

A Review on Design and Manufacturing of Aqua Silencer

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ABSTRACT

Purity of air is most important from the public health point of view, because every individual person breathes approximately 22000 times per day, inhaling about 15 to 22 Kg of air daily. Polluted air causes physical ill effect decides undesirable aesthetic and physiological effects. The main pollutants contribute by automobiles are carbon monoxide (CO), unburned hydrocarbon (UBHC), oxides of nitrogen (Nox) and Lead. An aqua silencer is fitted to the exhaust pipe of 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. Because of this property, water is used in this silencer and hence its name as aqua silencer. Due to this we reduce the noise and emissions from exhaust. 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, lowers the sound level. Because of this property water is used in this silencer and hence its name aqua silencer. It is tested on two wheeler vehicle i.e. (petrol engine). The noise and smoke level is considerable less than the conventional silencer.

Keywords: *Aqua Silencer Activated charcoal, Perforated Tube, Noise.*

1. INTRODUCTION

Silencer is also termed as muffler. It is used for reducing the noise emitted by exhaust of an internal combustion engine, which is a major source of noise pollution. It becomes a more vital concern when used in residential areas or areas where noise creates hazard. Generally, noise level of more than 80-90 dB is injurious for human being. The main source of noise in an engine are divided in two parts, first is the exhaust noise and second is the noise produced due to friction of various parts of the engine. The engine exhaust noise is the most dominant.

To reduce this noise, the most effective way of using a muffler in the engine. The level of noise reduction depends upon the design, construction and the working procedure of mufflers. If a car running without a muffler then the noise level is unbearable. The most of the advances in the acoustic filters and exhaust mufflers came out in last four decades. Hence good design of the muffler should give the best noise reduction and offer optimum backpressure for the engine. Backpressure is the extra static pressure exerted by muffler on the engine through the restriction in the flow of exhaust gases. The insertion loss is defined as the difference in the acoustic power radiated without and with the muffler fitted.

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 by introducing this aqua silencer. It is fitted to the exhaust pipe of an 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 it is highly porous and possesses extra free valences so it has high absorption capacity. So absorb the gases from the engine and release much less position to the environment. The noise and smoke level is considerable less than the conventional silencer, no need of catalytic converter and easy to install.

2. COMPONENTS AND EXPLANATION

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 pasted over the perforated tube. Perforated tube is tube generally made up of stainless steel and have holes punched or drilled around its periphery. These tubes are provided to guide the flow and hence their main function is to reduce the backpressure of the engine. However, with the appropriate design of perforated tube it is possible to increase the transmission loss of the muffler.

Backpressure is essential for the performance of a silencer. Pressure drop of exhaust system includes losses due to piping, silencer, and termination. The most critical component regarding backpressure of any commercial muffler is cross flow perforated tube in which the diameter of the perforated tube hole and porosity of the perforations are most critical. If the diameter of the hole increases the backpressure decreases sharply by 40%. The change in diameter of holes has remarkable effect on back pressure.

Charcoal Layer

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. 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 colour, which can be removed with activated charcoal. It is also used to absorb odours and toxins in gases, such as air.

Outer Shell

The whole setup was kept inside the outer shell. It is made up of iron or steel. The water inlet, outlet and exhaust tube was provided in the shell itself.

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. Check valves are two-port valves, meaning they have two openings in the body, one for fluid to enter and the other for fluid to leave. An important concept in check valves is the cracking pressure which is the minimum upstream pressure at which the valve will operate. Typically the check valve is designed for and can therefore be specified for a specific cracking pressure.

The Aqua silencer was filled with water and it is directly connected to the exhaust pipe of the engine. There is a chance for the water to get enter into the engine cylinder. To avoid this, Non return valve is used. It allows the flow of fluid in one direction only.

3. 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 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.

