

Design and Fabrication of Eco-Friendly Aqua Silencer

S. Santhosh Sathish Kumar

Student
Department of Mechanical Engineering
Kings College of Engineering, Punalkulam

S.Richard Brinton

Student
Department of Mechanical Engineering
Kings College of Engineering, Punalkulam

G.Sarath Kumar

Student
Department of Mechanical Engineering
Kings College of Engineering, Punalkulam

S.Saravanamanoj

Student
Department of Mechanical Engineering
Kings College of Engineering, Punalkulam

M.Babu

Associate Professor
Department of Mechanical Engineering
Kings College of Engineering, Punalkulam

Abstract

The objective of this work is to develop an silencer that can rectify Air pollution and Noise produced in this conventional silencer. Air pollution is most important from the public health of view, because every individual person breaths approximately 22000 times a day, inhaling about 15 to 22 kg of air daily. Polluted air causes physical ill effect decides undesirable a esthetic and physiological effects. Air pollution can be defined as addition to our atmosphere of any material, which will have a dexterous effect on life upon our planet. The main pollutants contribute by automobile are carbon monoxide (CO), unburned hydrocarbon (UBHC), oxides of nitrogen (NO_x) and Lead. And also contribute heavily to contamination of our environment so it is imperative that serious attempts should be made to conserve of our environment from degradation. An Aqua Silencer is an attempt, in this direction; it is mainly dealing with control of emission, heat and noise. 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 AQUA SILENCER.

Keywords: Aqua Silencer, Emission Control, Noise Reduction, Perforated Tube

I. INTRODUCTION

Global warming is increasing on our earth due to major increase in the pollution. 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 is get exposed from vehicles. The other sources such as big factories, electric power, generation plants, big industries etc. So it is required to solve these problems 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 Silences is used to reduce the noise and control the emission of dangerous gases. In aqua silencer the main component perforated tube which consists of number of different diameter holes. Generally these are 4 set of holes on perforated tube. 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 .These is 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 layer having high absorption capacity. The aqua silencer system is design for replace commonly used single unit silencers in engine with its slender structure and less weight. It plays an important role in control the noise and emission of gases from engines. Air pollution causes dangerous physical effect on the human body, animal and environment. The main reason to use aqua silencer is because now a day's air pollution is increasing rapidly. This system reduces the dangerous exhaust gases from the auto. These emission controlled by the activated charcoal layer around perforated tube and lime water. The charcoal layer having high capacity to absorb emission gases from engine. This type charcoal layer with lime water reacts chemically with emission gases and changes the chemical structure of emission gases. The smoke or emission gases and noise level in aqua silencer is very less than the commonly used silencers.

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 is considerably less than the conventional silencer; there's no need of a catalytic converter and it is easy to install.

A. Working Principle of Aqua Silencer:

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 and thus the huge mass of gas from the silencer is spitted into smaller mass and the whole set of working tends to be simplified .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 thus the gas from the silencers body tend to be filtered and rectified from those hazardous gas. 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.

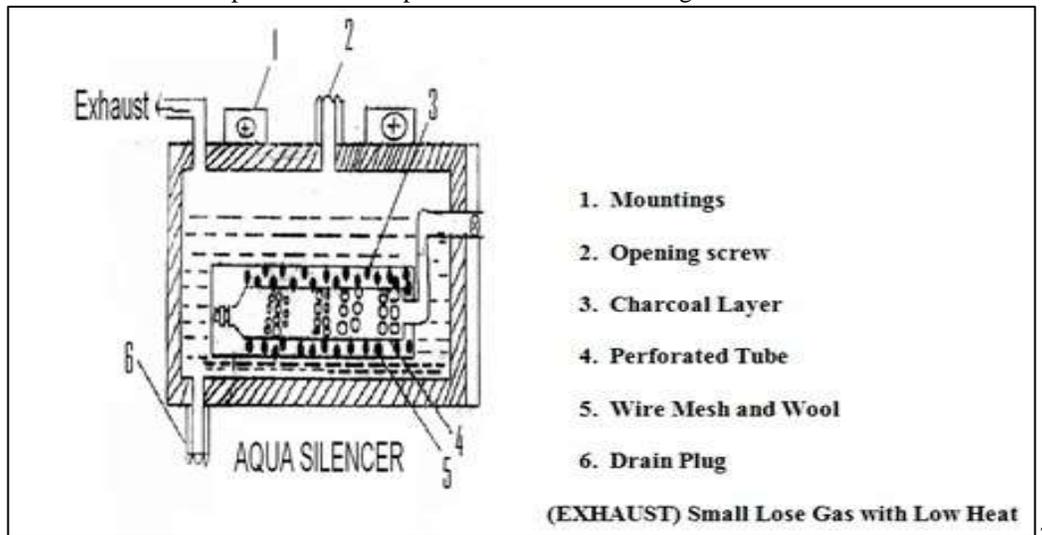


Fig. 1: Principle of Aqua Silencer

II. LITERATURE REVIEW

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 [6]. 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 [9]. 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 non-return 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 in to the atmosphere [1]. „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, CO₂, NO_x, and Hydrocarbon [5] and the main contribution of air pollution comes from automobiles and industrial engines releasing gases like carbon dioxide and unburnt Hydrocarbons [6].

