

## 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. Air pollution is very serious problem for the public health of view, because every person breaths approximately 22,000 times a day, inhaling 15 to 22 kg of air daily. Air pollution effect on living things. The main component due to which air pollution is increasing are carbon- dioxide, which is get exposed from vehicles and other harmful gases which is comes out from the big factories, electric power, generation plants, big industries etc.

**Key words:** Aqua Silencer

### I. 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.

In order to avoid these type of gases by introducing this aqua silencer. It is fitted to the exhaust pipe of the engine. Sound produced under water is less hear able than it produced in atmosphere. This mainly because of small sprockets in water molecules, which lowers its amplitude thus, lowers the sound level. The emission can be controlled by using the activated charcoal layer and it is highly porous and possesses extra free vacancies so it has high absorption capacity. So absorb the gases from the engine and release much less position to the environment. The noise and smoke level is considerable less than the conventional silencer further there is no need of catalytic converter and easy to install [2].

In this silencer, the Charcoal and Water is used so it is called hybrid aqua silencer, and it is useful in automobile,

industry, DG sets & DG machines, Marin and Boats also so, it is known as hybrid universal aqua silencer.

### II. 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.

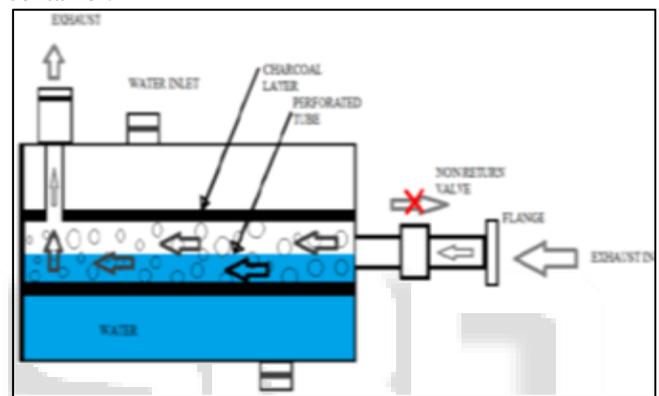


Fig. 1:

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 possess 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.

### III. EFFECTS OF DISSOLVED GASES ON LIME WATER

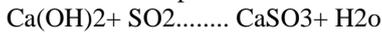
The lime water is a good absorbing medium. In aqua silencer the gases are passed through perforated tube which is dipped in lime water. When these gases dissolved in water they form acids, carbonates, bicarbonates etc,

- 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.

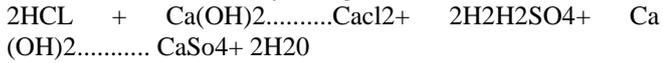
- 2) Action of dissolved CO<sub>2</sub> The dissolved carbon dioxide forms bicarbonate at lower PH and Carbonates at higher PH. Calcium carbonate will precipitate when carbon dioxide present in exhaust gas and in contact with lime water.
- 3) Effect of dissolved NO<sub>x</sub> The NO<sub>x</sub> is abnoxious product of combustion-the oxides of nitrogen. nitrogen absorbed to a larger extent by water.

#### A. Reactions

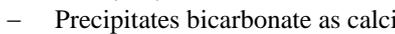
- The SO<sub>2</sub> gas is removed from the flue gases forming calcium sulphate.



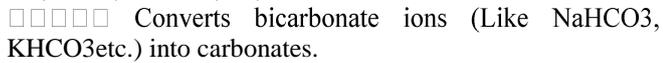
□□□□ Neutralizes any acid present in water



- Precipitates bicarbonate as calcium carbonate



- Precipitates bicarbonate as calcium carbonate



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



#### COMPONENTS AND EXPLANATION

#### B. 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.

#### C. 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.

#### D. 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.

#### E. Bend Pipe

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

#### F. Working

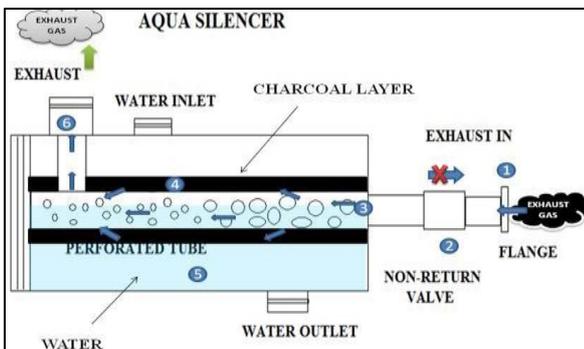


Fig. 2: Layout of an Aqua Silencer

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.

Basically an aqua silencer consists of a perforated tube which is installed at the end of the exhaust pipe. The perforated tube may have holes of different diameters. The very purpose of providing different diameter hole is to break up gas mass to form smaller gas bubbles the perforated tube of different diameter. Generally 4 sets of holes are drilled on the perforated tube. The other end of the perforated tube is closed by plug. Around the circumference of the perforated tube a layer of activated charcoal is provided and further a metallic mesh covers it. The whole unit is then placed in a water container. A small opening is provided at the Top of the container to remove the exhaust gases and a drain plug is provided at the bottom of the container for periodically cleaning of the container. Also a filler plug is mounted at the top of the container. At the inlet of the exhaust pipe a non-return valve is provided which prevents the back flow of gases and water.

#### IV. MERITS & DEMERITS

#### A. Merits

- 1) Control emission and noise in greater level.
- 2) Detoxification
- 3) CO reduced 60% to 70%.
- 4) Less vibration during running time.
- 5) Easily engine gets start.
- 6) Emission and noise controlled at greater level.

#### B. Demerits

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

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