

FABRICATION AND ANALYSIS OF AQUA SILENCER

Prof. Dilip Sangotra, Kaustubh Thengadi, Sankalp Kawade, Arnav Chimankar, Dhananjay Thakre

Department. of Mechanical. Engineering, Yeshwantrao Chavan College of Engineering, Nagpur

Abstract

Air contamination is increasing more as time passes. Air contamination happens due to vehicles, electro- power generating plants, machine-made and domestic fuel utilization, and so forth. Also, the contamination isn't good just for Environment yet additionally for Human creatures. So, major steps ought to be taken to reduce the contamination. So, we know that internal combustion motors are fundamental part in transportation via road and also sea, Food cultivation and numerous different businesses. The main contaminants which worsen the pollution via vehicles are Carbon monoxide, Carbon dioxide, hydrocarbons which are not burnt fully, Nitrogen-oxides, Sulfur-dioxide, Lead. So, in order to tackle this, we made an attempt. i.e.: aqua silencer. The main components of the Aqua Silencer are Perforated Tube, Activated Charcoal, Flange, Non-return Valve, Outer shell. As the emissive gasses enter the silencer it will pass through the perforated tube which will convert the high mass gas molecules to low mass gas molecules. after this the gasses will react with the Activated charcoal layer & will be purified. Due to this Air Contamination will decrease. Sound produced due to working of the vehicles is lessened by making use of water because noise heard in water is heard less than when it is heard in open air. due to this Noise Pollution will be reduced. Aqua silencer uses cheap materials and is easy to fabricate. So deliberate steps shall be taken to reduce these pollutants and thus increase the quality of the air we breathe

Keywords: Automobiles, Perforated Tube, Activated Charcoal, Air Contamination, Noise Pollution, Aqua silencer.

1. Introduction

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. Our project can also be utilized to lessen sounds as well as the outflow from Internal Combustion engines. The idea behind why we built the Aqua silencer is: In this modern era people are buying large numbers of automobiles and due to this the pollution, which is caused by emission of harmful gasses from these vehicles is increasing which results in more health problems towards the people as well as the climate. This outflow is constrained because of the activated-charcoal layer wound over the perforated tube which is present in the Aqua silencer. The activated-charcoal has an ability of retaining harmful gases emitted by the engine. These harmful emissions as well as sound levels from Aqua silencer are exceptionally low when compared to the regular silencers.

Sound made by the engine turns into a concern in public and residential spaces where sometimes noise makes it difficult for us to even hear nearby people. Sound levels greater than 75-80 db are dangerous to people. So primary reason for unwanted- noise is the exhaust and that sounds made by cause of friction between different components while the engine is running. As result, authorities currently request that noise levels are kept beneath specific cut-off points. To lessen sounds produced from the vehicle engine water is used.

2. Literature Survey:

- Alen.M.A (Aug-2015): Alen has discerned that the issue of back pressure can be solved by using perforated tube and due to this the sound levels get reduced. Also, the contamination of water is negligible in aqua silencer.
- Akhil Anil Kumar (May 2016): It has been observed that since water is a good absorbing medium, by using water and activated charcoal it produces almost negligible pollution and smoke-less emission. Also because of water the sound levels get reduced. The performance of the aqua silencer is very similar to the conventional silencer furthermore is also highly cost effective keeping in mind the long term usage

- Sarath Raaj (March-2016): Sarath raj also discovered that in order to keep the back pressure constant it will be more effective to use a perforated tube and activated charcoal. This will also help in the reducing emissions of unhealthy gases emitted by engine- exhaust and the sound levels were also getting reduced.
- KEVAL I. PATEL (June 2014): It is observed that water is an excellent absorbent medium and hence the noise is brought down and furthermore involving activated charcoal and water, the exhaust discharge can be brought down to a more-controlled levels. In our prototype there is very low water contamination. It is smoke-less and low emission discharge. The aqua silencer tends to be additionally utilized both for bikes and four-wheelers and furthermore can be utilized in industrial ventures.

3. Methodology:

- STUDY OF EXISTING SOLUTIONS, PATENTS AND APPLICATION RESEARCH.
 - CONCEPTUAL DESIGNING.
 - FINALISING THE DESIGN.
 - PROCUREMENT
 - ASSEMBLING
 - TESTING.
 - BUFFING, SURFACE FINISHING & SPRAY PAINTING.
 - NECESSARY MODIFICATIONS.
 - FINAL PRODUCT
- As you can see the methodology is highlighted in the above roadmap.
 - First, we will set certain objectives for the project. After setting the objective we will carry out extensive research needed for the project and this research will be compiled in the form of literature survey.
 - After this we will design the aqua silencer conceptually using various CAD software and finalize the specifications.
 - After this fabrication of the actual unit and its parts will start.
 - After fabrication the prototype of the aqua silencer will be assembled and testing will

begin.