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 (UBHC), Respirable combustible Dust (RCD) . The above polluting contents in the engine exhaust are to be controlled by the Aqua Silencer [5].

A. Causes 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, and the engine rating. Injection system, Rating, Fuel, Load, Engine type and speed & Fuel – air ratio

We know that in addition to harmful emission, engines also produce a very high amount of noise. Industrialization, together with the needs of our modern society for various machines for Human comfort, fast travel and appliances for routine jobs in homes and offices, has led to increase in the levels of noise pollution almost everywhere. The harmful effects of noise are well known [8]. Exposure to noise causes detrimental effects on neuro-endocrine, cardiovascular, respiratory and digestive systems. Chronic exposure to noise causes fatigue and interferes with concentration, thus reducing work efficiency [10]. The basic principle 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 [9]. By using water as a medium, the sound produced can be lowered. With further development, it can also be used in automobiles.

B. Project Methodology

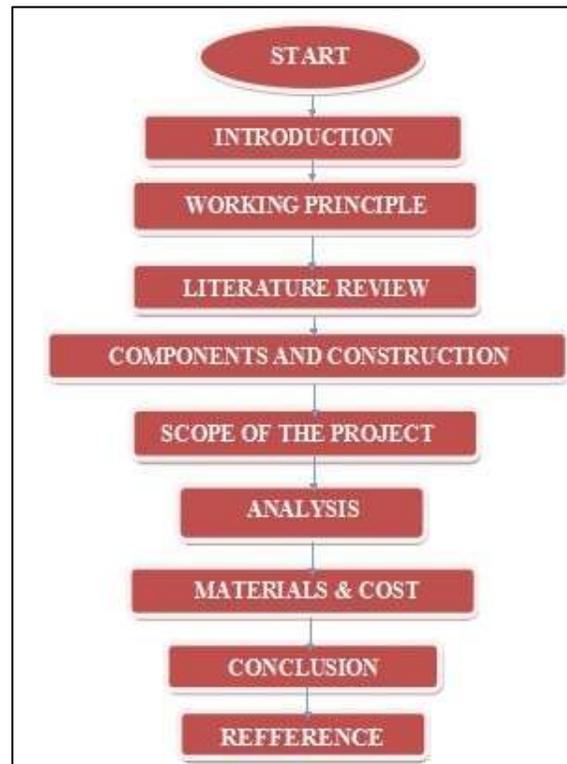


Fig. 2: Work flow of the article

C. Components and 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 diameter. Generally 4 sets of holes are drilled on the perforated tube. The other end of the perforated tube is closed by plug. The very purpose of providing different diameter hole is to break up gas mass to form smaller gas bubbles the perforated tube of different. 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.



Fig. 3: Perforated Tube



Fig. 4: S-Tube



Fig. 5: Resonance Type Muffler



Fig. 6: Non-Return Valve



Fig. 7: Charcoal & Lime Stone (CaCl₂)



III. SCOPE OF THE PROJECT

An aqua silencer system is designed in such a way as to substitute for conventional single unit engine silencers installed on industrial engines and heavy vehicles. Its construction is simple and it has a slender design; in addition to having a minimal 'footprint', it also optimizes the engine exhaust system for reducing backpressure and decreasing noise levels. It is used to control the noise and emission in IC engines. The reason why we opt for aqua silencer is that, in our world, air pollution causes physically and mentally Methodology is a very important element to be considered to make sure the fluent working of the project and to get expected results.

In other words, methodology can be described as a framework which contains the elements of the work based on the objectives and scope of the project. A good framework can present the overall view of the project and be used to arrange or extract the data easily. This includes the various steps involved such as literature study, design of specimen, fabrication of parts, assembly, testing phase, etc.

IV. ANALYSIS

As per the acceleration given and driven to the engine the emission varies such as therefore conversion is done due to the presence of, Activated charcoal is placed inside the Perforated Tube with the AQUA medium to dissolve the gas and to reduce the emission.

