

Design and Fabrication of Aqua Silencer for Emission Control as well as Noise Reduction

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Abstract – This research study aims to control the emission and noise reduction of engine by inventing aqua silencer at its exhaust. The regular silencer is used for noise reduction and emission control, but; aqua silencer technique is invented in regular silencer to reduce the noise and emission control at great level. Silencer collects the exhaust of engine; reduce its noise and delivers to the atmosphere. While reducing the noise level of engine backpressure should be minimum; this effects on its efficiency. This silencer contains water which helps not only for noise reduction but also control of emission. The aqua silencer is designed by referring the various research papers and test results are calculated.

Key Words: Aqua Silencer, emission control, noise reduction, backpressure.

1. INTRODUCTION

The automobile engine should be always equipped with silencer to attenuate the acoustic pulses generated by the engine. The noise is generated because of pressure difference between exhaust of engine and atmosphere. This pressure difference can be bridged by inventing silencer at the exhaust of automotive engine. The invention of silencer at the exhaust of engine helps to reduce the noise level as well as controls the emission.

Environment pollution is the major problem in the world. The air pollution sources are automobiles, thermal power stations, industrial processing, refuse burning etc. These pollutants are hazardous for environment as well as human beings. The polluting agents at the automobile exhaust are carbon-monoxide (CO), Carbon-dioxide (CO₂), Un-burnt Hydro Carbon (UBHC), Sulphur-dioxide (SO₂), Oxides of Nitrogen (NO_X) and Lead etc. The pollution should be controlled for the preservation of living organisms. The aqua silencer can be used for the reduction of noise level and controlling the pollution.

The aqua silencer is fabricated with less cost as well as easily for installation. This silencer is installed at the exhaust of the engine. The aqua silencer is very effective for the controlling pollution and reducing the noise level as compared with regular silencer; because noise produced inside the water is less audible as compared to noise in free atmosphere. There

are small sprockets are present in water molecules which helps to reduce the asperity of noise. The perforated tube and charcoal layer is also provided inside the silencer. The charcoal layer installed in this silencer helps to control the emission. This charcoal layer sieves the harmful sulphur and nitrous contents coming out from the engine therefore there is no necessity of catalytic converter. In the regular silencer catalytic converter is used for emission control but this silencer is replaced by aqua silencer with minimum cost and good performance.

2. LITERATURE REVIEW

Mr. Sachin S. Morti et. al. (2021) have researched on backpressure investigation and design modification to reduce noise level of silencer used for single cylinder water cooled diesel engine through CFD simulation. In this research study, silencer design is modified by using CFD simulation software as a tool for numerical analysis. The comparison between regular silencer and modified silencer is made and results are tabulated with the help of CFD simulation. The modified design of silencer is enormously efficient in noise reduction of engine than regular silencer. The backpressure of modified design of silencer is also minimum as compared to regular silencer, which increases engine efficiency. The perforated baffle plate is installed inside the silencer to control the acoustic pulses generated by engine.

Mr. Sachin S. Morti et. al. (2021) have reviewed on design modification to reduce the noise level of silencer used for single cylinder water cooled diesel engine. This review aims to design modification of silencer for noise reduction of engine with minimum backpressure. The reviewer has referred various international journals for studying different kinds of numerical methods used for shape modification of silencer. The CFD simulation and virtual lab software can be used for design modification of silencer. In this review study various methods such as CFD simulation software, virtual lab software, acoustic software, various geometrical types of exhaust multifarious and their consequence on the pastime of engine have collected and discussed.

Prof. Rakesh B. Thakare et. al. (2020) have published research paper on aqua silencer for conservation of earth environment as well as pollution control to preserve the life

of living organisms. The charcoal layer used in aqua silencer having good absorption power which helps for noise reduction. The aqua silencer is very effective device for the reduction of noise and controls the emission coming out from exhaust gas of engine using perforated tube and charcoal layer.

