

Fabrication of Aqua Silencer to Control Emission and Knock Intensity

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ABSTRACT

The main pollutants produced by automobile exhaust include CO, HC, NO_x, SO₂ and volatile organic compounds. Hence to reduce these pollutants from exhaust of engine, a new technology is introduced called Aqua silencer. The other sources such as big factories, electric power generation plants, big industries etc. Aqua silencer is one of the attempts taken in reducing the air pollution. It is incorporated with the exhaust pipe of engine system. These Silencer is used to reduce the knock intensity and control the emission of dangerous gases. It incorporates with perforated tube, which perform vital role & usage of cheap chemicals as if lime water, activated carbon and water with the assistance of straight forward but effective change within the design and fabrication of the silencer to scale back the noise and toxic emission levels.

KEYWORDS: Aqua silencer, Perforated tube, Lime water

I. INTRODUCTION

The aqua silencer is a novel device that has been developed to address the issue of noise pollution caused by internal combustion engines, particularly in marine applications. Noise pollution from these engines can have detrimental effects on both the environment and human health. The aqua silencer utilizes the principles of fluid dynamics to reduce noise emissions by passing exhaust gases through a series of chambers filled with water and baffles. This causes the sound waves to break up and dissipate before they can be emitted into the environment. The device is environmentally friendly and has been found to be effective in reducing noise levels in various industries. In this context, this device has been studied and researched extensively to understand its working principle and its effectiveness in reducing noise

pollution. The following sections will provide a detailed explanation of the aqua silencer, including its design, working principle, and applications

What is Aqua Silencer?

An Aqua silencer may be a quite silencer, which comprise of a perforated tube Spread with a layer of charcoal. The perforated tube has three arrangements of varied measurement gaps penetrated thereon. The actuated charcoal is roofed on the surface of the perforated tube and this unit is completely submerged in lime water. An aqua silencer is then appended to the exhaust of the system

II. THEORY OF PROJECT

1. ENGINE EXHAUST

Exhaust gas or flue gas is emitted as a result of the combustion of fuels such natural gas, gasoline, petrol, biodiesel blends diesel fuel, fuel oil or coal. According to the type of engine, it is discharged into the atmosphere through an exhaust pipe, flue gas stack or propelling nozzle.



FIG 1: Engine Exhaust

2. SILENCER

“Aqua Silencer” is an attempt made to deal with the control of overall emissions & undesirable sound at tail pipe of a vehicle, before it is emitted to the atmosphere. It can be fitted along with or instead of catalytic converter at the tail pipe

of exhaust system of a vehicle



FIG 2: Silencer\

3. PERFORATED TUBE

It consists number of holes of various diameter mainly there are four sets of holes. It is used to convert the high mass of bubble to low mass and very important activated charcoal layer is pasted are it.



FIG 3: Perforated Tube

4. NON-RETURN VALVE

A non-return valve allows a medium to flow inonly one direction. The flow through the non-return valve causes a relatively large pressure drop,whichhas to betaken into account when designing the system.



FIG 4: Non-Return Valve

5. EXHAUST GAS ANALYSER

An exhaust gas analyzer or exhaust CO analyzer is an instrument for the measurementof carbon monoxide among other gases in the exhaust, caused by an incorrect combustion, the Lambda coefficient measurement is the most common.



FIG 5: Exhaust gas Analyzer

III. WORKING OF AQUA SILENCER

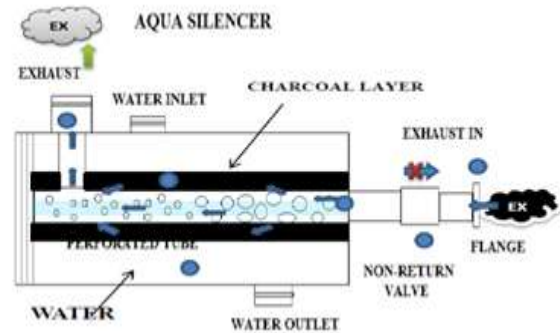


FIG 6: Layout of an Aqua silencer

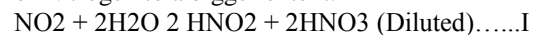
When exhaust gases enter into the aqua silencer, the perforated tube changes over High Mass air pockets in to Low Mass air pockets. At that point, they are accessible in to contact with lime water they artificially respond with it and experience charcoal layer, which again decontaminate the gases. It is highly porous and possess extra free valences so it's high absorption capacity. Since the charcoal layer is roofed with outer shell which is crammed with water. Sound produced under water is a smaller amount hearable than it produced in atmosphere. This occurs due to small bonds in water molecules, which reduces mass volume of bubbles & control sound level, by this way aqua silencer reduces noise and pollution.