Diagram

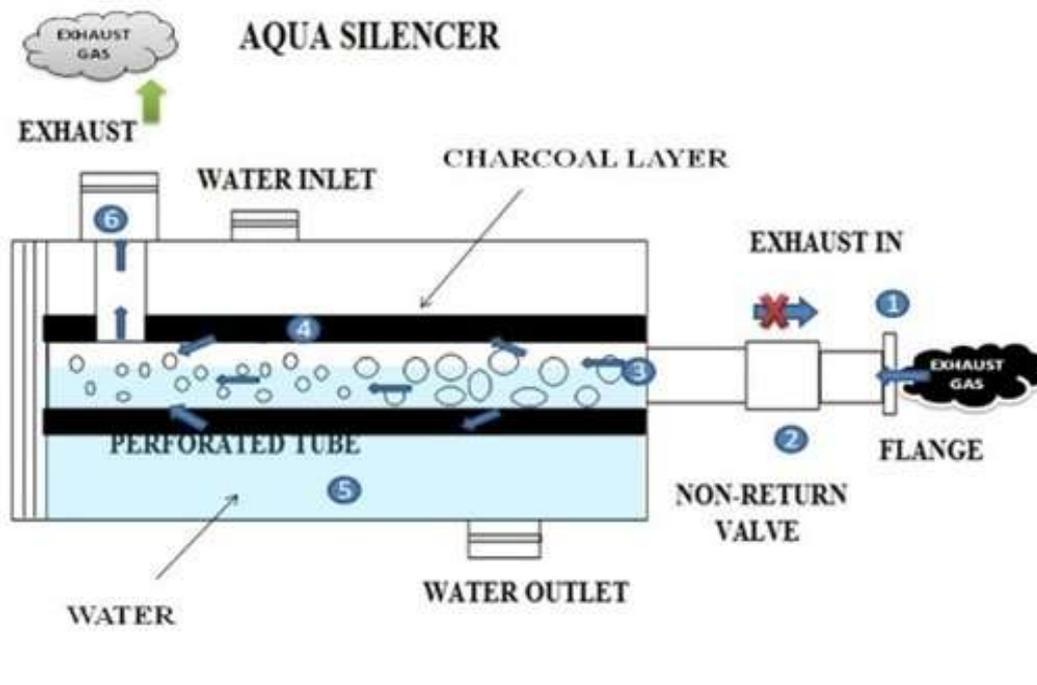
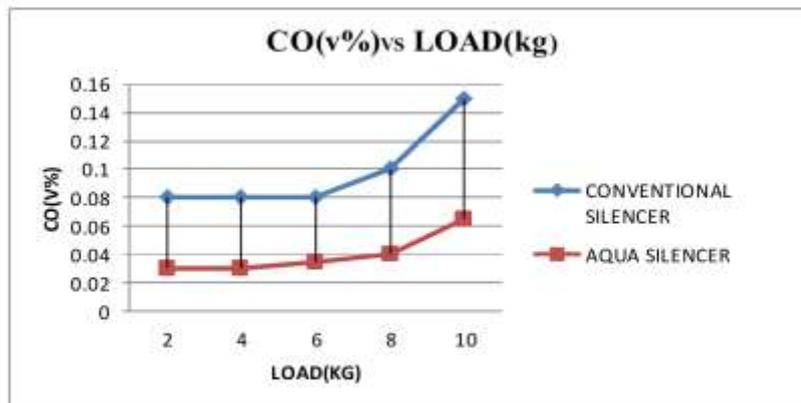


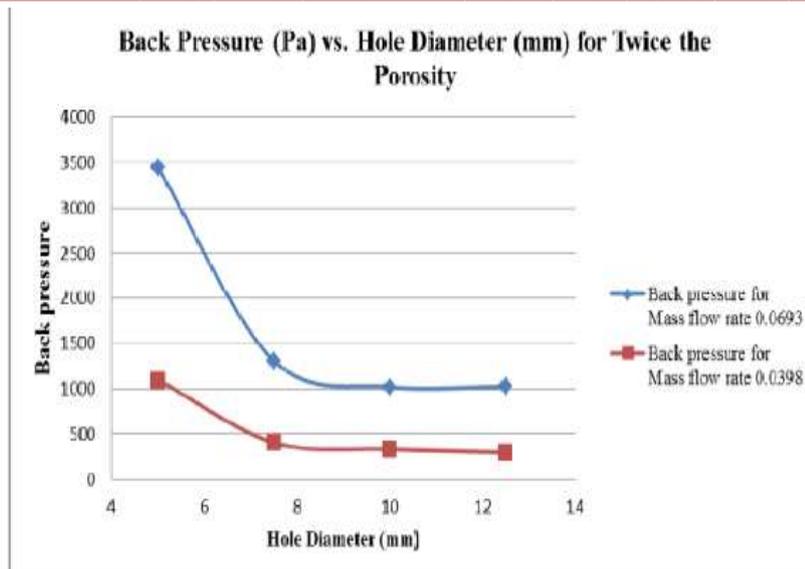
Fig. Aqua Silencer

4. GRAPHS

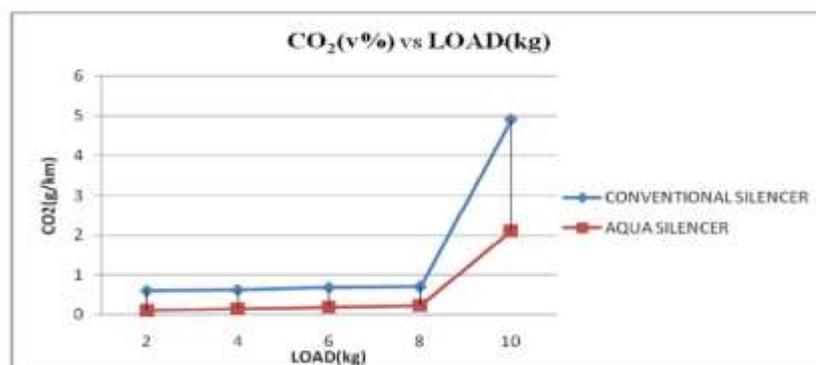
1) CO VS LOAD



2)



3) CO₂ VS LOAD



5. CONCLUSION

The aqua silencer is most effective in reduction of the emission of gases from the engine exhaust. By using water medium sound intensity can be lowered. It is smokeless and pollution free emission. It can be used for two wheelers and four wheelers and for industrial application.

By using perforated tube the fuel consumption remain same as conventional system by using water as medium the sound can be lowered and also by using activated charcoal in water we can control the exhaust emission.

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7. REFERENCES

- [1] Shigley, Joseph Edward, Theory of Machines and Mechanisms, Tata McGraw Hill, New York, 2003
- [2] A Text Book of Mechanical System Design, Farazdak Haideri, Third Edition, Chapter 2, Page No. 149 – 241.
- [3] Mechanics of Materials I, Third Edition, E. J. Hearn, University of Warwick, United Kingdom, Chapter 1, Page No. 1-8.