

# A Novel Approach to Design and Fabricate a Vehicle Silencer for Reduced Air Pollution

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## Abstract

In the present-day living situation, air contamination makes human life truly wiped out and impacts other living organs on the earth. This air contamination/air pollution is mainly caused due to the gases coming out from the industries or automobile exhaust gases. These gases contain very harmful and dangerous constituents and therefore it is necessary to reduce the adverse impact of these gases. In the present work, an effort has been made to design and fabricate a silencer that can be used in vehicles or automobile engines and reduces air pollution with few changes in its design.

**Keywords:** Air pollution, industries, and automobiles, silencer for vehicles or automobile engines.

## 1. Introduction

An aqua silencer is generally employed to regulate the disorder and discharge in IC motors. The enthusiasm that ignites the selection of this component as our current project is, in the present-day living scenario the air pollution makes human life physically sick and also impacts other living organs on the earth. The vehicles that worked by taking energy from various fuels are the primary source of this air pollution [1]. These vehicles produce harmful exhaust gases like unburned hydrocarbons, carbon dioxide, and so on. To stay away from these kinds of gases we present the aqua silencer. It can be easily installed/fixed with the exhaust outlet of the motor/engine. The sound that carried out from this silencer is submerged/injected in water and hence the loudness of the exhaust sound declines and it is less hearable than it directly exposed in open surroundings. The application of diminutive sprockets in water particles brings down the plentifulness and also reduces the sound level [2-3]. The discharge can also be inhibited by applying the triggered charcoal layer and it is intensely porous and forces supplementary free valences so it has a high ingestion limit. So it ingests the gases from the motor and discharges substantially less contamination to the earth. The commotion and smoke level is substantial but not precisely the traditional silencer. This silencer can ensure the exclusion of an exhaust system and it is also simple to introduce/operate. It can provide less sound and less polluted air which is probably the most discussed and highly rated problem under today's civilization. Emissivity should be controlled by its various purposes i.e.; charcoal sectioning, and by providing a catalyst to remove harmful gases. The biggest advantage of this is it is not much costly even it does not affect much efficiency of the engine [4-7].

## 2. Literature Survey

As per the report and the various searches, we found that work done before over the aqua silencer is quite less often. We read various aspects and many of the reports that it won't succeed much due to the formulation and few of the problems related to the size and the charcoal and sodium gas reactions provided to its exhaust port.

Here as we can see in figure 1 the size of the silencer made before. We are up to change the size and make it well-sized which can fit easily in the vehicles. And we are trying to produce a silencing port which can also be used in the industries as chimneys which can produce less smoke [8-10].



Figure 1: Aqua Silencer

## 2.1 Objectives

- To reduce air pollutants from exhaust coming out through engines.
- To reduce sound radiations coming out from silencer and reduce sound pollution.
- To overcome the problem of emissivity from the exhaust coming out.
- To precipitate carbon content.
- No vibrations during the running of an engine.
- Pollution-free vehicle.
- We can use this process as in chimneys in large or small scale industries.
- Less amount of smoke comes out through exhaust port.
- Not much cost consuming process should help the vehicle to be overrated and affects the environmental problems in a better way.
- It can provide a big change in automobiles by emitting radiations, emissivity, heating of engines all of them can be improved under one process.
- Eco-friendly environment and automobiles.

## 2.2 Problem Formulation

- *Chemical Reactions:* The gases which should be balanced and removed out of the exhaust ports i.e., calcium sulphate, sodium oxide, hydrochloric acids(neutralizer), sulphuric acid(reducing neutralizing agents), sodium bicarbonate, calcium bicarbonate. These gases are balanced as we have shown below

under the working process.

- *Water Level Indication:* As the name suggested aqua means water. It depends upon the water prospect as the water molecules formed and the droplets absorb the sound ration and the air polluting agents dissolve underwaters. But the problem occurs is the indication of water level under which we get to know the amount of water required and when to skip the polluted water with fresh water.
- *Weight And Size:* The weight and size of this silencer are more and big as compared to usual silencers. This makes the vehicle a bit heavy and that should create unbalance. These are the most probably problems occurring while making our project. We will do various outcomes as discussed below to overcome these problems and provide better superior working of the project aqua silencer.

### 3. Methodology

#### 3.1 Construction

1. First of all, we took a normal silencer from the market.
2. Then we cut it into the two halves, vertically from the center by using a multipoint cutting machine as shown in figure 2 (a).
3. Then we took two sheets of grade 16 and drilled 4 sets of holes of approx 10-12 mm.



Figure 2: (a) Perforated sheets (b) Silencer with valves

4. After this, we took 3 valves and welded 2 valves on the upper half of the silencer and one on the lower half (figure 2-b).
5. Then we took charcoal, crushed it in the powder form and made its slurry by mixing with the water.