Sachin Morti et. al. (2019) have studied on design modification and acoustic analysis of silencer used for agriculture diesel engine. In this review the various methods of design modifications of silencer are described with the reference of international journals. During design modification of silencer analytical study can be made by using various numerical methods such as CFD Simulation, acoustic software. The main aim of study is to review of various international journals for the reduction of noise level of silencer with minimum backpressure. The backpressure generated by exhaust gas effects on efficiency of engine. Therefore silencer should be modified with reduced noise as well as minimum backpressure.

Shweta B. Said et. al. (2017) have researched on aqua silencer to reduce the pollutants coming out from engine exhaust. Aqua silencer consists of perforated tube, lime water and charcoal layer for attenuation of noise and pollution control. On comparing with regular silencer, aqua silencer is very effective for backpressure of engine; which increase engine efficiency. Aqua silencer sieves the pollutants emitted by the automotive engine and controls the emission. The acidic gas coming out from the engine reacts with lime water and neutralizes the acidic property.

3. PROBLEM DEFINITION

The silencer is used for the reduction of noise and control of emission. The regular silencer is not more effective for emission control. Noise pollution is very important thing for preservation of environment. The existing silencer is not more effective for noise and emission control; therefore, it is necessary to control noise and emission for the preservation of environment.

4. OBJECTIVES

- To control the emission of exhaust gas emitted by automobile engine through inventing charcoal layer in the silencer.
- To reduce the noise level by installing aqua silencer to attenuate the acoustic pulses generated by automobile engine.

The air pollution takes place due to incomplete combustion of fuel in the automotive engine, which effects on living organisms. The unpleasant noise is heard due to pressure difference between acoustic pulses generated by engine and atmospheric pressure. This acrid noise effects on mental stability of engine operator as well as external surrounding environment. Therefore it is necessary to reduce the asperity of noise and control the pollution by inventing aqua silencer technique at the exhaust of automobile engine.

5. SCOPE OF THE WORK

The aqua silencer is eversion of regular silencer. Some modifications are made in the regular silencer to ameliorate its performance such as reduce the noise and control the emission. The overall shape of silencer is modified in comparing with regular silencer. This research work of silencer modification concentrates on noise reduction and emission control of exhaust gas emitted by automobile engine. The aqua silencer consists of lime water, which helps to control not only asperity of noise but also emission of exhaust gas emitted by automotive engine. There is possibility of increase the overall size and weight of aqua silencer as compared to regular silencer; but, it can be reducer in future work.

6. METHODOLOGY

For the invention of aqua silencer on automobile engine following methodology is used.

