

A REVIEW ON ANALYSIS OF DOUBLE BAFFLE MUFFLER

Pravin B. ghungrad¹, Prof. R.L.Karwnde², P rof. Md. Irfan³, Prof. P.K.Bhoyar⁴.

¹PG Student, Department of mechanical engineering, MSS'S CET, JALNA, MH India.

^{2, 3, 4} Assistant professor, department of mechanical engineering, MSS'S CET, JALNA, MH India.

ABSTRACT

Muffling devices are essential part of any vehicle that uses internal combustion engine. Noise from automobile is one of the components for noise pollution to environment thus Exhaust noise is one of the main source of vehicle and exhaust system to attenuate noise meeting required levels and sound quality emission based on environment norms. Change in muffler design may be expected to provide broadband high noise attenuation and low pressure drop. Various sound absorption material used in this process. Here easily available absorptive materials are glass fiber which used with same space. Generally there are different process which used in reduction of noise and pollution so basically such all things are studied in these system and their application.

Keyword: - ANOVA, hybrid muffler, material for sound absorption, Taguchi, pollution reduction technique.

1. INTRODUCTION

Traffic noise and pollution is one of the most relevant environment problems in urban areas. Noise refers to the irregular and abashed sound which disturbs peoples work and impairs people's health. The major source of pollution and noise in recent days is automobile vehicles. Basically there are different type of vehicle which used in day to day life. Also there are different other source which generate noise and pollution but the major contact of these type of equipment not in human.

The major source of pollution and noise in recent days is vehicles so the major part which reduce these things are silencer. Our aim is to reduce these all parameter which caused the pollution and deeply focus on silencer. Sound which generate from the muffler will reduced by using different sound absorbing material and that's why in recent days more work which done on the material which absorb maximum sound energy and which is combination of one or more two different material these are composite material and in recent days there are various material which available in market that can effectively reduce sound so these material are available in various range and having different property. So effectively sound absorption and pollution reduction technique will be studied in these whole system to better understand the various technique, method and different process.

1.1 Need of work

The environmental pollution and maximum noise generation process is recently done due to the use of two wheeler as well as four wheeler vehicle. When these vehicle are working under vehicle norms which is given by government of India. There is no problem of any environmental as well as automobile system but due to unregularly service of vehicle or improper fuel used in the system the maximum amount of pollution is generated and that's why more problem will occur in working of vehicle. The main component of reduction of these pollution as well as noise is silencer and that's why generally we used these part is to reduce maximum noise and pollution so each and every part of these system will affect the work of silencer they are much more important to study.

2. LITERATURE REVIEW

Claudio Poggiani et.al. [2015] in this paper study in done on 'Optimization of a fast light-off exhaust system for motorcycle applications' main objective of this paper is that reducing the catalytic converter light-off time, without affecting engine performance and component cost. After the numerical study, several prototypes

have been designed and built for experimental tests. The vehicle experimental results in terms of exhaust gas temperatures at the catalyst inlet and outlet highlight the improvements with the best exhaust prototype compared to the original configuration in this work, an experimental and numerical methodology has been applied to the development of a fast light-off muffler for motorcycle application. Among all, the PROTO E design was the best prototype in term of Light-off temperature, attaining 27s gain on the dyno and 80s on the vehicle, compared to the OEM. [1]

Dr. K. Ashok Reddy[2016] worked on 'A Critical Review on Acoustic Methods & Materials of a Muffler' Main objective of paper was Literature review on acoustic methods and materials of a muffler used in different application like automobile, aerospace industry, compressor and industrial noise has been put forwarded by other coworkers has been presented in this manuscript. Materials properties like stress, temperature, thermal conductivity and density has been technical presented in this Work. Compared with the older absorbing materials produced in the 1960s-2015s, the new materials has become safer, lighter and more technologically optimized. This paper has concentrated on noise attenuation consideration of absorption materials. It was concluded that studying on noise eliminations by innovative material such as refractory foam in experimental and practical approach becomes a new area of study. [2]

C.P. Om Ariara Guhana et.al. [2017] worked on 'Exhaust System Muffler Volume Optimization of Light Commercial Vehicle Using CFD Simulation' Main objective of this paper was weight reduction of existing exhaust system by optimizing muffler volume with the help of 3D design tool CATIA V5 and Computational fluid dynamics commercial tool ANSYS CFX. Back pressure, noise level, sound quality and exhaust gas Temperature are the key important parameters for design verification. the CFD analysis has been carried out for existing and down sized mufflers, These CFD results has been verified with physical vehicle level test. When the muffler size is reduced without changing the parameter then back pressure increase from 2.655 kPa to 2.949 kPa, when they increased number of holes in the inlet pipe from 49 to 70 and baffle position changed from 200 mm to 170 mm, the back pressure has been reduced from 2.655 kPa to 2.742 kPa. [3]