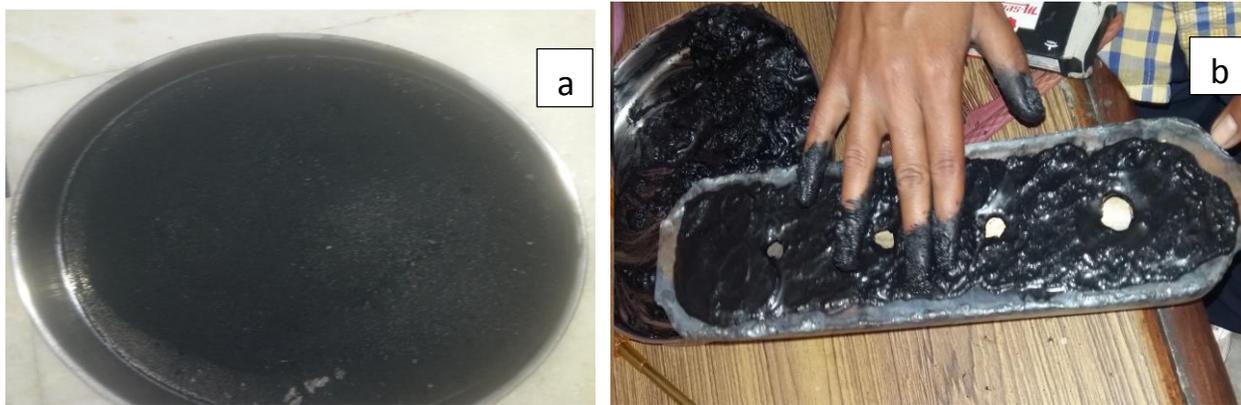


Figure 3: (a) Charcoal powder (b) Activated charcoal slurry on sheets

6. The slurry of charcoal is then pasted between the perforated sheets as shown in figure 3.
7. Then we kept the sheets between the upper and lower halves of the silencer and welded them and finally, we joined the exhaust inlet of the silencer to the exhaust outlet of the engine and took the results (figure 4).

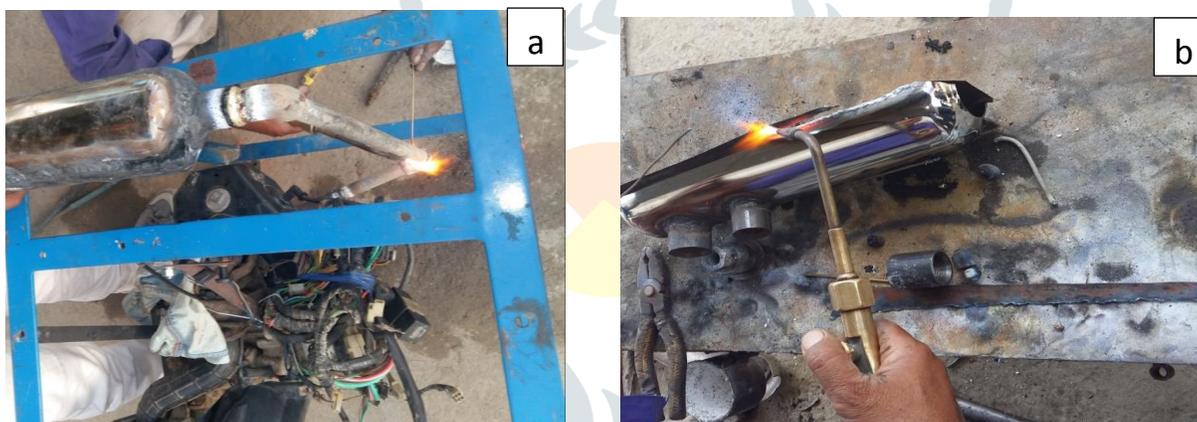


Figure 4: (a) Exhaust pipe welded to the engine (b) Silencer being welded



Figure 5: Main design of aqua silencer

### 3.2 Working

The perforated cylinder alters the high frame air pockets into low frame air pockets as the exhaust gases permitted to enter into the aqua silencer. Further, these gases are either forced or allowed to pass through the charcoal layer that once more purges these gases. The discharge can also be inhibited by applying the triggered charcoal coating and it is intensely porous and forces supplementary free valences so it has a high ingestion limit. The gases may get broken down into the water in the wake of overlooking the charcoal coating in an appropriate portion. To finish, the exhaust gases come out from the opening and travel into the open air. This is how an aqua silencer diminishes commotion and pollution.



Figure 6: (a) Inlet of aqua Silencer (b) Exhaust of engine

### 4. Result Analysis On Emission

To obtain the outcome of the current work pollution check was done of the engine exhaust with and without utilizing the aqua silencer. The reports are shown in figure 7 and figure 8.

