaust tube was providing in their shell itself.



**Fig. Outer shell.**

- d) **Flange:** A flange is the connection of pipe where the connecting pieces have flanges by which the parts are bolted together flange is essential part it connects silencer to engine.



Fig. Flange.

- e) **Charcoal Layer:** Charcoal layer having high absorption capacity because it having large surface area. These types of charcoal called activated charcoal. These activated charcoal i produced by heating it up to 1500 degree centigrade for specified hours in a burner. Thus, it is surface get increasing.

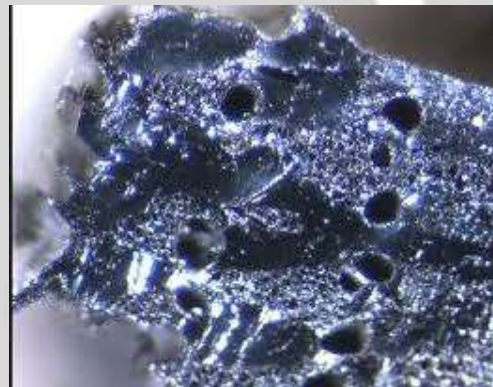


Fig. Charcoal Layer.

- f) **H- Pipe:** It is a device which is used to connect two pipes together. It consists of two threaded sides.



Fig. H- Pipe

#### 4. ASSEMBLY

The main component of aqua silencer is perforated tube. It fitted at end of exhaust pipe of engine. This perforated tube consists of different diameter holes to convert increase in mass bubbles to decreasing mass bubbles on perforated tube. Generally, 4 sets of holes are drilled. The plug is providing to close the other end of perforated tube. The activated charcoal layer and metallic mesh covers is provided around circumference of



perforated tube. The perforated tube contains the lime water inside it which chemically reacts with exhaust gas from the engine.

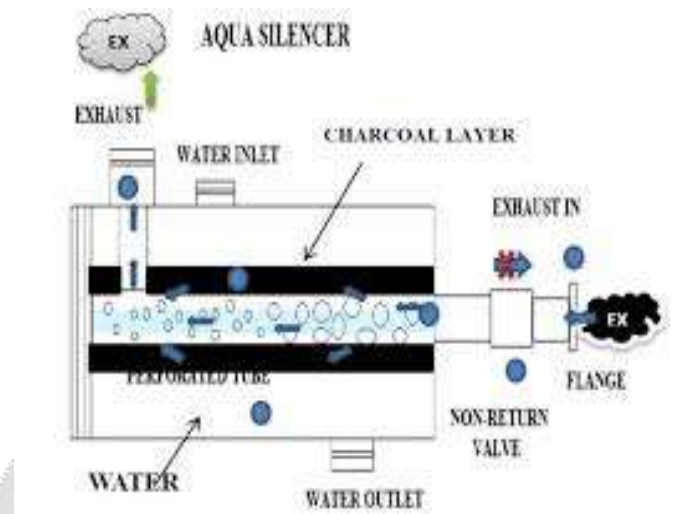


Fig. Construction of Aqua Silencer.

## 5. WORKING PRINCIPLE

The exhaust gas from the engine cylinder is enters in to the twin filter silencer through perforated tube. Through the perforated tube gas first enters in to the primary filter of the silencer. Perforated tube is a special tube having different diameter sections. So, the perforated tube converts high mass bubbles in to low mass bubbles. At the primary filter lime water reacts with toxic gases & reduces its concentration. After that they pass to the secondary filter consist of charcoal which again purify the gases. A charcoal is highly porous and possesses extra free valences. So, it has high adsorption capacity. Finally, the exhaust gases escape through the opening in to the atmosphere. The twin filter silencer is more effective in the reduction of emission gases from the engine exhaust gas using water and lime stone mixture. By using water and lime stone mixture the back pressure will remain constant and the sound level is reduced. By using water as a medium the sound can be lowered and also by using limestone in water, we can control the exhaust emission to a greater level. The water contamination is found to be negligible in twin filter silencer, because the amount of acidity level in twin filter silencer is expected to be below the dangerous acidity. It is smokeless and pollution free emission and also very cheap. Hence twin filter silencer reduces both noise and pollution. The twin filter silencer's performance is almost equivalent to the conventional silencer.

## 6. MERITS

- Control emission and noise in greater level.
- 2. Detoxification 3. CO reduced 60% to 70%.
- At running of engine, there is no vibration.
- Easy starting.
- Reduce noise and pollution at greater level.
- Carbon is separated.
- Cost is low.
- Easy construction and working.
- No need of catalytic converter.

## 7. DEMERITS

- Limewaterfillings required frequently.
- It is expensive than conventional silencer.
- Lime water should be filled once in a year.
- Weight is more compared to conventional silencer.
- Space is required.

## 8. APPLICATION

- It is used in marine & boats
- It is applicable for DG sets & DG machine
- It is used in industrial sector
- It is also used in automobile sector

## 9. CONCLUSION

By using Activated charcoal and Perforated tube it effectively eliminates the pollutants in the exhaust gases and reduces the Noise, also back pressure remains constant, fuel consumption is same that of conventional silencer. It is a smokeless and pollution free emission. It has been experimentally observed that the aqua silencer is successfully effective in reducing emission of gases from the engine exhaust. By using water as a medium, the sound levels have been reduced and by using activated charcoal in water, it produces almost pollution-free and smokeless emission and is also cheap considering long term use. The aqua silencer's performance is almost equivalent to the conventional silencer. It can be widely used in industrial engines and with a little improvisation, in heavy weight vehicles. This project analyzed the smoke content of the exhaust gas before and after treatment and it was found that there is a considerable reduction in the emission as pointed out by the test results.

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