



FABRICATION AND TESTING OF AQUA SILENCER

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ABSTRACT

To conserve the earth's environment from degradation and also the public health from Air pollution it is very imperative than serious steps are to be taken for conserving them and Aqua silencer is an attempt to do so. Aqua silencer is mainly used for dealing with the emission and noise. An aqua silencer is generally attached to the exhaust of 2-stroke engine. In this Aqua silencer both the Lime water wash method and Absorption method are used. The gases like HC, CO from the engine exhaust are absorbed. The final emission is analyzed using an automobile gas analyzer and the reduction of gases HC, CO is measured.

Key words: Fabrication, Aqua silencer.

INTRODUCTION

Air pollution is a major problem. The main pollutants contributed by automobiles are (CO), Un-burnt Hydro Carbon (UBHC), (NO_x) and Lead etc. Other sources which cause pollution are electric power generating stations and Industries. So it is imperative that serious attempts should be made to conserve earth's environment from degradation. An aqua silencer is an attempt in this direction. It mainly deals with control of emission and noise. An aqua silencer is fitted to the exhaust pipe of an engine. Air pollution is the introduction of chemicals, particulate matter, or biological materials that cause harm or discomfort to humans or other living organisms or damages the natural environment. These substances called pollutants can occur naturally or they can be produced by human activities. Natural pollutants include dust, pollen, salt particles, smoke from forest fires, and gases from organic waste. Most pollution caused by human activities is directly or indirectly the result of burning of fuels in furnaces or engines¹⁻³.

Construction of aqua silencer

The aqua silencer in this project mainly consists of:

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Perforated tube

A tube of 20 mm diameter, 230 mm long is drilled with 500 holes with different diameters. The purpose of these holes on the tube is to break down the large mass of gas entering, into smaller ones as shown in Fig. 1. This perforated tube is attached to the exhaust of the engine. The other end of the perforated tube is closed by plug.



Fig. 1: Perforated tube with attachments

Activated charcoal

Activated charcoal is used as an absorber to absorb the smoke. Activated charcoal has more absorbing capacity because it has more surface area. A layer of activated charcoal was wrapped around the perforated tube using a thin mesh.



Fig. 2: Activated charcoal

Non return valve

The use of non-return valve is to enable the flow of fluid in one direction only. 20 mm diameter non-return valves are fixed at both inlet and outlet. The non-return valve is used to prevent the back flow of gases and water and to maintain upstream pressure.

The whole setup is surrounded by water. Two openings are present at both the top and bottom. The opening at the top is used to remove the exhaust gases and the one at bottom is to clean the container. The container also contains a filler plug. The back flow of the gases and water is regulated by a return valve at the exhaust. Main aim is to control sound and noise⁶.

Working

An Aqua silencer is an updated version of a normal silencer. As the exhaust gases enter into the aqua silencer, the perforated tube converts high mass bubbles into low mass bubbles, after that they come into contact with lime water they chemically react with it and pass through the charcoal layer which again purify the gases. The gases like HC, CO are absorbed from the emission. The charcoal is highly porous and possesses extra free valences so it has high absorption capacity. The purified gases are then released into atmosphere. The contaminated lime water which has precipitates of calcium carbonate and bicarbonates in the aqua silencer is replaced once in a year. The charcoal layer is covered with an outer shell which is filled with water. Sound produced under water is less hearable than sound produced in atmosphere. This is mainly because of small sprockets in water molecules, which lowers its amplitude thus, lowers the sound level hence aqua silencer reduces noise and pollution. A schematic diagram is shown in Fig. 3.

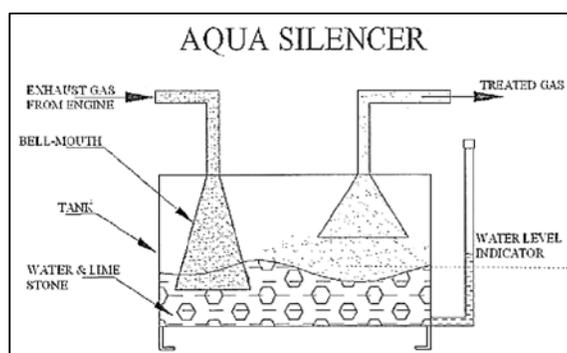


Fig. 3: schematic diagram of aqua silencer

The fabricated aqua silencer is shown in Fig. 4.