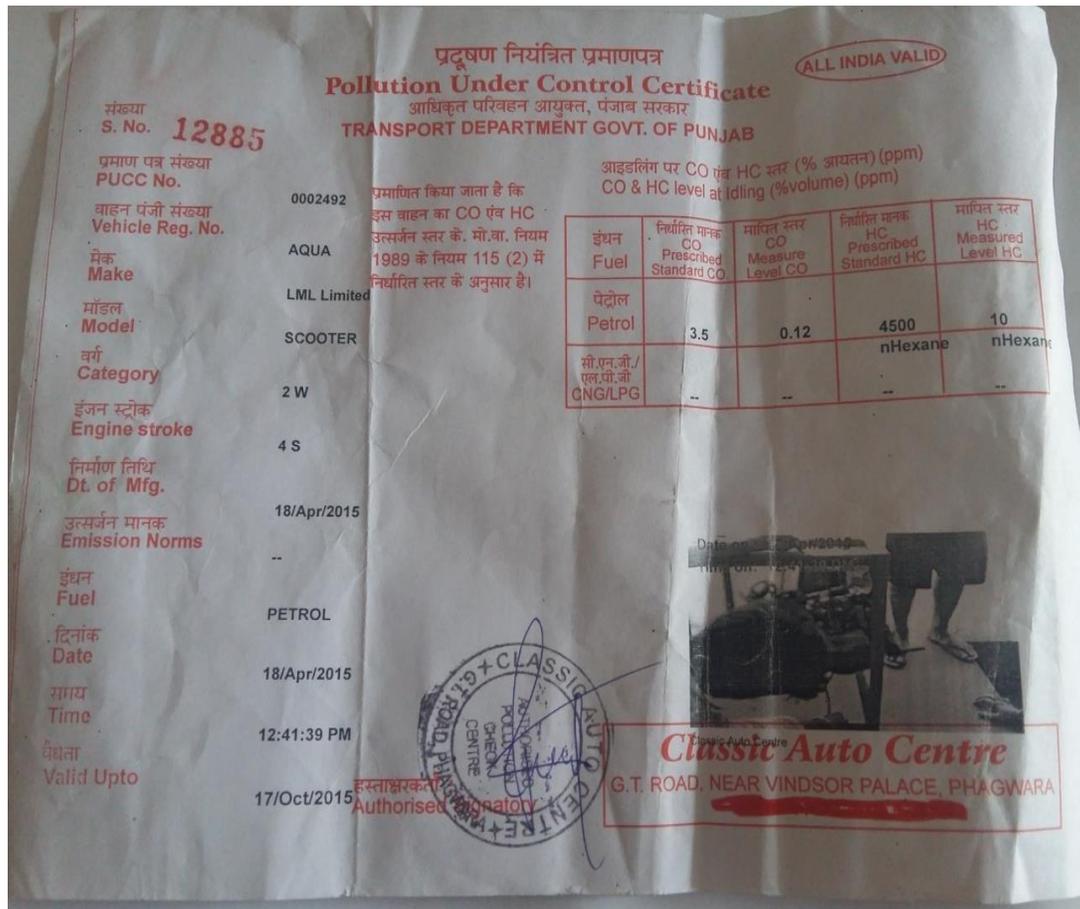


Figure7: Pollution test without aqua silencer



Figure 8: Pollution test with the aqua silencer

## 4.1 Result Analysis

### A) Without aqua silencer

| Fuel   | Agreed typical<br>CO | Restrained<br>level CO | Agreed typical<br>HC | Restrained<br>level CO |
|--------|----------------------|------------------------|----------------------|------------------------|
| Petrol | 3.5                  | 0.12                   | 4500<br>nHexane      | 10<br>nHexane          |

Table 1: Data without aqua silencer

### B) With aqua silencer

| Fuel   | Agreed typical<br>CO | Restrained level<br>CO | Agreed typical<br>HC | Restrained level<br>CO |
|--------|----------------------|------------------------|----------------------|------------------------|
| Petrol | 3.5                  | 0.01                   | 4500<br>nHexane      | 0<br>nHexane           |

Table 2: Data with the aqua silencer

## 4.2 Sound Test

First, the noise of the engine with 4-stroke single-cylinder diesel engine in our laboratory was up to 105db. Then the noise produced after the aqua silencer was fitted up to 75db. Thus the noise reduction was achieved and the noise was measured by using a decibel meter.

## Conclusion

The utilization of aqua silencer is increasingly successful in reducing the emission of harmful release gases from the motor exhaust as it utilizes a perforated cylinder and coating of charcoal over it. The exhaust sound confidently brought down by a considerable amount by utilizing water as a medium. In addition, we can also regulate the exhaust outflow by applying initiated charcoal in the water to a more prominent level. The utilization of the perforated cylinder ensures a decreased sound level and steady the backpressure. By utilizing a perforated cylinder the fuel utilization stays the same as the regular framework. The water tainting is seen as immaterial in water silencer. It is a smokeless and contamination-free outflow and furthermore, it is extremely modest.

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