

## Research Paper on Aqua Silencer

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**Abstract:** An Aqua Silencer is used for control of emission and noise in automobile exhaust. By using activated charcoal, perforated tube and outer shell it is constructed. An aqua silencer is connected to the exhaust pipe of engine. The activated charcoal filters the harmful sulphur oxides and nitrogen oxides content produced from the engine. Sound produced under lime water is less hearable than it produced in conventional silencer. This mainly because of small sprockets in water molecules, which lowers its amplitude thus, lowers the sound level. Because of this property lime water is used in this silencer and hence its name AQUA SILENCER. It is tested in single cylinder 4- stroke petrol engine the noise and smoke level is considerable less than the conventional silencer. The main pollutants contribute by automobiles are Carbon monoxide(CO), Unburnt Hydrocarbon(HC), Oxides of nitrogen( Nox) and Lead etc., other sources such as electric power generating stations, industrial and domestic fuel consumption, refuse burning, industrial processing. An aqua silencer is used control of emission and noise.

**Key Words:** Aqua Silencer, activated charcoal, perforated tube, outer shell, sulphur, oxides of Nitrogen, noise.

### Introduction

We all know that the automobile industry plays a major role in causing air pollution, so for reducing air as well as noise pollution we are using Aqua Silencer. The exhaust gases released from engine are carbon monoxide (CO), carbon dioxide (CO<sub>2</sub>), Nitrous Oxide (NO<sub>x</sub>), Sulphur Dioxide (SO<sub>2</sub>), Unburnt Hydrocarbons (UBHC). These toxic gases are very harmful for environment, human health. Aqua Silencer is used to reduce emissions and noise and also reduces its harmful effects with the help of activated charcoal, lime water.

### What is Aqua Silencer?

Basically perforated tube which is connected at the end of the exhaust pipe in Aqua Silencer. The perforated tube has different diameters. Purpose of providing different diameter holes is to convert high mass bubble to low mass bubbles.

Generally 3 sets of holes are drilled on the perforated tube. One end of perforated tube is closed. The activated charcoal

layer provided on circumference of perforated tube. The whole unit is then full immersed in a lime water container.

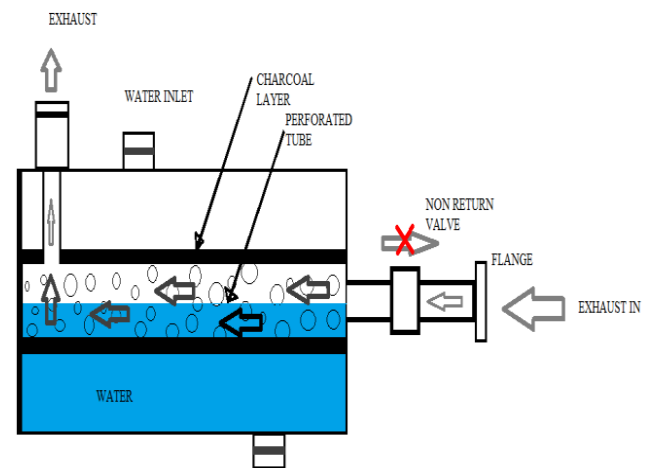


Fig. 1 [8]

A small opening is at the top of the container to pass the exhaust gases in atmosphere & a drain plug is provided at the bottom of the container for periodically cleaning of container.

Also filler plug is at top of container for filling lime water. At the inlet of the exhaust pipe a non-return valve is provided which prevents the back flow of lime water.

1. When exhaust gases enter into the Aqua silencer, the perforated tube split high mass bubbles in low mass bubbles after that they pass through charcoal layer which is pasted over the perforated tube again purify the exhaust gases.
2. It is highly porous and posses extra free valences so it has high absorption capacity.
3. After passing gases over the charcoal layer gases dissolve into the lime water and finally the exhaust gases escape through the opening in to the atmosphere.
4. Hence aqua silencer reduces noise and emission.

## EFFECTS OF DISSOLVED GASES ON LIME WATER

The lime water is a good absorbing medium. In aqua silencer the gases are passed through perforated tube which is dipped in lime water. When these gases dissolved in water they form acids, carbonates, bicarbonates etc,

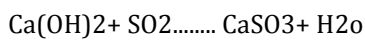
**1. Action of dissolved SO<sub>2</sub>** When SO<sub>x</sub> is mixed in water, it form SO<sub>2</sub>, SO<sub>3</sub>, SO<sub>4</sub>, H<sub>2</sub>SO<sub>4</sub> i.e. sulfur Acid ( H<sub>2</sub>SO<sub>3</sub>), it forms Hydrogen Sulphide which causes carious egg smell, acidify and corrosion of metals.

**2. Action of dissolved CO<sub>2</sub>** The dissolved carbon dioxide forms bicarbonate at lower PH and Carbonates at higher PH. Calcium carbonate will precipitate when carbon dioxide present in exhaust gas and in contact with lime water.

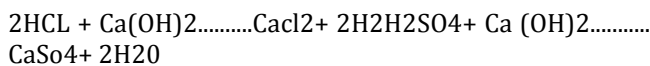
**3. Effect of dissolved NO<sub>x</sub>** The NO<sub>x</sub> is abnoxious product of combustion-the oxides of nitrogen. nitrogen absorbed to a larger extent by water.