V. NOISE LEVEL ANALYSIS

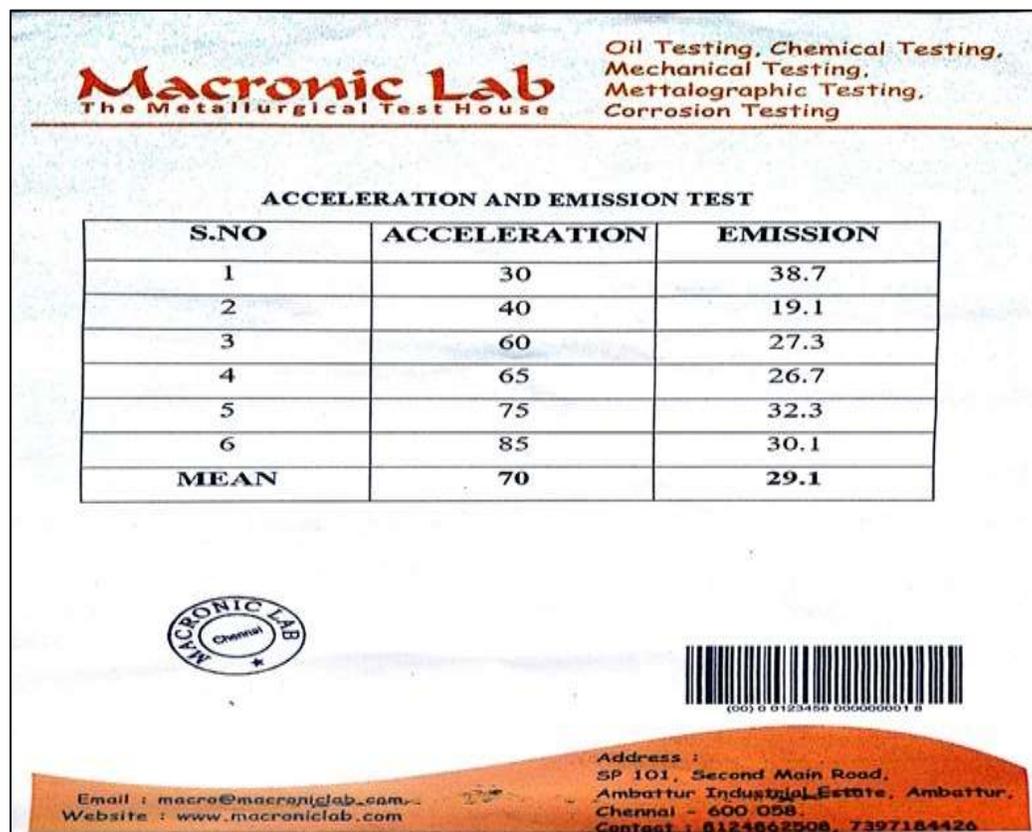
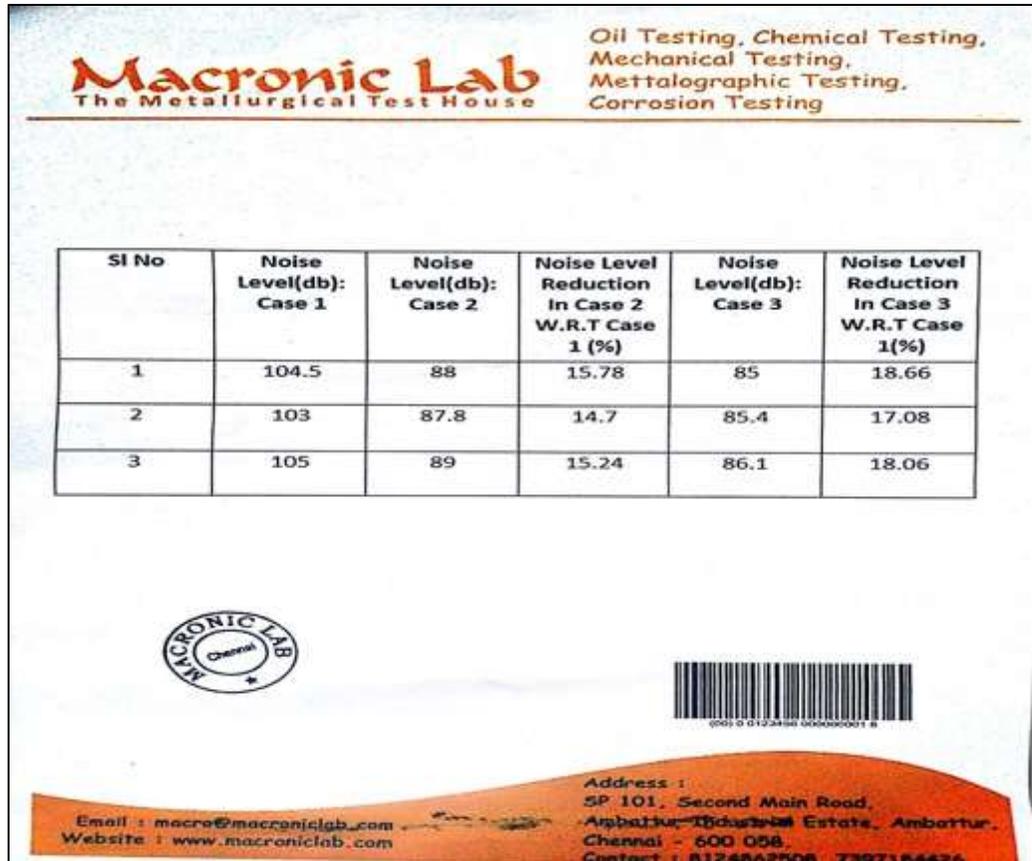


