



DESIGN AND FABRICATION OF REDUCING TOXIC PARTICLE SILENCER

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ABSTRACT

Air is most important for the public health point of view, because every individual person approximately 22000 times breathes per day and inhale 15 to 22 Kg of air daily. Air pollution can be defined as accumulation of materials in to atmosphere, which will have a dexterous effect on life upon our planet. Due to high cost and less output power of petrol engines, diesel engines are more in use rather than petrol engines but the toxic gases emitted in diesel engines are greater than petrol engines. The main pollutants contribute by automobiles are carbon monoxide (CO), unburned hydrocarbon (UBHC), oxides of nitrogen (Nox) and lead. Electric power generating stations, industrial and domestic fuel consumption also some other sources to air pollution. In this regard reducing toxic particle silencer (RTP) is introduced in the automobiles to control the noise and emissions. It is fitted to the exhaust pipe of engine. RTP silencer controls emissions by reducing the toxic particles in automobiles exhausts and it doesn't require catalytic converter. In this paper, toxic content in petrol engine exhausts at various running speeds are studied by changing the lime stone content in RTP silencer. Reduction of HC and CO emissions are observed by changing the lime stone content from 25 to 150 grams.

Key words: Air pollution, ETP silencer, Carbon monoxide (CO), Unburned hydrocarbon (UBHC), Oxides of nitrogen (Nox) and Lead.

INTRODUCTION

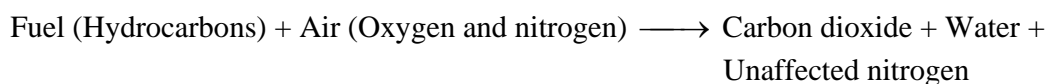
In most of the developing countries including India, air pollution is the major problem. Due to this, most of the people affected by health related problems such as respiratory diseases, risk of developing cancers and other serious ailments etc. Most of the people in the world they do not have adequate measurements to protect themselves from air

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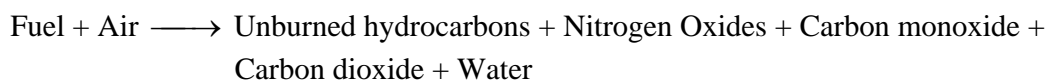
pollution. Rapid urbanization in the world results increase in motor vehicles, which is the main source of air pollution. There are several methods to improve the air quality by improving the fuel quality, formulation of necessary legislation and enforcement of vehicle emission standards, improved traffic planning and management etc. The non-technical measures taken includes creates awareness in population regarding the possible economic and health impacts of air pollution, purchase vehicles with advanced emission control devices and use of cleaner fuels. In automobiles, main pollutants are carbon monoxide (CO), unburned hydrocarbon (UBHC), oxides of nitrogen (NOx) and lead. The combinations of all these gases in excess quality results automobile pollution but these are in certain range are acceptable. Engine is not tuned properly and the quality of fuel is not good then all these result in a higher level of pollutants in engine emissions. An RTP silencer is an attempt is mainly dealing with control of emission and noise, when it is fitted to the exhaust pipe of engine results decrease in noise and smoke levels considerably when it is compared with conventional silencer. RTP silencer is cheaper, doesn't require catalytic converter and easy to install. It will reduce the toxic content of exhaust up to the acceptable limit before they are emitted to atmosphere.

Toxic gases from engine exhausts: Personal automobiles in most of the cities in the world are single greatest polluter. Power to move the vehicle is obtained by burning the fuel in engine during the process pollutants are released from engine as byproducts of combustion. Prefect combustion process pollutants are less compared to usual engine combustion process.

Perfect combustion



Typical engine combustion



Tradition fuels like diesel and gasoline are mixture of hydrocarbons, which contains hydrogen and carbon atoms. In prefect combustion process oxygen in the air convert hydrogen and carbon in the fuel to water vapors and carbon dioxide, but in imperfect combustion process exhaust gas contains harmful unburned hydrocarbons, which cause

major formation of smog. The increase in the NO_x emission is the reason for the acid rain and CO reduces the flow of oxygen in the blood stream.

