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REVIEW ON DESIGN AND FABRICATION OF AQUA SILENCER

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Abstract— Aquasilencer is used to replace conventional silencer; the paper debriefs the various effects of aqua silencer which is more efficient than the conventional silencer also it reduces the noise and control air as well as noise pollution. This Silencer controls the emission and noise in engine exhaust which is achieved by using activated charcoal, perforated tube and outer shell. An aqua silencer is fitted to the exhaust pipe of engine. The main pollutants contributed by automobiles include CO, UBHC, NOx and Lead etc. The activated charcoal layer filters this harmful nitrous and Sulphur content produced from the engine. Sound produced under water is less audible than it produced in atmosphere. This is mainly because of small sprockets in water molecules, which lowers its amplitude thus, sound level decreases. Due to this lime water is required in this silencer and hence its name Aqua Silencer. Serious attempts should be made to reduce this pollutants and save our environment.

Keywords—Emission, noise, size, silencer, charcoal.

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 (CO₂), Nitrous Oxide (NO_x), Sulphur Dioxide (SO₂), Unburnt Hydrocarbons (UBHC). These toxic gases are very harmful for environment, human health. Aqua Silencer is used to control these emissions and also reduces its harmful effects with the help of activated charcoal, lime water and water. What is Aqua Silencer? Basically perforated tube which is installed at the end of the exhaust pipe in Aqua Silencer. The perforated tube has different diameters. Purpose of providing different diameter hole is to break up gas mass to form smaller gas bubbles. Generally 4 sets of holes are drilled on the perforated tube. Plug is used to close one end of perforated tube. 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 half immersed in a lime water container.

A small opening is at the top of the container to remove the exhaust gases & a drain plug is provided at the bottom of the container for periodically cleaning of container. Top of the container is connected by filler plug. 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. When exhaust gases enter into the Aqua silencer, the perforated tube converts high mass bubbles in low mass bubbles after that they pass through charcoal layer which again purify the exhaust gases.

2. It is highly porous and possess extra free valences so it has high absorption capacity.

3. After passing gases over the charcoal layers some of the gases may dissolve into the water and finally the exhaust gases escape through the opening into the atmosphere.

4. Hence aqua silencer reduces noise pollution.

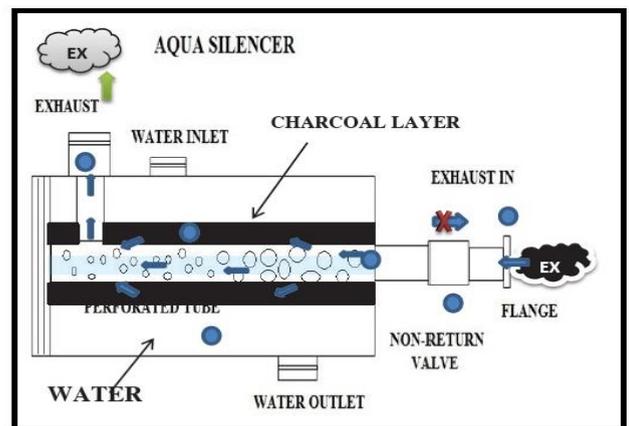


Figure 1. Layout of an aqua silencer

2. CONSTRUCTION

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 main purpose of providing different diameter holes is to break up gas mass to form smaller gas bubbles the perforated tube of different diameters. Generally, 4 sets of holes are drilled on the perforated tube. The other end of the perforated tube is closed by plug. Perforated tube contains lime water inside it which chemically reacts with exhaust gas from the engine.

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. A U bend is provided at the end of perforated tube which functions as a non-return valve which prevents the back flow of exhaust gas and lime water back to the engine.

3. WORKING

As the exhaust gases enter in to the aqua silencer, the perforated tube converts high mass bubbles in to low mass bubbles after that they come in to contact with lime water they chemically react with it and pass through the charcoal layer which again purify the gases. It is highly porous and possess extra free valences so it has high absorption capacity.

Since the charcoal layer is covered with outer shell which is filled with water. Sound produced under water is less hearable than it produced in atmosphere. This is mainly because of small sprockets in water molecules, which lowers its amplitude thus, lowers the sound level

hence aqua silencer reduces noise and pollution.

7. LITERATURE REVIEW

4. EFFECTS OF DISSOLVED GASES ON LIME WATER

The lime water is a good absorbing medium. In aqua silencer the gases are made to be dissolved in lime water. When these gases dissolved in water they form acids, carbonates, bicarbonates etc.

1. Action of dissolved SO_2

When SO_x is mixed in water, it forms $\text{SO}_2, \text{SO}_3, \text{SO}_4, \text{H}_2\text{SO}_4$ i.e. sulphur Acid (H_2SO_3), it forms Hydrogen Sulphide which causes a rotten egg smell, acidify and corrosion of metals.

2. Action of dissolved CO_2

The dissolved carbon dioxide forms bicarbonate at lower PH and Carbonates at higher PH. This levels 40-400 mg/litre the carbon dioxide mixes with water to form Carbonic acid. It is corrosive to metals and causes greenhouse effect.

