

AQUA SILENCER TO REDUCE EXHAUST EMISSION AND NOISE FROM I.C. ENGINE. – REVIEW

Purav Patel^[1], B.S Patel^[2], A.B Damor^[3]

(M.Tech. Student, Mechanical Department, BVM Engineering College, Anand^[1])

(Asso. Professor, Mechanical Department, BVM Engineering College, Anand^[2])

(Asst. Professor, Mechanical Department, BVM Engineering College, Anand^[3])

ABSTRACT

Currently many countries are like India suffering from environment pollution. Air pollution which causes ill effects to live personality as well as nature. Carbon dioxide, unburnt hydrocarbon level is rapidly increasing in environment, so it is important to solve the problem by taking some serious steps. Aqua silencer can replace ordinary silencer and in the silencer emission gases were controlled by charcoal which activated by activation method and aqueous form of chemical. Environmental hazardous gases were absorbed capably within the silencer and to make automobile friendly. The noise produced within aqueous solution which is less audible because of small sprocket hall which through solution molecules get lower amplitude and get low the sound. Aqua silencer is cost reliable and compact in size compare to ordinary silencer.

Keywords – Activated charcoal, Aqua silencer, Aqueous chemical solution, Carbon dioxide, Unburnt hydrocarbon

I. Introduction

Silencer is also known as muffler which was used for decreasing noise which produced by exhaust of an engine, It's came to major source of pollution. It becomes more important to concern when used in public areas it was taken by hazardous noise. Human hearing capacity is around 50-80dB above that it will be injurious to human health. [6] Main source of noise in engine was divided in two parts, first is the exhaust noise and second is the noise produced due to friction of various parts of the engine. Mainly focused on exhaust noise from engine.

In Aqua silencer main components are perforated tube, activated charcoal, chemical solution as lime water and cylinder.

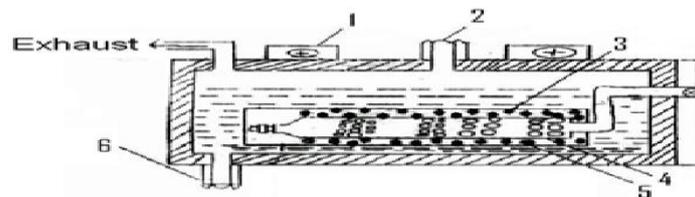


Fig.1 The schematic diagram of aqua silencer shown. [1]

1. Mounting
2. Filler plug
3. Charcoal layer
4. Perforated tube
5. Wire mesh
6. drain plug [1]

While Aqua silencer is working as exhaust gases enter into aqua silencer, the perforated tube which is installed at the last section of the exhaust pipe. Perforated tube contains different diameter holes which convert high bulk bubbles in low bulk bubbles after that passes through charcoal layer which again purify the gases then after gases dissolve into water and reaming gases will be

exhaust at narrow path opening provide at the top of the container which make path for remain exhaust gases to atmosphere. A plug at is provided at bottom of container for periodically cleaning of the water filled container.

II. Literature Review

N. Mehta et.al has experimenting on aqua silencer and modify that to reducing carbon particles up to 32.7% they was experimenting on very high loaded diesel engine. Modified aqua silencer schematic diagram shown fig.2^[1] in modification they add by-pass cylinder. Comparative study of ordinary silencer and modified aqua silencer is made and opacity is measured 3.98 and 3.08 respectively. Significantly improvement observed in performance of a modified aqua silencer.

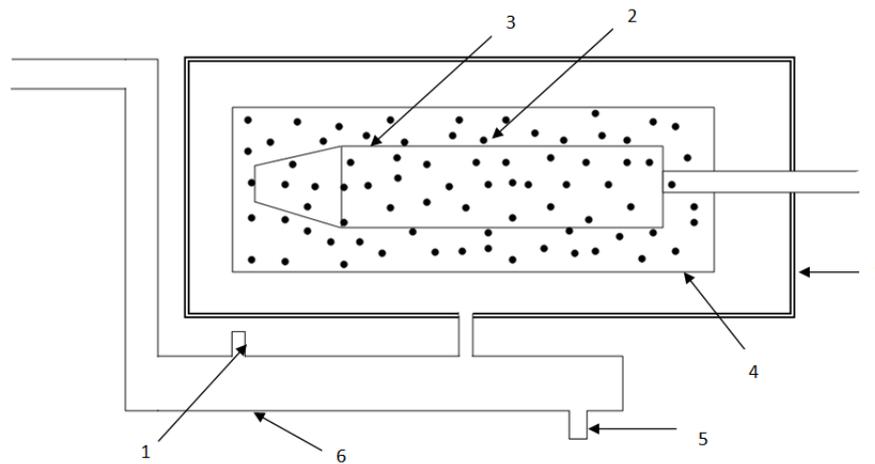


Fig. 2 Schematic diagram of Modified Aqua Silencer

1. Filler plug
2. Charcoal layer,
3. Perforated tube,
4. Wire mesh,
5. Drain plug,
6. By-pass cylinder
7. Main cylinder

P. Krause et. al has introducing electronic muffler with two possibilities semi active and active system. In semi active mufflers which have internal geometry will be convert according engine circumstances during driving. An active system adding anti-noise or controlling influence on exciting exhaust gas flow in order to smooth the gas pressure and this way a sound decrease there both solutions are shown by different measurements results. While considering semi-active system to switching valve in the exhaust system. It's changing the design of silencer which engine need to it and getting good acoustic efficiency at low frequency. The achievable attenuation is in region of 6 to 12dB and also while considering active system the maximum achievable attenuation is under stationary condition 30 to 35 dB and in vehicles this attenuation goes down to 5 to 10 dB.