Details of Chemical Reaction:

GASES AND PARTICULATES IN EXHAUST:
 In addition to heat and water vapor, the pollutants in diesel exhaust are Carbon monoxide (CO), Carbon dioxide (CO₂), Oxides of Nitrogen (NO_x), Sulphur dioxide (SO₂).

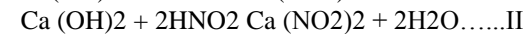
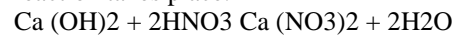
Chemical Reaction 1

One of the pollutants of the combustion is NO_x (Oxides of Nitrogen). Water will absorb the oxides of Nitrogen to a bigger extent.



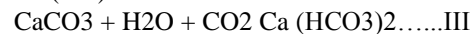
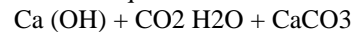
Chemical Reaction 2

If bit of lime water is added in outer tank, further reaction takes place.



Chemical Reaction 3 When the carbon-di-oxide present within the exhaust gas comes in touch with the limewater, carbonate will precipitate. The carbonate when further exposed to carbon-di-oxide, calcium-bi-carbonate are going to be precipitated.

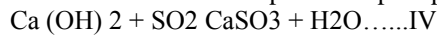
The subsequent is that the reaction,



Chemical Reaction 4

The Sulphur-di-oxide present within the Diesel Exhaust also reacts with the limewater. However,

the tiny trace of Sulphur-di-oxide makes it little difficult to live the magnitude of the reaction, accurately. The subsequent equation gives the reaction and calcium sulphite will precipitate.

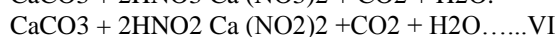


Chemical Reaction 5

The presence of steam makes it possible to possess a preliminary reaction with oxides of nitrogen, within the following manner;



The resultant products when are available contact with carbonate the subsequent reaction takes place $\text{CaCO}_3 + 2\text{HNO}_3 \rightarrow \text{Ca(NO}_3)_2 + \text{CO}_2 + \text{H}_2\text{O}$.



IV. RESULTS

Emission Test Results	Regulation	Ordinary silencer	With Activated Charcoal Layer
CO (Carbon Monoxide)	3.0	0.300	0.200
HC (Hydro Carbon)	3000	400	270

Table-1: Experimental results for two-Wheeler

As shown in above table, amount of pollutant CO for ordinary Silencer was 0.300, which has been reduced up to 0.200 & amount of HC pollutant for ordinary silencer was 400 PPM, which has been reduced 270 PPM, when we have attached aqua silencer with activated charcoal layer with exhaust pipe of 2-wheeler vehicle.

Ordinary silencer:

S.N O	Capacity (%)	KVA(l/m)	Max. Rpm	Idle Rpm	Oil Temp
1	36.1	1.08	1054	615	095
2	39.7	0.97	1246	554	084
3	42.3	1.25	0951	780	091
4	51.6	1.05	1143	703	
AVG	49.3	1.08			

Table 2: Result of 4-wheeler ordinary silencer

Aqua Silencer with Activated Charcoal:

S.N O	Capacity (%)	KVA(l/m)	Max. Rpm	Idle Rpm	Oil Temp
1	36.1	1.07	1054	609	085
2	39.7	0.75	1246	544	082
3	42.3	0.15	0951	756	085
4	51.6	1.02	1143	701	
AVG	49.3	0.74			

Table 3: Results of 4-Wheeler with Activated Charcoal

Applications of Aqua Silencer

- To scale back these pollutants from Exhaust of Engine a replacement technology is introduced called Aqua silencer.
- An Aqua silencer might be a gadget want to channel the harmful gases delivered from vehicles like CO, UBHC, NO_x and Lead.
- It uses the charcoal layer, perforated tube and water for its working.
- It is utilized in Industry to get rid of the harmful containment from the exhaust gases.
- Generally suitable for heavy vehicles and industry applications.

V. CONCLUSION

The progress in science & technology is a non-stop process. New things and new technology are being invented. As the technology grows day by day, we can imagine about the future in which thing we may occupy every place. An Aqua Silencer having more efficiency to reduce emission gases from engine using lime water, charcoal layer and perforated tube with the use of perforated tube back pressure always remains constant and sound level of exhaust reduces. Contaminations of water remain very less in aqua silencer. In this system fuel consumption remain same as conventional silencers because the use of perforated tube. Due to use of water as a medium sound reduces this system having pollution free emission and smokeless. This system is very cheap. This system is used for both four wheelers and two wheelers. It plays important role in industries.

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