3. Effect of dissolved NO_x

The NO_x in exhaust gas under goes Oxidation to form ammonia, Nitrate, Nitrite, Nitric acid. This synthesis of protein and amino acids is affected by Nitrogen. Nitrate usually occurs in trace quantities in exhaust gas.

4. Adsorption Process

Activated charcoal is available in granular or powdered form. As it is highly porous and Possess free valences. So, it possesses high absorption capacity. Activated carbon is more widely used for the removal of taste and odorous from the public water supplies because it has excellent properties of attracting gases, finely divided solid particles and phenol type impurities, the activated carbon, usually in the powdered form is added to the water either before or after the coagulation with sedimentation. But it is always added before filtration. Feeding devices are similar to those used in feeding the coagulants.

5. MERITS AND DEMERITS

5.1 Merits

- No vibration when the engine is running.
- Start the engine easily.
- Control emission and noise in greater level.
- Carbon is precipitated.

5.2 Demerits

- Lime water filling is required once in a year
- Silencer weight is more comparing to conventional silencer.
- Additional space is required.

6. 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. The water contamination is found to be negligible in aqua silencer. It is smokeless and pollution free emission equivalent to the conventional to the silencer

a) Akhil Anil Kumar - 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. 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 box 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. [1]

b) Alen.M.A - An Aqua Silencer is mainly dealing with control of emission and noise in automobile exhaust. By using activated charcoal, perforated tube and outer shell it is constructed. An aqua silencer is fitted to the exhaust pipe of engine. The activated charcoal filters the harmful sulphur and nitrous content produced from 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, lower the sound level. Because of this property water is used in this silencer and hence its name is AQUA SILENCER [2].

c) Rahul.S.Padval - In aqua silencer the main component perforated tube which consists of number of different diameter holes. Generally, these are 4 sets of holes on perforated tube. Charcoal layer is pasted over that tube and 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 is happening 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 high absorption capacity [3]

d) Prof H.AKhande - An aqua silencer fitted to the exhaust pipe of engine can control exhaust emission and noise effectively as compared to that of conventional silencer, it is cheaper, no need of catalytic converter and easy to install. Sound produced under water is less hearable than it is produced in atmosphere. This mainly because of small sprockets in water molecules, which lowers its amplitude thus, lower the sound level. Because of this property of water is used in this silencer and hence its name AQUA SILENCER [4].

e) Prof. M. M. Kulkarni - Water in the scrubber tank can itself play an important role in absorbing the obnoxious products of combustion like the oxides of Nitrogen. It also serves to dissolve the unburned hydrocarbon, which is present in the Diesel emission, thereby serves to suppress a spark before it is emitted to the surrounding environment. In place of water, a weak lime solution could be used and this change will allow for the chemical reaction to take place at a faster pace. All the gases present in the Diesel Exhaust except the Carbon Monoxide is readily with the working medium namely the lime water and Calcium Carbonate. Water, intern

indirectly supports the chemical reaction by not allowing the unburned HydroCarbon to deposit over the Calcium Carbonate, which will otherwise prevent further Chemical reaction, between the working media and constituents of the Diesel emission. [5]

f) Rohit Takre- Aqua Silencer can be said to be an advanced system which can be used along with or instead of a catalytic converter, using which exhaust emissions at tail pipe of an exhaust system can be easily lowered than specified levels, along with reducing undesirable noise at tail pipe. Also, the use of water decreases overall temperature of exhaust gases coming out via tail pipe, which may add to greenhouse gases. Overall emissions at tail pipe which contains harmful constituents like lead (Pb), carbon monoxide (CO), oxides of nitrogen (NOx) & unburnt hydrocarbons (UBHC) can be lowered than existing levels using adsorption method, which uses activated charcoal to adsorb these harmful constituents. [6]

g) Dr. P.K. Sharma- An Aqua Silencer is fixed to the exhaust pipe of engine. Sound produced underwater is less audible than it produced in atmosphere. This is mainly because of small sprockets in water molecules, which drops its amplitude thus, lower the sound level. Because of this property water is used in this silencer and hence its name AQUA SILENCER. The noise and smoke level are considerably less than the conventional silencer, it is inexpensive, no need of catalytic converter and easy to install. Air pollution can be defined as addition to our environment of any material, which will have a deleterious effect on life upon our planet. The main pollutants contribute by automobile are carbon monoxide (CO), unburned hydrocarbon, oxides of nitrogen (NOx) and Lead. [7]

h) Santosh Kumar- 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. [8]

8. LITERATURE GAP

In near future Aqua Silencer will be a weapon against pollution rise. But in above research papers authors does not researched about the reduction size, emission and noise of the silencer.

9. PROBLEM DEFINED

1. The existing silencer are bigger in size; therefore, it occupies more space and installation become difficult and also increases installation cost.
2. The existing silencer controls emission and noise but further emission and noise can be reduced.

10. OBJECTIVES

- 1) To reduce size of silencer without affecting the efficiency.
- 2) To reduce Emissions of the engine as per pollution

- policies.
- 3) To reduce Noise of engine.

11. FUTURE SCOPE

- I. It can be used in Automobile Vehicles.
- II. It can be used in Generators in industries.

12. ACKNOWLEDGEMENT

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