### Reactions

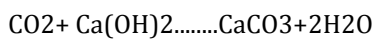
- ▶ The SO<sub>2</sub> gas is removed from the flue gases forming calcium sulphate.



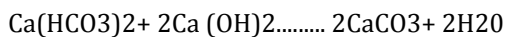
- ▶ Neutralizes any acid present in water



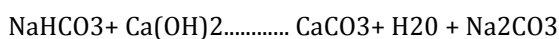
- ▶ Precipitates bicarbonate as calcium carbonate



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- ▶ Converts bicarbonate ions (Like NaHCO<sub>3</sub>, KHCO<sub>3</sub> etc.) into carbonates.



## COMPONENTS AND EXPLANATION

### Perforated Tube

The perforated tube has number of holes of different diameters on its circumference. It is used to convert high mass bubbles to low mass bubbles. The charcoal layer is pasted over the perforated tube with the help of metallic mesh.

### Charcoal Layer

The charcoal layer has more absorbing capacity because it has more surface area and also it has more porosity. This charcoal is called as ACTIVATED CHARCOAL. It is manufactured by heating the charcoal above 1450 °c for several hours in a burner. Its surface area gets increased.

### Outer Shell:

The whole setup was kept inside the outer shell. It is made up of stainless steel. The water inlet, outlet and exhaust tube was provided in the shell itself.

### Bend Pipe

Bend pipe is used for connect aqua silencer and exhaust chamber.

### Working

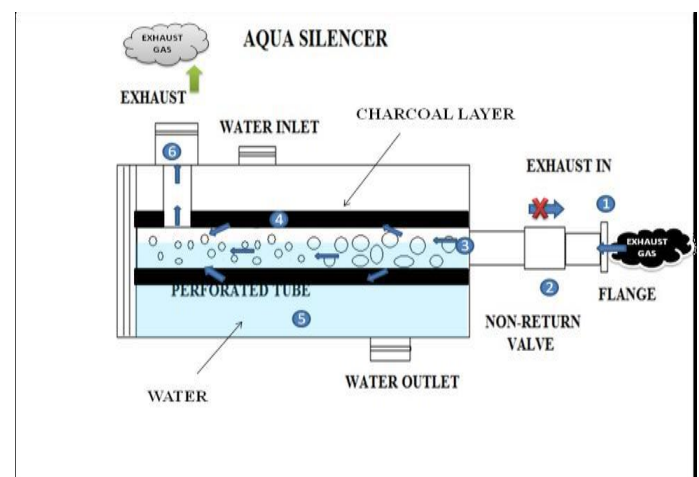


Fig -2: Layout of an aqua silencer

The exhaust gases passed into the aqua silencer, the perforated tube converts high mass gas bubbles in to low mass gas bubbles after that they come in to contact with lime water they chemically react with lime water and pass through the charcoal layer which again purify the gases. It is highly porous, does not react with lime water and its porosity remains constant in water . Since the charcoal layer is covered with metallic mesh which is filled with lime water. Sound produced under water is less hearable than it produced in conventional silencer. This is mainly because of water molecules because water has good damping property, which lowers its amplitude thus, lowers the sound level hence aqua silencer reduces noise and pollution.

## MERITS AND DEMERITS

### Merits

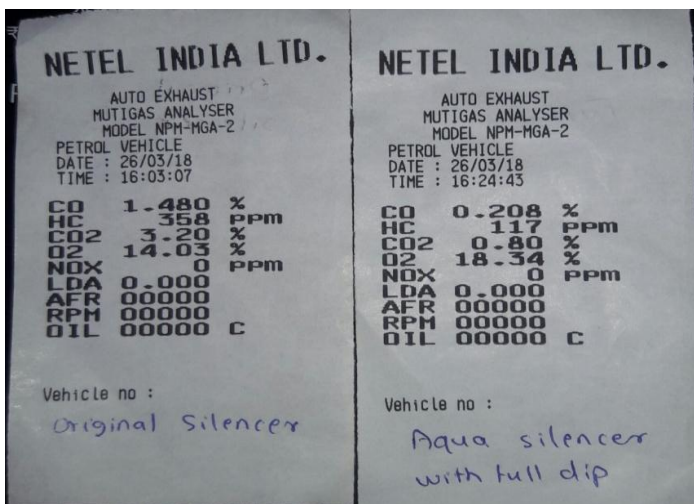
1. Control emission and noise in greater level.
2. Detoxification
3. CO reduced 60% to 70%.

### Demerits

1. Lime water filling is required frequently.
2. It is expensive than conventional silencer.

## Results

Tests are taken on HERO HONDA SPLENDOR



Parameter	Original Silencer	Aqua silencer with full dip
CO	1.480 %	0.208 %
HC	358 PPM	117 PPM
CO2	3.20 %	0.80 %
O2	14.03 %	18.34 %
NOX	0 PPM	0 PPM
LDA	0.000	0.000
AFR	00000	00000
RPM	00000	00000
OIL	00000 C	00000 C

## Result Table

General Silencer		Aqua Silencer		% Reduction
CO	1.480%	CO	0.208%	85
HC	358 PPM	HC	117 PPM	67
CO2	3.20%	CO2	0.80%	75
O2	14.03%	O2	18.34%	18%(increase)

## CONCLUSION

1. Emissions are reduced upto greater level.
2. Size of the silencer is reduced and can be used for two wheeler.

## Future Scope

1. It can be used in two wheeler.
2. It can be used in industrial application also.

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