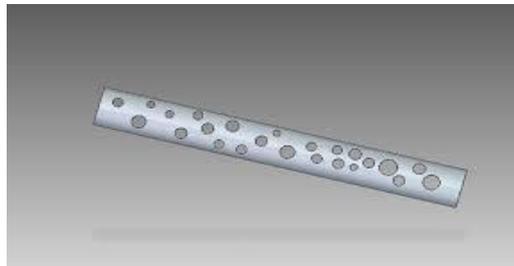
- After testing the aqua silencer, the results will be compiled in the form of thesis/ project report and will be submitted to the college.

4. Components of Aqua Silencer:

- Perforated Tubes
- Flange
- Activated charcoal layer
- Casing (outer shell)
- Non return valve
- Wire Mesh

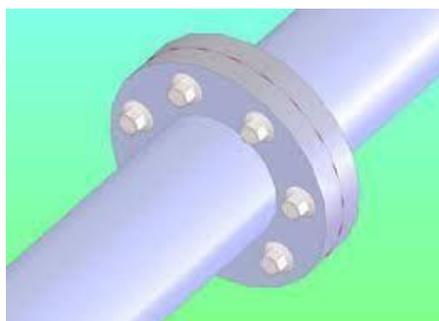
1) Perforated tube:

In Aqua Silencer, generally the perforated cylinder is attached to the main exhaust pipe. It has random holes of different diameters for converting high-mass air bubbles into low-mass air bubbles. It further has a layer of activated-charcoal which is pasted with the help of metallic mesh.



2) 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.



3) Activated Charcoal Layer:

The charcoal layer used in the aqua silencer is different, named activated-charcoal layer which was obtained by heating charcoal at 1500* degree for long durations which results in increased surface area. Due to the increased surface area, it has high absorbing capacity. This will mean that it will work effectively in absorbing gasses. The layer has pores and hence is highly porous as well as has free valance electrons. Therefore, it should be very effective.



4) Casing:

The casing is made up of stainless steel due to the desirable qualities and the whole setup is kept inside a cylindrical shaped outer shell. Water inlet plug, water outlet plug and exhaust pipe is also provided in the casing. Also, the casing should be big enough to store sufficient water.



5) Non- Return Valve:

When the prototype (Aqua silencer) is attached to the main exhaust the water flows into the exhaust pipe and clogs it. So, in order to sidestep this issue a non return



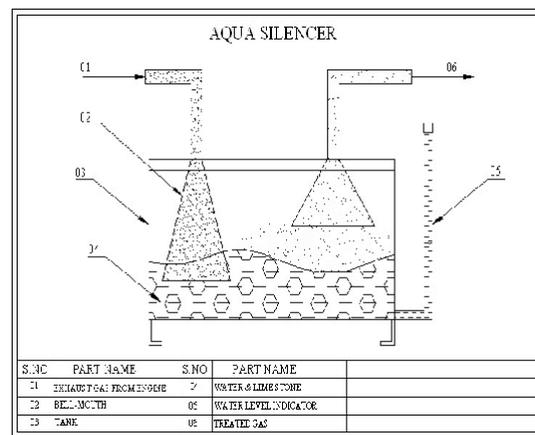
valve is attached. The valve does not let the water flow in both directions and keeps the water trapped in the aqua silencer.

6) Wire Mesh:

The wire mesh does the job of holding the activated charcoal in the aqua silencer. The wire mesh used is fine and allows the exhaust gas to pass through it easily. Stainless steel is used to make the wire mesh. It has a melting point of 1300°C – 1500°C.

5. Working Principle:

After the harmful gases enter the prototype, high mass air-bubbles are changed into low mass air-bubbles because of the 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 come in contact with water, the gases react with water. As a result, some gases get dissolved here and then they pass through the water in the open cavity above and then exit the silencer through the exhaust outlet.

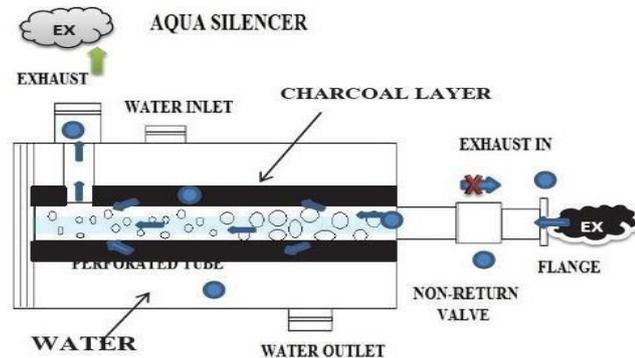


6. Working:

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 decontaminates 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.

