

AQUA SILENCER

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ABSTRACT Air pollution is very serious problem on our earth. The main component due to which the air pollution is increasing are (CO), (NOx) and lead which exposed from vehicles. The other sources such as big factories, electric power, generation plants, big industries etc. So, it is required to solve this problem by taking various serious attempts. Aqua silencer is one of the attempt taken in reduce the air pollution. It is fitted to the exhaust pipe of engine or system. These silencers are used to reduce the noise and control the emission of dangerous gases. In aqua silencer the main component perforated tube which consist number of different diameter holes. In aqua silencer the main component tube which consist of number of different diameter holes. Generally, there are 4 set of holes. Charcoal layer is pasted over that tube and it is used to convert high mass bubbles to low mass bubbles.

The aqua silencer reduces emission noise because, the sound produced in aqua silencer under water having less amplitude than the sound produced in open atmosphere. This happen because of in water molecules there are small sprockets which lowers amplitude of emission gases and lower the sound level. The charcoal layer which is pasted over perforated tube can control the emission using the activated charcoal and highly porous extra free valences so these layers having absorption capacity.

KEYWORD: Aqua silencer, pollution free, charcoal layer, perforated tube, noise.

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 emission is controlled by the activated charcoal layer around perforated tube and lime water. The charcoal layer has high capacity to absorb emission gases from engine. These type charcoal layer with lime water reacts chemically with emission gases and changes the chemical structure of emission gases. The smoke or the emission gases and noise level in aqua silencer is very less than the commonly used silencers.

In this silencer charcoal and water is used so it is called hybrid aqua silencer, and it is useful in automobile, industry, marine and boats. Aqua silencer is easy to install and there is no need of catalytic converter. Aqua silencer is one of the important methods for effective reduction of toxic gases and noise.

In addition to heat and water vapor, the pollutants formed in engine exhaust are:

- Carbon monoxide (CO)
- Carbon dioxide (CO₂)

- Oxides of nitrogen (NO_x)
- Sulphur dioxide (SO₂)
- Particulate and unburned hydrocarbons (UHBC)
- Respirable combustible dust (RCD)

These pollutants in engine exhaust are to be controlled by the aqua silencer.

Cause of smoke:

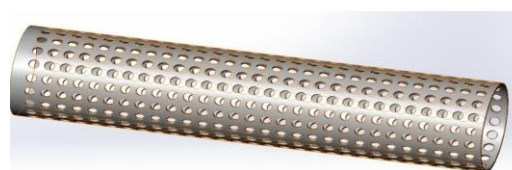
The main cause of smoke is incomplete combustion of fuel inside the combustion chamber. Two main reasons for incomplete combustion are incorrect air- fuel ratio and improper mixing. These might result due to engine design factors, such as injection system characteristics, the induction system, governor control; the fuel used the engine rating.

We know that in addition to harmful emission, engines also produce a very high amount of noise. Exposure of noise causes detrimental effects on neuro-endocrine, cardiovascular, respiratory and digestive systems. The basic function of using water in reducing noise is that sound produced under water is less audible than in atmosphere. This is mainly because of small sprockets in water molecules, which lowers its amplitude thus, lowers the sound level.

COMPONENTS:

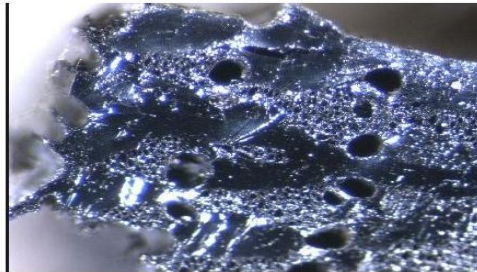
- Perforated Tube.
- Charcoal Layer.
- Outer Shell.
- Non-Return Valve.
- Flange
- Drain plug

PERFORATED TUBE: The perforated tube has number of holes of different diameters on its circumference. It is used to convert high mass bubbles to low mass bubbles. The charcoal layer is pasted over the perforated tube with the help of metallic mesh.



Charcoal Layer: The charcoal layer is fixed over the perforated tube, these charcoal layers has more absorbing

because it has more surface area. It is called as ACTIVATED CHARCOAL and it is produced by heating the charcoal above 1500oc for several hours in a burner due to which its surface area gets increased.



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 the silencer to engine.