Fabrication of RTP silencer

The outlet pipe nominal bore is 50 mm from the engine was connected to the scrubber tank whose inlet diameter is equal to the out let pipe. The shape and length of the pipe is decided according to the space availability to keep the flow resistance to a minimum. Scrubber tank is fabricated in three stages. It includes tank, bell-mouth and lime stone container. Tank is made of standard steel plates of 3 mm thick and fabricated by electric arc welding process to withstand maximum pressure of 0.8 N/mm² [8 Kg/Cm²] with leak – proof. Tank size is 8 liters capacity to accommodate lime stone container and bell mouth inside. Water content in the tank is 4 liters corresponding to 115 mm water level from the bottom of the tank. Baffles are provided, which will encourage through scrubbing of the exhaust gas and it will prevent the entry of water into the lime stone container. Bell mouth is provided to expand the exhaust gases and it will reduce the back pressure and temperature it is lies between 500°C to 700°C following Fig. 1 shows the assembly of bell mouth. Back pressure is further reduced by providing suitable space between the bell-mouth and tank top flange.

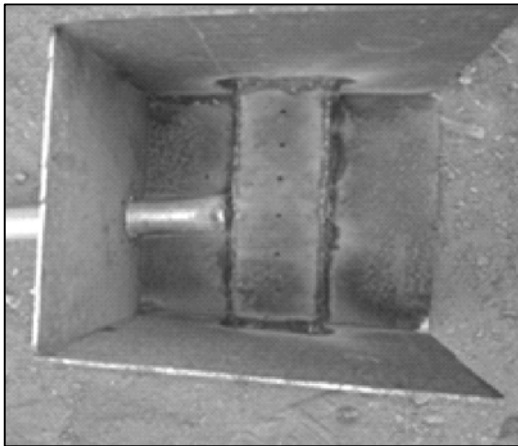


Fig. 1: Fabricated model of bell mouth

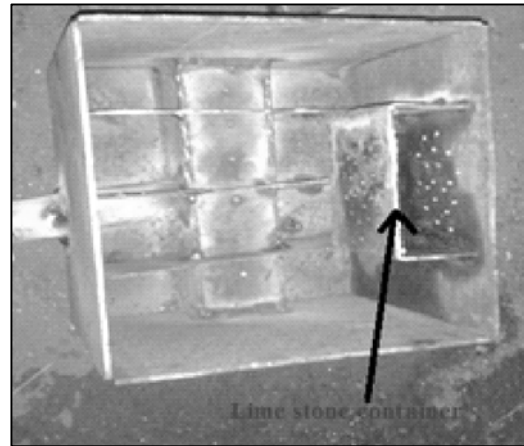


Fig. 2: Lime stone container

Lime stone container and out let pipe fabrication: It is made up of 2 mm thick standard steel plates and cross sectional area 35 mm x 40 mm and capacity less than 2 liters. Circular holes are provided to side wall of the container to easy flow of exhaust and its diameter should be less than lime stone to avoid to falling in to tank during filling. The conical shape at top reduces the flow area, increasing the velocity and reduces pressure

before it is let into the outlet pipe. Separating the outlet portion (Fig. 2) to know the lime stone level and to change the lime stone easily. Outlet pipe from the scrubber tank is fabricated using standard medium duty pipes of nominal diameter is 60 mm is equal to diameter of the inlet pipe. The flange at the one end is to suit the flange on the outlet of the lime stone container. The shape and length of the pipe is to keep the flow resistance to a minimum.

Lime stone water and oil are used in this experiment. At first tank is filled up to the level limestone container. Exhaust from the engine is fed to inlet pipe of the silencer. Inside the silencer the exhaust gas moves through the bell mouth container. The exhaust gas will comes out the bell mouth through the hole made on it. The exhaust gas will react with the lime stone water and the toxic gas will be removed to a certain extent polyurethane filter and coconut shell is used to remove the escaped toxic particle from the exhaust. The analysis of the setup is done using pollution under control (PUC) certification system. Here, we had used a four gas analyzer and the software used is ELGI Eco mate gas analyzer India.

RESULTS AND DISCUSSION

Exhausts from RTP and actual silencer were analyzed by using pollution under control (PUC) Certification system. Here we used a four gas analyzer and the software used is ELGI Eco mate gas analyzer India (Fig. 3). At variable speeds HC and CO emission from four stroke engine with actual and RTP with various limes tone content (25 g, 50 g, 75 g, 100 g, 125 g and 150 g) is observed. At initial speeds HC and CO emissions are nearly equal in both the silencer when speed is increased are gradually decreased. HC and CO emissions also considerably decreased when the lime stone content increased in RTP silencer.