7. Effect of Dissolved Gases in Water:

In aqua silencer when the harmful gasses come in, they dissolve in water in some quantities to form carbonates, bicarbonates, acid, etc. This is because water is a good absorbing medium.

- 1) Action of dissolved Sulfur oxides.
- 2) Action of dissolved Carbon oxides.
- 3) Action of dissolved Nitrogen oxides.

A) Action of dissolved Sulfur oxides:

When oxides of sulfur has a reaction with water, this forms Sulfur-dioxide, Sulfur-trioxide, H₂S, SO₄, Sulfuric Acid: this reaction gives Hydrogen Sulphide which is the cause of carious egg smell, and can acidify and corrode metal.

B) Action of dissolved Carbon oxides:

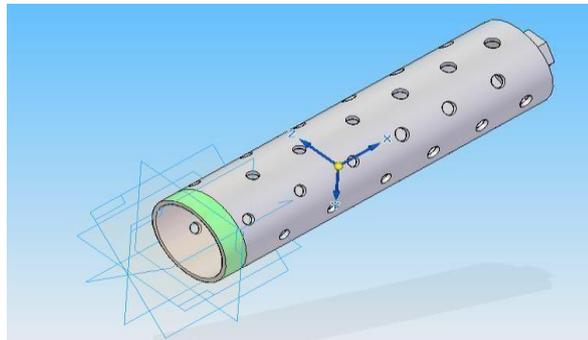
When the carbon oxides are dissolved Carbonates are formed at higher PH and bicarbonates are formed at lower PH. Their levels are 40-400 mg/l. Scales are formed in pipes and boilers. Carbonic acids which are harmful and corrosive to metals are formed.

C) Action of dissolved Nitrogen oxides:

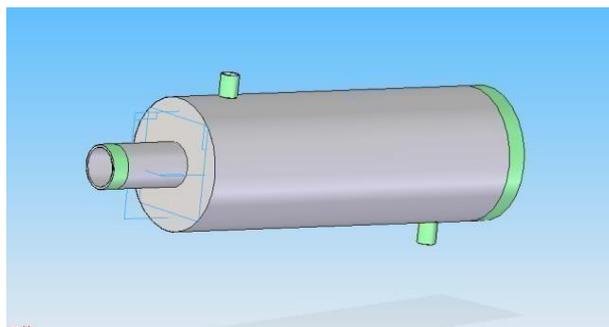
When NO_x reacts with water, it oxidizes which results in ammonia and also nitrate, nitrite and nitric acid.

8. Design of Aqua Silencer:

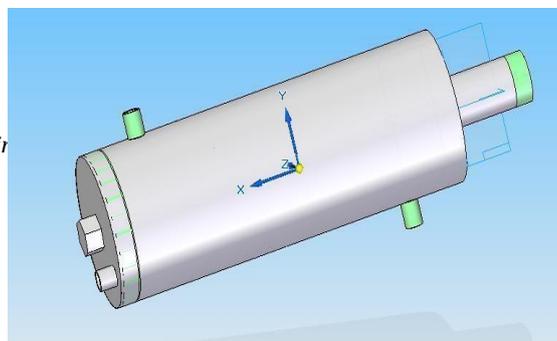
a) 3-D View of Perforated Tube:



b) 3-D View of Casing:



c) 3-D View of Aqua Silencer:



9. Merits and Demerits:

Merits:

- In Aqua Silencer less vibration is caused as compared to the conventional silencer.
- As compared to the regular silencer the cost of creating the Aqua silencer is low.
- Easy construction and working.
- Harmful gasses are separated.
- Reduction of air pollution is more

De-Merits:

- Extra space is required at exhaust pipe.
- A conventional silencer weighs less than the aquasilencer.
- Since water is present in the aqua silencer maintenance is required after every few months

10. 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 aquasilencer 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

11. Reference:

- Keval I. Patel,
“Design And Development of Aqua Silencer for TwoStroke Petrol Engine” June
IJIRST–International Journal for Innovative Research inScience &
Technology
Vol. 1, Issue 1. 2014

- Alen M, Akshay, Prem Sanskar, R. Mohammed Shafeeque
“Fabrication and testing of Aqua Silencer”
International Research Journal of Engineering and Technology
Vol.5, Issue 11. (May- 2016)

- Akhil Anil Kumar, Anoop N, Aquib Jawed, Bijoy E, Midun T, Mohameed Shiyas
Rajnath Krishna
“International Journal of Engineering and Innovative Technology”
Vol. 5, Issue 11. (May- 2016)

- Sarath Raj, Ajbin K Aniyam, Akshay Aji, Anandhu Raj, Anandu Mohan, Sharon
T.R (OCT- 2015) \
“Fabrication and testing of Portable Twin filter Aqua Silencer”
International Journal of Mechanical and Industrial Technology,
Vol. 3, Issue 2.