

Emission Control of Two Stroke Petrol Engine Using Thermal Coated Charcoal Silencer and Emission Control Silencer

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Abstract: Air pollution is one of the major problem in the present world. In this study, we will discuss about the design and fabrication of the charcoal silencer which is fitted to the exhaust pipe of engine and another advanced design of emission control silencer. The charcoal silencer controls both air pollution and sound pollution. The small size of wet charcoal is placed between the honeycomb shape filters and by using this charcoal silencer sound also reduced. The charcoal silencer tested in the laboratory and its smoke level and noise levels are compared with the ordinary silencer.

Key words: Air pollution, charcoal silencer, petrol engine, marine engineering, laboratory, fabrication

INTRODUCTION

Air pollution is the introduction of chemicals discomfort to every living being. These partials are called as pollutant which is affect the humans (Veeraragavan, 2013). The air is naturally polluted by dust, salt particles, gases from domestic waste and etc. but maximum pollution occurs when fuels burns in the engines.

Air pollution is one of the important aspects from the public health of view because an average rate of respiration in a human is 22000 times a day inhaling about 15-22 kg of air per day. Adeyinka *et al.* (2004) and Deshmukh (2001) is the introduction of particulates, biological molecules or other harmful materials into Earth's atmosphere, causing disease, death to humans, damage to other living organisms such as food crops or the natural or built environment. The major parts of Charcoal silencer include:

- GI pipe of 460×120 mm
- End cup 130120 mm
- Coupling of 20 mm
- Nipple of 230×20 mm
- Nipple of 153×20 mm
- Water level indicator
- 'L' joint of 20 mm

Additional features:

- Thermal coating in the both inner and outer filter
- Coating chemicals are copper sulphate and sodium hydroxide
- The small size solid state charcoal is placed between the two filters
- By this thermal coating and the presence of charcoal reduces the HC emission and NOx emission

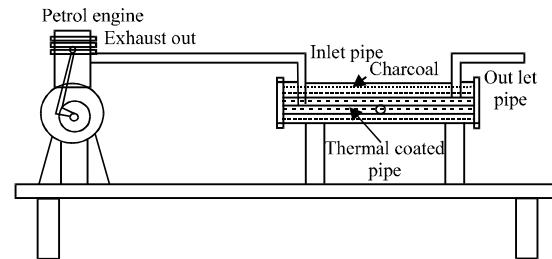


Fig. 1: Charcoal silencer setup

MATERIALS AND METHODS

Fabrication: The two inner and outer honeycomb shape filters are placed in the centre of the GI housing pipe. Both inner and outer honeycomb shape filters are thermal coated by the chemicals which are NaOH and CuSO₄. The charcoal is placed between the inner and outer filter. (Kumar *et al.*, 2015). Open and closed type knob is fitted over the filters. The knob helps to wet the charcoal by the water.

In Fig. 1, the knob fitting, close both sides by the circular plates. The one circular plate is centrally drilled for connect the silencer flange. And another one plate is drilled in the corner to reduce the flow velocity of the exhaust gas from the engine. After completing all the above process, the charcoal silencer fitted to the engine (Rajesh *et al.*, 2016).

RESULTS AND DISCUSSION

Test results: Table 1 explains the content of carbon dioxide, nitrogen oxide and hydro carbon in load without

using the charcoal silencer. The pollution is greatly reduced across the load by using the proposed method.

Table 2 explains about the pollution affected elements is discussed and quantity of these elements is mentioned in numerical value by using the charcoal silencer. In charcoal silencer is used for reducing the content of pollution in atmosphere.

Another advanced design of emission control silencer:

The main pollutants contribute by automobile are Carbon monoxide (CO), Unburned Hydrocarbon (UBHC), Oxides of Nitrogen (NO_x) and lead. Automobiles are not the only sources of air pollution and other sources such as electric power generating units industrial and domestic fuel consumption industrial processing etc. also contribute heavily to contamination of our environment, so, it is imperative that serious attempts should be made to conserve of our environment from degradation.

The pollution level is very high in 2 stroke engine which emits significant amount of Particulate Matter (PM), Unburned Hydrocarbons (UBHC), Carbon monoxide (CO) and Oxides of Nitrogen (NO_x) which affects the eco system.

Our newly fabricated silencer is an attempt in this direction, it is mainly dealing with control of emission in 2 stroke engine. The inner surface of the silencer is coated with refractory (Aluminium silicate) and Activated Carbon Filter (ACF) in a particular ratio which absorbs the Unburned Hydrocarbon (UBHC) and reduces the Carbon monoxide (CO) emission. This fabricated silencer is fitted to the exhaust pipe of engine. Refractory and activated carbon filter acts as an adsorbent at low temperature. Because of this property both are used in a silencer in order to control the emission from the stroke engine. The smoke level is considerable less than the conventional silencer, it is cheaper, no need of catalytic converter and easy to install.