Fig. 3: ELGI Eco mate gas analyzer

Comparison of RTP silencer with actual silencer

The experimentation was done on four stroke petrol engine at variable speed with actual and RTP silencer with different lime stone content. Comparison of HC and CO emissions in both the silencers at various speeds are shown in Figs. 4 and 5.

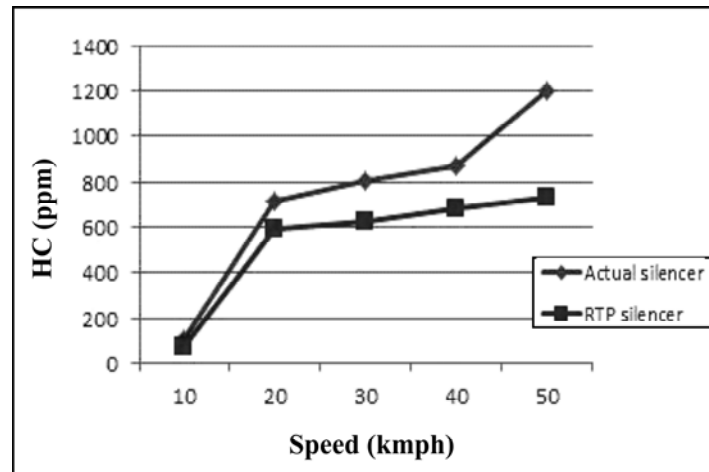


Fig. 4: Comparison of HC emission of four stroke engine using RTP and actual silencer at variable speed

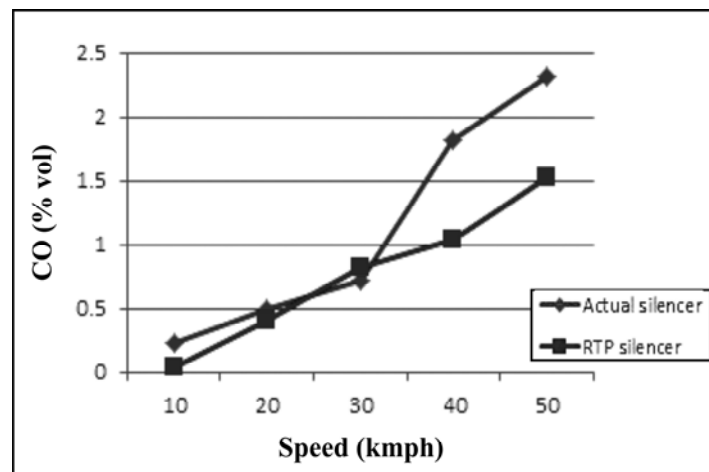


Fig. 5: Comparison of CO emission of four stroke engine using RTP and actual silencer at variable speed

When the limestone content in RTP silencer is increased, emission was reduced and confirmed by observing the emission released from RTP silencer when 25 grams of lime stone is added. Comparison of HC and CO emission in actual and RTP silencer with 25 grams of lime stone is shown in Figs. 6 and 7.

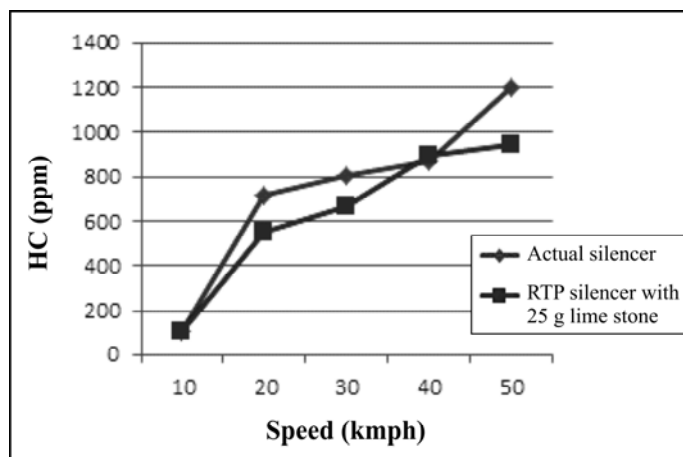


Fig. 6: Comparison of HC emission in four stroke engine using RTP and actual silencer at variable speed