Fig. 8: Certificate of Noise Level, Acceleration and Emission Analysis



Fig. 9: Aqua Silencer Setup & Project Members

Table – 1
Material used and their cost

SL.NO	MATERIAL	QUANTITY	COST(RS)
1	OUTER CYLINDER	1	500
2	PERFORATED TUBE	2&3mm pipe to 3 meter	50
3	RESONANCE TYPE MUFFLER	3cm	120
4	WOOL AND CHARCOAL LAYER	200 gm	20
5	FLANGE COUPLING	1	70
6	NON-RETURN VALUVE	1	30
7	LIME STONE (cacl)	100 gm	10
8	DRAIN PLUG	1	20
9	C-CLAMPING	2	50
10	STRAIGHT SLOTS	2	40
11	BOLT AND NUTS WITH WASHER AND BUSHES	-	80
12	WELDING PROCESS	-	900
13	DRILLING PROCESS	-	100
14	MACHINEING PROCESS	-	100
15	CUTTING PROCESS	-	100
16	BENDING PROCESS	5 bends	120
17	THREADING PROCESS	3 sides	50
18	SHAPING PROCESS	-	50
19	POLISHING PROCESS	-	100
20	PAINTING PROCESS	-	160
	Total		2,670

VI. CONCLUSION

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

REFERENCES

- [1] Keval I. Patel, Mr. Swastik R, Gajjar "Design And Development Of Aqua Silencer For Two Stroke Petrol Engine" IJRST-International Journal for Innovative Research in Science & Technology| Vol. 1, Issue 1, June 2014| ISSN(online): 2349-6010.

- [2] Sharad R. Mahajan “Air Pollution from I.C. Engines & its Control” International Journal of Inventive Engineering and Sciences (IJIES), October 2013.
- [3] Yogesh V Morankar , Prof. M. R. Khodke ,“Noise Reduction Of A Diesel Engine: A Review,” International Journal of Engineering Research & Technology (IJERT)ISSN: 2278-0181, Vol. 3 Issue 5, May – 2014.
- [4] S.*, PatilSnehal S., NandrekarAmruta A., Abhijeet S. Kabule, “Use Of Aqueous Ammonia In Silencer For Removal Of Co2, So2 And Nox From Exhaust Gases Of I.C. Engines” RawaleSudarshan International Journal of Engineering Science and Innovative Technology (IJESIT)Volume 2, Issue 5, September 20.
- [5] P.Balashanmugam1, G.Balasubramanian2,” Developments of Emission and Noise Control Device (Aqua Silencer)”; Scientific Journal Impact Factor (SJIF): 1.711International Journal of Modern Trends in Engineering and Research.
- [6] JuhiSharaf; ” Exhaust Emissions And Its Control Technology For An Internal Combustion Engine” International Journal of Engineering Research and Applications , Vol. 3, Issue 4, Jul-Aug 2013.
- [7] Mankhiar Ajay B, Sindhu LS , G. Sasikala ,“An Advancement To Reduce Pollution Effectively By Using Ti Nanotubes In Aqua silencer” International Journal Of Engineering Sciences & Research Technology.
- [8] Abdul Rehman, Surya Yadav, Amansaxena, “Reviewed Of Noise Control In Ic Engine” International Journal of Scientific Research Engineering & Technology (IJSRET), Volume 3, Issue 8, November 2014.
- [9] Alen.M.A, Akshay. M, PremSankar. R, Mohammed Shafeeque. M, “Fabrication and Testing Of Aqua Silencer” International Research Journal of Engineering and Technology (IRJET) Volume: 02 Issue: 05 | Aug-2015
- [10] Patel Praful M, GajjarSwastik R., “A Literature Review On Design And Development Of Industrial Generator Silencer” IJSRD - International Journal for Scientific Research & Development| Vol. 3, Issue 01, 2015