Dakai Chen et.al. [2017] worked on 'Study on sound absorption property of ramie fiber reinforced poly(L-lactic acid) composites Morphology and properties' and Main objective of this paper is to study various property of ramie fiber material which will be useful for absorb sound and reduce noise pollution. The data of sound absorption property measurement shows that the composites with short ramie fiber has better sound absorption property than the ramie fabric reinforced PLLA composites. Moreover morphological studied by SEM reveal the micro phase separation in the PBTA/PLLA composite. [4]

Teresa Bravo et.al. [2016] studied on 'Sound attenuation and absorption by anisotropic fibrous Materials Theoretical and experimental study' and Main objective of this paper is analytical and experimental studies carried out to examine the attenuation and absorption properties of rigidly-backed fibrous anisotropic materials in Contact with a uniform mean flow. The aim is to provide insights for the development of Non-locally reacting wall-treatments able to dissipate the noise induced by acoustic excitations university over in-duct or external lining systems. A two dimensional model has been estimated for understanding the influence of anisotropy on the attenuation and absorption property of rigidly backed fibrous material in the flow and no flow cases. A simulated annealing search method has been used to calculate the least attenuated axial propagation constant in the material. Various result are obtain which are as follows Mean fibrous range 7-10 μm Low frequency is greater than 0.7, low speed flow id greater than 0.15.[5]

Ramon Mendes Knabben et.al. [2016] worked on 'Evaluation of sound absorption capacity of asphalt mixtures' and main Objective of paper this is to minimize harmful noise levels to human health has been developed in various countries in order to improve life quality. Silent asphalt mixtures has good sound absorption capacity. The sound absorption coefficient of these mixtures is considered one of the most important parameters influencing noise generated by the tire-pavement interaction. Silent asphalt mixtures has good sound absorption capacity. The sound absorption coefficient of these mixtures is considered one of the most important parameters influencing noise generated by the tire-pavement interaction. Studies showing that the sound absorption coefficient was effective for reducing tire-pavement noise at frequencies between 800 and 1600 Hz. [6]

Dr. Ashesh Tiwari et.al. [2015] worked on 'Performance of transmission loss on hybrid muffler by using rock wool and glass fiber as an absorbing materials' and A Muffler (silencer) was an important noise control element for reduction of machinery exhaust noise, fan noise, and other noise sources involving the flow of gases. The combination of both reactive and absorptive muffler was termed as hybrid muffler. Hybrid muffler design may be expected to provide broadband high noise attenuation and low pressure drop. Various sound absorption materials that are currently used for noise reduction. An experimental method and wave 1-D

simulation for transmission loss (TL) measurement in central inlet and central outlet muffler with packing density of glass fiber and rock wool. With the comparison of rock wool and glass fiber as absorptive material shows that maximum transmission loss can be achieved with rock wool with respect to all packing density. Also it has investigated that hybrid muffler was beneficial to improve transmission loss performance in medium to high frequency zone. A the noise attenuation increased up 9.23 dB and 32.7 dB by using glass fiber and rock wool respectively. [7]

Gaurav S. Gosavi et.al. [2017] they worked on 'Minimization of CO & CO₂ from exhaust of two wheeler motorcycle'. Main objective of this paper study focused on decreasing the level of CO₂ from exhaust gases of a Two-Wheeler or Motorcycle by adsorption technology. The adsorption is carried out in an absorber like device containing a bed of charcoal through which the exhaust gases are passed. After adsorption they found a significant amount of CO₂ reduction from exhaust gases with an excellent beds efficiency. The type of CO₂ adsorption was reversible that is physical adsorption is observed. The saturated bed of charcoal is again recharged or dumped as a fertilizer in the field to increase crop yield. Adsorption and many more unit operations but this process has adequate potential to dominate in pollution control techniques because if charcoal powder is used as an adsorbent then they can reduce the overall cost dramatically here impurities decreased by 20.35% of CO₂ and 46.08% of CO. [8]

Prof. G.S Joshi [2015] he studied on 'Design and Development of Automobile Silencer for Effective Vibration Control' and Silencer is a part of the exhaust system of an automobile that plays a vital role. It needs to has modes that are located away from the frequencies that the engine operates at, whether the engine be idling or running at the maximum amount of revolutions per second. This paper postulates the first stage in the design analysis of an exhaust system. With the specified properties of the material, the exhaust system is modeled by using a conventional FEM package. The silencer natural frequencies has been calculated by using the ANSYS package and by FFT analyzer. By both the method the natural frequencies are nearly same and that are useful while the design of silencer to avoid the resonance. Though the dynamic performance can be increased by increasing the mass of silencer. [9]