Table 1: Without charcoal silencer

Load (kg)	HC (ppm)	CO (%)	No _x (%)
30	110	0.115	0.0017
35	156	0.120	0.0023
40	193	0.500	0.0031
45	240	0.850	0.0046
50	295	0.930	0.0057
55	336	1.020	0.0063

Table 2: With charcoal silencer

Load	HC (ppm)	CO (%)	No _x (%)
30	48	0.052	0.00085
35	70	0.083	0.00091
40	95	1.035	0.00097
45	116	1.054	0.00103
50	152	1.097	0.00109
55	161	1.106	0.00117

Pure aluminium powder and sodium silicate is collected separately and the aluminium silicate and sodium silicate is mixed in 10:2 ratio to prepare slurry. Moisture can be added up to 2% for mixing. The slurry should be free from any impurities. The slurry prepared is taken and neatly pasted inside walls of the casing manually with hands. Other method for pasting slurry to the walls is by placing the slurry in the open end and air is passed from air compressor. The slurry pasted to the walls is heated to remove the moisture content. Heating also, makes the slurry to get attached to the mild steel surface which reduces the risk of material detaching from the metal surface. Different composition of slurry:

- 100% refractory and 0% activated carbon
- 90% refractory and 10% activated carbon
- 80% refractory and 20% activated carbon
- 70% refractory and 30% activated carbon

Refractory is pasted uniformly all over the inner surface of silencer up to 0.5 cm. Activated carbon is advisable to paste only in the central pipe (middle section) of silencer because at the outlet port of an engine the temperature will be more than the ignition temperature of ACF. Also when the area of cross section increases the velocity decreases. This makes the gas to stand in the middle region for sometime compared to front pipe.

Performance of silencer made of aluminum material subjected to low frequency impact loading this makes the ACF particle to adsorb un burnt hydrocarbon effectively within its ignition temperature (Fig. 2).

The cross section, the wire mesh and the exhaust pipe with the clamp of the silencer are given in the Fig. 3.

Advantages:

- Mixture of refractory and activated carbon filter will reduce CO to 60-70% compared to conventional silencer
- Low cost
- Controls air pollution
- It gives better result than catalytic converter
- Doesn't create back pressure as in case

Disadvantages:

- Surface temperature of silencer will increase due to the presence of refractory compared to ordinary silencer

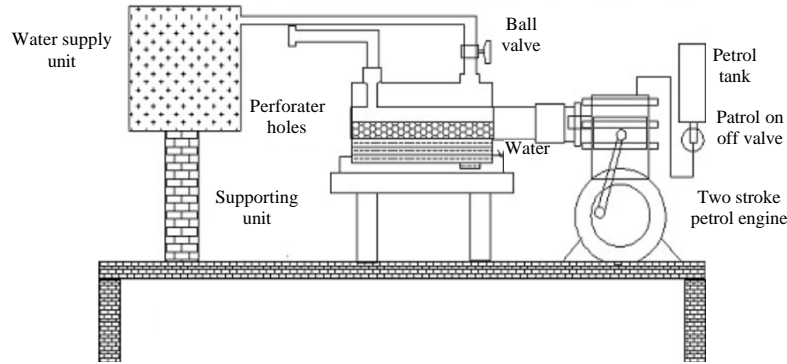


Fig. 2: Noise controlling

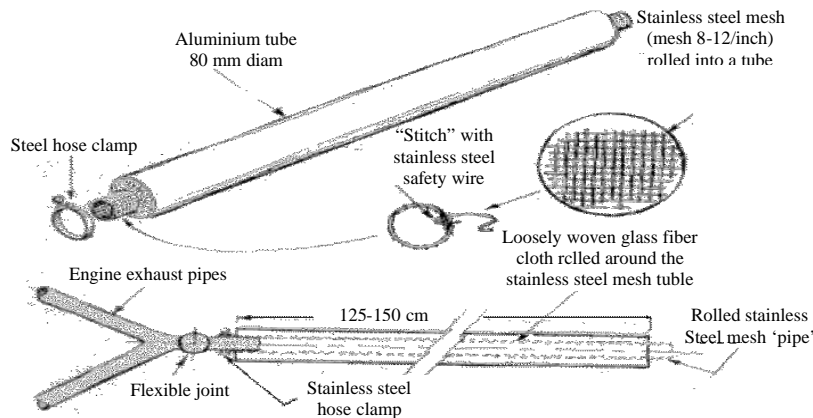


Fig. 3: Internal views of the silencer

- Activated carbon filter will reach its ignition temperature at 240°C
- Only part of exhaust gas will hit the refractory film

CONCLUSION

By the above study, the emission of the two stroke petrol engine is reduced by the charcoal silencer. Both HC and CO levels are decreased half amount of the normal silencer. The NaOH and CuSO₄ act as a catalyst to reduce emission and wet charcoal helps to reduced NO_x pollution and reduced sound from the engine.

In the case of emission control silencer with the mixture of refractory and activated carbon filter, we can see that the quantity of CO and HC can be reduced by using a silencer which is generally coated with 20% activated carbon filter and 80% refractory layer at inner surface. Smoke emission is less and controls air pollution.

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