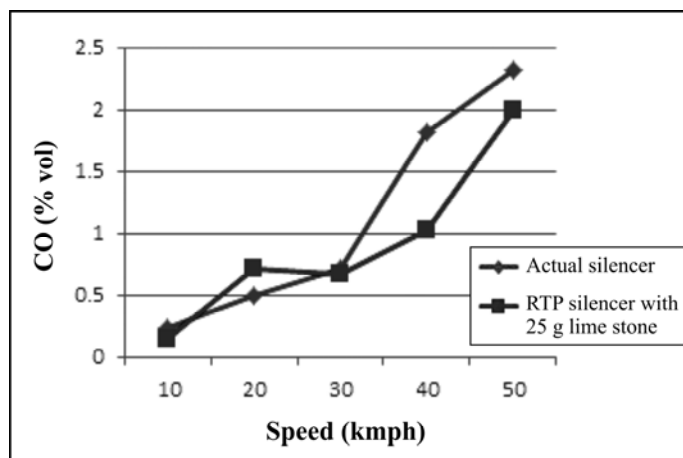


Fig. 7: Comparison of CO emission in four stroke engine using RTP and actual silencer at variable speed

Further addition of lime stone to RTP silencer resulted a decrease in HC and CO emissions considerably when compared with actual silencer as shown in Figs. 8 and 9.

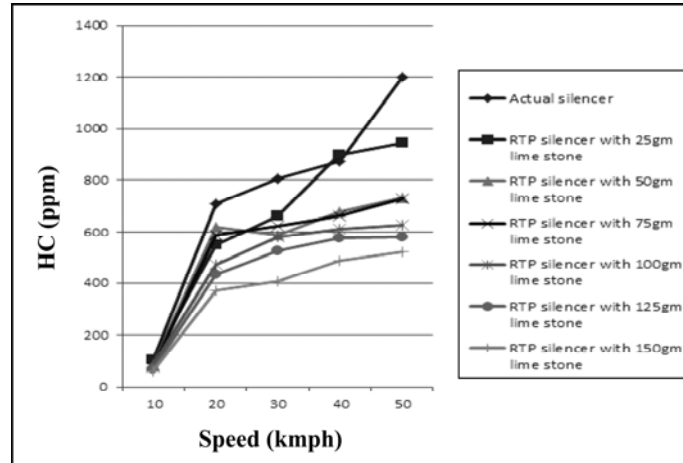


Fig. 8: HC Emission of four stroke engine using RTP silencer at different lime stone content and actual silencer at variable speed

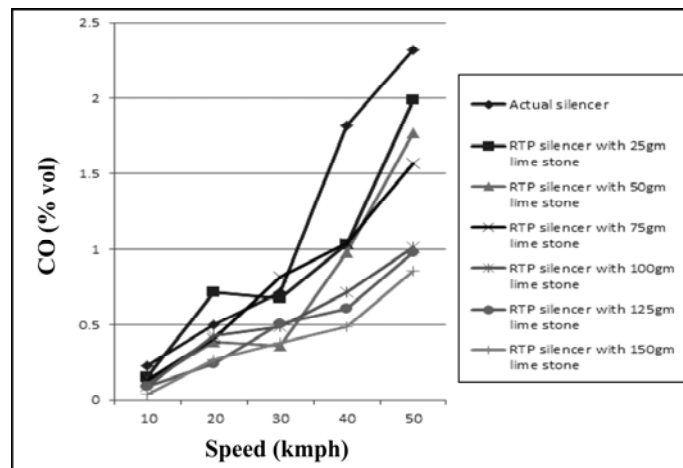


Fig. 9: CO Emission of four stroke engine using RTP silencer at different lime stone content and actual silencer at variable speed

CONCLUSION

An RTP silencer is designed and fabricated and the test is conducted by varying speed and at different quantities of lime stone content. Following are the conclusion drawn from the emission test –

- The RTP silencer has the ability to reduce the toxic particle from the engine.

- The RTP silencer has good capability to reduce smoke and noise to an agreeable level.
- With the use of Lime water stone in the silencer, the toxic levels is seen to be decreasing in four stroke engines. There is better reduction (22.6%) of HC emissions at 75 g of limestone and at optimum speed of 30 kmph.
- The toxic levels are found to be decreased with the increase in the content of the lime stone. while increasing lime stone content from 25 g to 150 g in the RTP silencer, HC emissions reduced by 38.5% and CO emissions reduced by 44.1% at a speed of 30 kmph.

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