Tejas J. kalange et.al. [2016] worked on 'Design and analysis of muffler for two wheeler'. Noise from automobiles is one of the component for noise pollution to environment. Exhaust noise is one of the main source of vehicle and exhaust system are developed to attenuate noise meeting required levels and sound quality emissions based on environment norms. so to deals these problem, muffler should modified but there are various parameter which are affect these things and that's why the modification of the muffler should be describe in details. Design muffler with variation in porosity for minimum pressure drop, maximum amount of pressure is distributed in first chamber then next chamber pressure reduced will fast. So better to vary the porosity of pipe to get minimum pressure drop and uniform velocity distribution. [10]

Tarek Osman et.al. [2017] they worked on 'Production cost development for commercial exhaust systems' and this paper contains information about muffing devices which are essential for vehicle that uses internal combustion engines. This paper was concerned with applying manufacturing procedures to reduce the production cost of any commercial automotive mufflers through theoretical studies and experimental measurement verification. Material processing for vehicles produced for long period is a concern for automotive feeding industry. A frame of steps was followed to reduce the production time and total cost without affecting the mufflers performance. New design was proposed and compared to the original model to show 77.7% reduction in production methods and consequently reduction of the entire cost. [11]

Ranbir singh et.al. [2006] worked on 'A study of vehicular pollution' and this paper consist of information of pollution related to vehicle. The rapid urbanization has also resulted in a tremendous increase the number of motor vehicles that's why pollution also increase. Vehicles are now becomes main source of air pollution. This paper discuss towards the development of vehicular pollution control device which could control the pollution. In this work device use name as pollution lock it will be similar to the central remote locking, it is smart operating system that's will work on artificial intelligence technique. In that device lock will stop engine working on emission of pollutants above the permitted standard level. [12]

Masao kakuchi et.al. [2003] studied on 'Present and future trends of stainless steel for automotive exhaust for automotive exhaust system' in this paper contains stainless steel be used as material for decoration trims in automobile. In recent years it is mostly used as material for the exhaust system. it is because of stainless steels with good performance of high temperature characteristics and high corrosion resistance meet the social needs for cleans for clean exhaust gases and also reduced weight for better fuel economy. For two wheeler vehicle the exhaust gas temperature at the muffler was raised from 500 to 900 °C because of the catalytic

activities and application of stainless steels not only to the muffler but also to the whole exhaust system including the exhaust pipe rapidly expanded. Used material of stainless steel pipe of YUS 436S. Fabrication of exhaust system using YUS 21M (18Cr-2Al-0.5Si) having substantially significantly better. [13]

Prof. Buchade M.R et.al. [2017] they worked on 'Study and vibration analysis of two wheeler silencer' and aims study of silencer affecting on vibration and also performance. So it is necessary to reduce the vibrations. Model analysis is technique which was used to find natural characteristics of structure like natural frequency and mode shapes. In this study we used three different type of silencer having different material property and carried out analysis using ANSYS 16 software. The result was find out is as follows increase in natural frequency for silencer of material SUS409L is more than other two silencers of material SUS436j1L and SUS436L there for the silencer of material SUS409L has more stiffness as compared to other two silencers, so it has minimum vibrations. [14]

Ahmad Syed Anwar et.al. [2016] they worked on 'An innovative concept to improve the .muffler performance using automated mechanical IRIS' and A lot of research has been done in recent times in the field of acoustic filters and exhaust mufflers in order to reduce the exhaust noise. While using exhaust muffler, a back pressure on engine is always produce. This back pressure represents the extra static pressure exerted by the muffler on the engine through the restriction in flow of exhaust gasses. The back pressure value mainly depends on the muffler design and exit diameter of the exhaust muffler. It has been found that for a constant exit diameter of an exhaust muffler the back pressure varies with the change of the engine speed. In order to improve the muffler performance this study presents a new concept of integrating a mechanical IRIS with an engine muffler. IRIS inner diameter is synchronized with the exhaust gas pressure with the help of a spring mechanism. Results show that by using the automated mechanical IRIS the back pressure remain stable throughout the speed variation. [15]

3. RESEARCH FINDINGS AND GAP

A considering the above work and efforts by researchers, some literature finding which will be full feel by our present and future work so there are various literature findings which is describe in details as follows. the material used for sound absorption is play an important role in each and every muffler and that's why material used for the different type of silencer having different property so it is important that study of material property in silencer. Also the silencer inlet and outlet temperature are more important while study of these type of device. In silencer design baffle position and number of hole in tube which play major and important role in back pressure of silencer that's why all parameter are important while design muffler. Design silencer in such a way that they should reduce pollution, back pressure and improve engine performances so overall study of all the parameter will generate result of new silencer having better result.