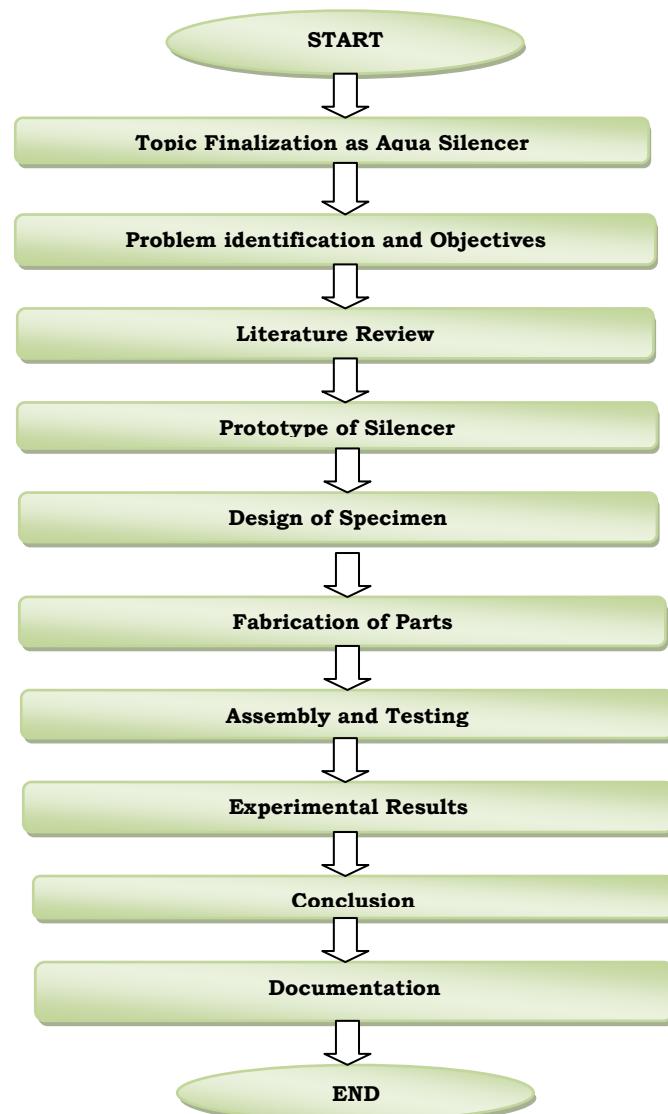


Fig. 01: Methodology of project

7. CONSTRUCTION AND WORKING

The aqua silencer is modified form of regular silencer used in automotive. It consists of following parts:

- Non return valve
- Outer layer (outer shell)
- Perforated tube
- Charcoal layer
- Lime water

The aqua silencer can be used very efficiently for the reduction of noise as well as to control the pollution of exhaust emitted by the engine.

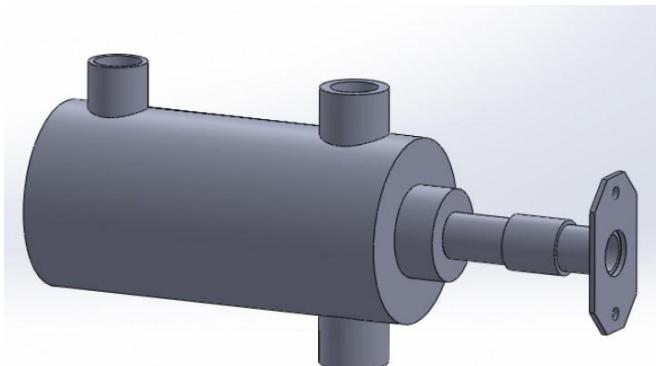


Fig. 02: CAD model of aqua silencer

The CAD model of aqua silencer is shown in Fig. 02. The non-return valve is installed at the inlet of silencer. It allows the exhaust gas flow in one direction only. It does not permit backflow of exhaust gas. The silencer is filled with lime water. The non-return valve helps to avoid backflow of lime water towards the engine.

After the non-return valve perforated tube is fitted inside the outer shell of silencer. The exhaust gas flows through this perforated tube. The charcoal layer is fixed over the perforated tube. This charcoal layer has more absorbing capacity. It absorbs the acidic gas coming out from the automotive engine and controls the emission.

The exhaust gas passes through the lime water. The aqua silencer is very effective for the controlling pollution and reducing the noise level than regular silencer; because noise produced inside the water is less audible as compared to noise in free atmosphere. There are small sprockets are present in water molecules which helps to reduce the asperity of noise.

The exhaust gas emitted by the engine enters in the silencer before non-return valve and then passes through the perforated tube; which is surrounded by charcoal layer. The emission is controlled in this charcoal layer by absorbing the hazardous exhaust contents. After the water has to pass through the lime water, in which intensity of noise get reduced. There is no necessity of catalytic converter which is used in regular silencer. The catalytic converter is replaced

by perforated tube covered with charcoal layer and lime water. The exhaust gas passes through the water and emitted to the atmosphere.

The drain plug is provided at the bottom of silencer for removing the limewater after specific span.



Fig. 03: Aqua silencer

The aqua silencer is shown in above fig. 03 which is used for the replacement of regular silencer of automotive.

3. CONCLUSIONS

The following conclusions are made on the comparison between aqua silencer and regular silencer.

- The aqua silencer consists of lime water which helps to reduce the noise level as compared to regular silencer. When exhaust gas passes through the lime water, the intensity of noise is reduced at great level.
- The perforated tube is inserted inside the silencer and it is enclosed with charcoal layer. The activated charcoal layer have more absorbing capacity. It absorbs the acidic gases emitted by automotive engine.

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BIOGRAPHIES

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