R. Barbieri et. al studied a methodology which combines finite element analysis and zoutendijk's practicable guidelines for objective as shape, design and obtain the dimensions for acoustics muffler with transmission loss to maximize the frequency range of attention and Improvisation in four parameters method which was used for transmission loss to evolutions and Helmholtz's equation was solved by numerically with finite element method. The numerical finite element method which improved four parameters method and zoutendijk's feasible direction method to find, within acceptable accuracy limits, the optimized dimensions of mufflers this method is very easy to implant.

M. Kumar et. al was examine non -linear free vibration response of shear deformation was covered for composite and sandwich plates. Authors use to mesh less method which based on multi quadric radial basic function for analysis of the problems. The non-dimensional frequency factor of the isotropic, orthotropic, covered and sandwich plates were presented and check them by in order

for accuracy form present method. Multiquadric based meshless method is utilized first time to best of author's knowledge for non-liner free vibration analysis of laminated, sandwich regular plates.

A. Kumar has observed about the particles combination, bubble and slugs formation etc. were affect straightly to heat and mass transfer process in hydrodynamics of fluidized bed. Author also discussed about the under vacuum situation, the amount of supply air was decreasing dominantly to produce comparable fluidization features as observed under atmospheric situations.

Dr. P. Sharma et. al has design aqua silencer considering properties like corrosion resistance, thermal expansion, reflectivity, ductility etc. author was selected material for aqua silencer was stainless steel and using perforated tube with different diameter and taking activated carbon size 0.35mm to 0.80mm in granular form. While experimenting they use EGA 2000P gas analyzer to measuring CO₂, O₂, and HC. While including actived charcoal can be better controlled of exhaust emission and using water as medium of sound can be lowered it will be applicable for both two wheeler and four wheeler.



Fig. 3 Two stroke single cylinder petrol engine.^[5]

J. Shah has founded catalytic converter has been some disadvantages were back pressure, cold start and size. U-Shape design aqua silencer generates lesser amount of back pressure and noise compare to commercial silencer and also in slender size.

S. Rawle has discussed about aqueous ammonia which is good absorbent solution. Aqueous ammonia solution use in instead of lime water solution ammonia absorbs emission of CO₂, NO in greater amount of exhaust gases of the engine .due to absorbing process rate of corrosion was less. It has the lowest enthalpy to separation for CO₂ release. It's seen that amount of CO₂ in exhaust gases was decreased an average of 25% as comparatively to ordinary silencer. Approx 25% carbon dioxide will be reducing by using aqueous ammonia compared to ordinary silencer. Proper concentration of ammonia will be very beneficial,

M. Jeguirim et. al has discussed about activated carbon which is most promising material for adsorption of CO₂, NO₂. Activated carbon generally provided or prepared by physical and chemical process to activation of various precursors minerals coal. Bituminous coal absorbs NO₂ 43.5(mg/g). While walnut shell and plum stone has high absorption rate compare to another.

III. Conclusion

Aqua silencer will better option against ordinary silencer which will control the air and noise pollution. There has been some improvement required like chemical solution which was the better for the good absorbing capacities. There also have one problem to every time to start engine change the charcoal every time.

References

[1] Nirav Mehta and Sachindra Doshi "Experimental Investigation on Innovative Modification of Aqua silencer" Internal Conference of Materials Processing and Characterization, ELSEVIER (ICMPC 2016)

- [2] P. Krause, H. Weltens and S. M. Hutchins, "Advanced Design of Automotive Exhaust Silencer Systems" SAE Technical Paper 922088
- [3] Renato Barbieri, Nilson Barbieri, "Finite Element Acoustic Simulation based shape optimization of a muffler", Applied Acoustics, 67 (4), 2006, Pages 346-357
- [4] Manoj Kumar Solankia, Sabin Kumar Mishrab, K.K. Shuklac, Jeeoot Singhd, " Nonlinear Free Vibration of Laminated Composite and Sandwich Plates Using Multi quadric Collocations", materials Today, Proceedings 2(4-5) 2015, 3049-3055.
- [5] Apurv Kumar, "Numerical Study of Hydrodynamics Under Vacuum Conditions in Bubbling Fluidized Beds" International Journal of Advanced Materials Manufacturing and Characterization,1(1),2012.
- [6] Dr.P.K.Sharma, Swapnil V. Kasar, Suryabhan A. Patil, Naresh A. Jadhav, Manish Deore, "Design and Manufacturing of Aqua Silencer for Two Stroke Petrol I.C. Engine." International Journal of advance engineering and Research Development Vol.4 March 2017.
- [7] Jayvir Shah and Dr. Vikas Patel, "Effect of Aqua Silencer & Catalytic Converter on Exhaust Emission" International Journal for Innovative Research in Science & Technology Volume 3 , Issue 12 , May 2017 ISSN : 2349-6010
- [8] Rawale Sudarshan S., Patil Snehal S., Nandrekar Amruta A., Abhijeet S. Kabule, " Use of Aqueous Ammonia in Silencer for removal of CO₂, SO₂ and NO_x from exhaust gases of I.C. Engines." International Journal of Engineering Science and Innovative Technology (IJESIT) Volume 2, Issue 5, September 2013.
- [9] M. Jeguirim, M. Belhachemi, L. Limousy, S. Bennici, "Adsorption/Reduction of Nitrogen Dioxide on Activated Carbons: Textural Properties versus Surface Chemistry" Chemical Engineering Journal 9 April (2018).