4. EXPERIMENTAL METHOD

In this work we used fabricated model of silencer to determine various result of silencer outlet. In this model used various type of design and experimental approaches for various result. Here used different measurement instrument, so following device are used thermocouple for inlet and outlet temperature measurement, exhaust gas analyses for checking of exhaust gas percentage and also used different microphone for checking of sound pressure intensity. Also used different analysis software for analysis of these all result. So these all type of instrument generally used in this experimental setup.

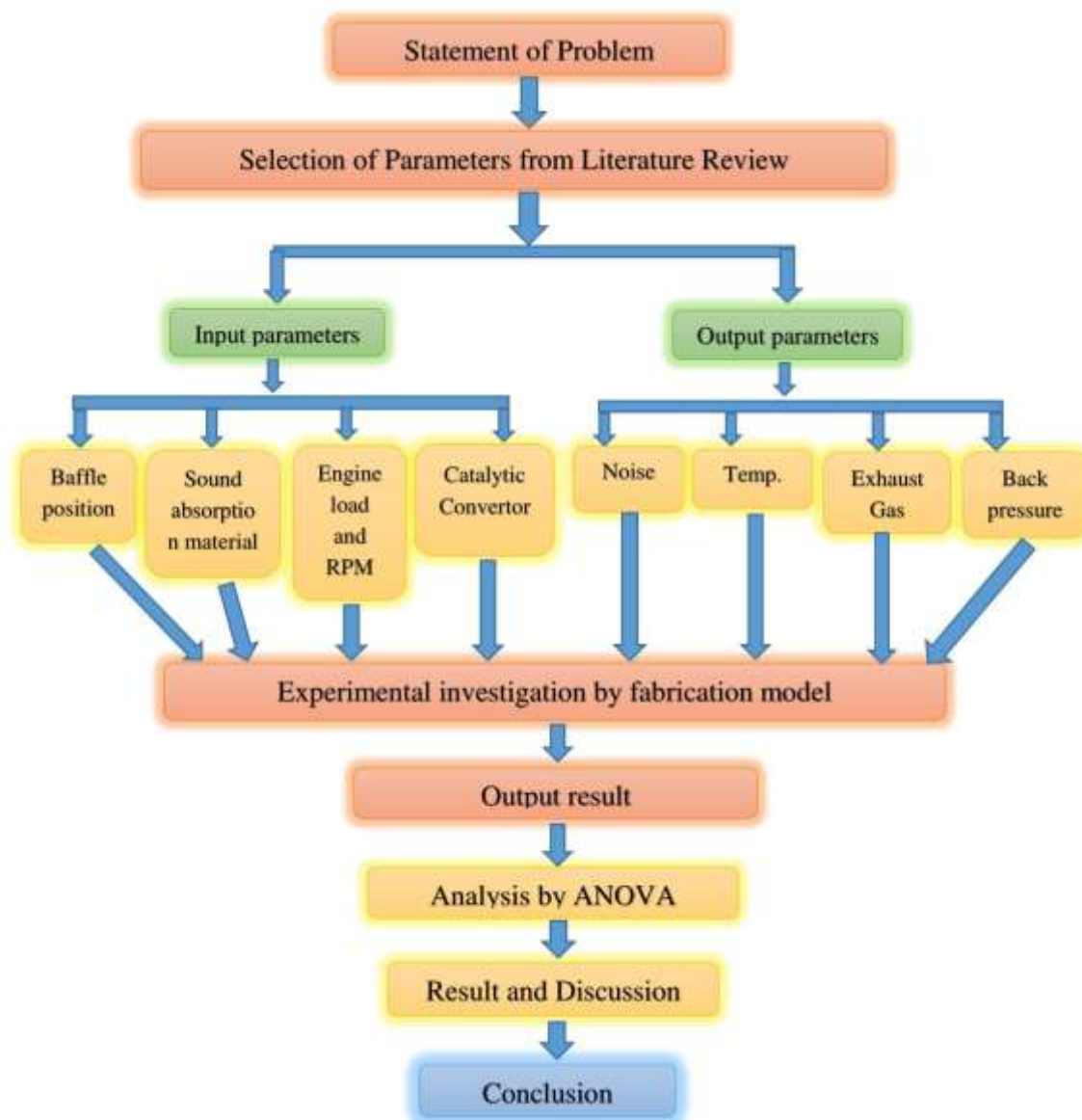


Fig. Flow chart of Methodology

5. CONCLUSION

This paper summarize that the application of change in various parameters like change in baffle position and number of holes on tube will reduce the back pressure in the engine. These reduction in back pressure will be helpful for improving engine performance. Also the noise of vehicle and noise pollution will be minimized by Changing the sound absorption material and increase quantity of catalytic converter. While increasing number of hole, baffle position and some material input and output temperature difference will be minimize. So the conclusion of this study is that by increasing and decreasing some engine, material and other parameter there is change in various output parameter.

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