Outer Shell: The whole setup was kept inside the outer shell. It is made up of stainless steel. The water inlet, outlet and exhaust tube were provided in the shell itself.

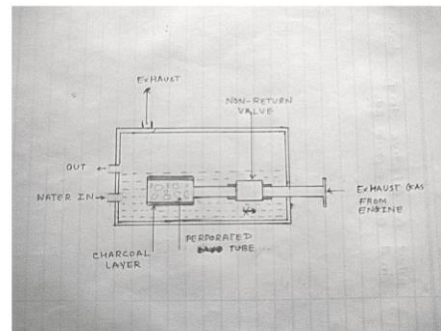


Non-Return valve: A non-return valve allows a medium to flow in only one direction. A non-return valve can be fitted to ensure that a medium flow through a pipe in the right direction, where pressure conditions may otherwise cause reversed flow.



2. CONSTRUCTION

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 provided 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. These whole unit or system is then placed in the container which is fitted with water to remove exhaust gas.



The small opening is provided at the top of water container and at the bottom of the container opening is provide for cleaning purpose. At the top of container fulfiller plug is also provided. A non-return valve is provided at the inlet of exhaust pipe to avoid back flow of gases and water as well. If exhaust gas enters to aqua silencer, perforated tube converts the high mass of bubbles to the low mass.

3. WORKING

The exhaust gases passed into the aqua silencer, the perforated tube converts high mass gas bubbles in to low mass gas bubbles after that they come in to contact with lime water they chemically react with lime water and pass through the charcoal layer which again purify the gases. It is highly porous, does not react with lime water and its porosity remains constant in water. Since the charcoal layer is covered with metallic mesh which is filled with lime water. Sound produced under water is less hearable than it produced in conventional silencer. This is mainly because of water molecules because water has good damping property, which lowers its amplitude thus, lowers the sound level hence aqua silencer reduces noise and pollution.

EFFECTS OF DISSOLVED GASES ON LIME WATER

The lime water is a good absorbing medium. In aqua silencer the gases are passed through perforated tube which is dipped in lime water. When these gases dissolved in water they form acids, carbonates, bicarbonates etc.

1. Action of dissolved SO₂ When SO_x is mixed in water, it forms SO₂, SO₃, SO₄, H₂SO₄ i.e. sulphur Acid (H₂SO₃), it forms Hydrogen Sulphide which causes carious egg smell, acidify and corrosion of metals.

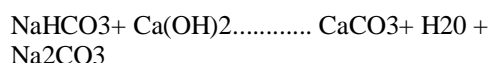
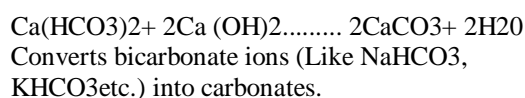
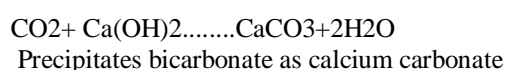
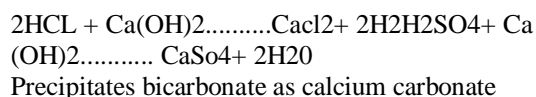
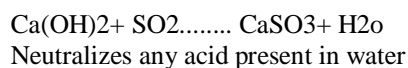
2. Action of dissolved CO₂ the dissolved carbon dioxide forms bicarbonate at lower PH and Carbonates at higher PH.

Calcium carbonate will precipitate when carbon dioxide present in exhaust gas and in contact with lime water.

3. Effect of dissolved NO_x the NO_x is abnoxious product of combustion-the oxides of nitrogen. Nitrogen absorbed to a larger extent by water.

Reactions

The SO₂ gas is removed from the flue gases forming calcium sulphate.



ADVANTAGES

- No vibration when the engine is running.
- Cost is reduced 60 to 70% compared to ordinary silencer.
- Sound is reduced
- Low cost
- Start the engine easy.
- Control emission and noise in greater level.
- Carbon is precipitated.

DISADVANTAGES

- Lime water filling is required frequently.
- It is expensive than conventional silencer.

APPLICATIONS

- 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

4. CONCLUSION

The aqua silencer is more effective in the reduction of emission gases from the engine exhaust using perforated tube, lime water and charcoal. By using perforated tube the back pressure 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. Due to use of water as a medium

sound reduces these systems having pollution free emission and smokeless. This system is very cheap.

This system is used for both four wheelers and two wheelers. It plays important role in industries.

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