Fig. 4: Aqua silencer

Treatment of water

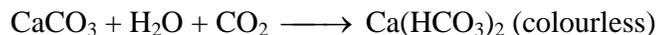
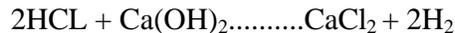
In aqua silencer the water gets polluted by the dissolved gases. The exhaust gases mix with water to form carbonates, acids like carbonic acid, sulphuric acid, and Nitrous acid. The petroleum products contain phenols, which gives suffocating smell. The sulfur gas mixes with water to form hydrogen sulphide, which give rotten egg smell. These should be controlled to prevent the water pollution. To control the water pollution following methods are used in this project.

1. Lime water wash method.
2. Absorption method.

Lime water wash method^{7,8}

Lime wash is a mixture of slaked lime. The water is treated with slaked lime. Quantitative analysis of water has to be taken for this process. After mixing the heavy precipitates, they settle down as sludge at the bottom of the tank and they are thus removed from time to time.

Lime can neutralize any acid present in the water. SO₂ is removed from the flue gases forming calcium sulphate. The precipitates of carbon dissolved as calcium carbonate and bicarbonate converts into carbonates. The equations are given below. The reactions with water are.



Thus the harmful gases are converted into precipitates and are removed from aqua silencer.

Absorption process^{7,8}

Granular or powdered form of Activated charcoal, which is available generally, is used in the aqua silencer. It has high valences and is porous in nature, which enables high

absorption capacity. It has excellent properties of attracting gases, It's finely divided solid particles enable absorption of gases. The water is added with charcoal before the coagulation with the sediment, which is actually in powdered form.

RESULTS AND DISCUSSION

The results which are obtained from the project analysis is given below in the Table 1. Smoke analyzer tests were carried out for analyzing the performance of the Aqua silencer. The smoke emission of the Aqua silencer, from a single cylinder two stroke petrol engine is analyzed using a gas analyzer. During these tests, it is observed that the amount of hydrocarbons and CO are reduced. This is because of the lime water and activated carbon embedded has absorbed the gases. The reduction in the contents of the emission in this aqua silencer is due to the charcoal embedded has absorbed 74% of the gases.

Table 1: Results

	Prescribed standard CO	Measured level of CO	Prescribed standard HC	Measured level of HC
Ordinary silencer	4.50%	3.8% ^[8]	7800 ppm	7200 ppm ^[9]
Aqua silencer	4.50%	2.9%	7800 ppm	6200 ppm

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EMISSION TEST CERTIFICATE

Vehicle Detail

Model/Make	Engine Type	Fuel Range
SUZUKI	2Stroke Petrol Engine	For 0.5 litre (Petrol)

Emission Test Result

Engine/Fuel Type	Permitted maximum		TEST RESULT	
2 Stroke Petrol Engine	4.5% CO	7800ppm HC	2.9%CO	6200ppm HC

Was the Vehicle Tested with Catalytic(s) Filled : **NO**
Test Result : **POSITIVE**

I, **(RETECH SOLUTIONS PVT LTD)** being the licensed for Testing and responsible installer, hereby certify that the smoke is reduced to 26% when comparing to the Existing of one.


 Superintendent Signature


 Authorized Signature

Fig. 5: Certificate of emission in Aqua silencer

Cost estimation

Material cost

S. No.	PARTS	Qty.	Material	Amount (Rs)
i	XL Engine	1	-	3500
ii	Muffler silencer	1	MS	2000
iii	Silencer connecting pipe	1	Steel	1000
iv	Lime stone with water mixing	4	-	200
v	Petrol tank	4	plastic	150
vi	Petrol tank connecting hose	1	Rapper	100
vii	Net and bolt	2	Steel	100
Viii	Stand (Frame)	1	Mild steel	650
	Total			7700

CONCLUSION

This project has provided an excellent opportunity and experience, to use the limited knowledge. The Aqua silencer is more effective in the reduction of emission gases, and the engine exhaust using perforated tube, lime water and activated charcoal. The aqua silencer has been fabricated and tested. It shows reduction in emission.

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