

Engine emission control by using human urine

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ABSTRACT

Internal combustion engine generate undesirable emission during the combustion process. In this, both SI and CI engines are equally responsible. The major causes of this emission are non stoichiometric combustion, dissociation of nitrogen and impurity in the fuel and air. The exhaust gas sent into the atmosphere by the engines contains hydrocarbon, carbon monoxide and nitrogen oxide for air pollution.

These pollutants are known to cause global warming, acid, rain, smog and respiratory and other health hazards. Therefore there are laws on emission standard which limit the amount of each pollutant in the exhaust gas emitted by an automobile engine.

Engine emission can be classified broadly into two categories vis. Exhaust emission and no exhaust emissions. Major exhaust emissions are unburnt hydrocarbon, oxides of hydrocarbon, oxides of nitrogen, oxides of sulphur, particulates and soot and smoke. And the sources of no exhaust emission are fuel tank, carburettor and crankcase. The main exhaust emission unburnt hydrocarbons. The present work is focused upon the reduction of exhaust emission only using no noble metal copper as catalyst in catalytic converter.

The worst thing about vehicular pollution is that it cannot be avoided as the emissions are emitted at the near ground level where we breathe. The pollution from vehicle are due to discharge like CO, unburned HC, Pb compounds, NO_x, soot, suspended particulate matter and aldehydes, among others mainly from the tailpipes. Recent study report that in Delhi one out of every 10 school children's suffers from asthma that is worsening.

Due to vehicular pollution devices developed for after treatment of exhaust emission includes thermal converters or reactors, traps or filters for particulate matters and catalytic converters. The most effective after treatment for reducing engine emission is catalytic converter found on most automobile and other model engines of medium or large size. It is basically a chemical chamber mounted in the flow system through the exhaust gasses pass. The chamber contains catalytic material and it is intended to convert harmful combustion by-products from an engine cylinder into harmless product. In presence of catalytic material the rate of chemical reaction increases because catalyst help to oxidizes harmful CO and HC emission to CO₂ and H₂O in the exhaust system and thus emission is controlled. Generally catalytic converter are called as three way converter because they are use to reduce the concentration of three emission gases CO, HC, NO_x in the exhaust.

I. PROBLEM STATEMENT

Problem statement focuses on the problems faced while constructing design model and analysis of the designed model. There are number of problems could be raised so the design procedure, fabrication of model and results must go in a proper way to achieve the objectives of the designing the new model of silencer. The problems which raised in design of model are tabulated below.

Backpressure in combustion chamber

Backpressure usually refers to the pressure exerted on a moving fluid by obstructions against its direction of flow. The word back may suggest a pressure that is exerted on a fluid against its direction of flow indeed, but there are two reasons to object. First, pressure is a scalar quantity, not a vector quantity, and has no direction. Second, the flow of

gas is driven by pressure gradient with the only possible direction of flow being that from a higher to a lower pressure. Gas cannot flow against increasing pressure. It is the engine that pumps the gas by compressing it to a sufficiently high pressure to overcome the flow obstructions in the exhaust system.

At continuously increasing back pressure levels, the engine has to compress the exhaust gases to a higher pressure which requires additional mechanical work and/or less energy gained by the exhaust turbine which can affect intake manifold boost pressure. This leads to an increase in fuel consumption, PM and CO emissions and exhaust temperature. The increased exhaust temperature can leads to overheating of exhaust valves and the turbine. An increase in nitrogen oxide emissions is also possible because of increase in engine load. Increased back pressure affects

performance of the turbocharger, results in changes in the air to-fuel ratio which increases which may be a main cause of emissions and engine performance problems. The magnitude caused due to effect depends on the type of the charge air systems. Increased exhaust pressure helps to prevent some exhaust gases from leaving the cylinder (especially in naturally aspirated engines), with the help of an internal exhaust gas re-circulation system which responsible for some nitrogen oxide reduction. Small amount of nitrogen oxide reductions reported with some diesel particulate filters system, usually in the range to 2-3% percent, are possibly resulted by this effect. More amount of exhaust pressures can increase the chances of failure of turbocharger seals of engine, which may resulting in oil leak agent the exhaust system. In systems with catalytic diesel particulate filters or other catalysts used in the engine, such oil leak can also result in the catalyst deactivation by phosphorus and other catalyst poisons present in the oil. Maximum engines have maximum allowable engine back pressure specified by the manufacturer of the engine. If the engine is used at higher speed and creates more back pressure might invalidate the warranty of particular engine. Those standards generally accepted by automotive engineers that for every inch of Hg of back pressure (Mercury inches of Hg is a unit used for measuring pressure) nearly 1-2 HP of power lost depending on the displacement and efficiency of the engine, as well as the combustion chamber design etc.

Flow control mechanism

The flow control mechanism plays a crucial role for injecting two different solutions in different reaction chamber. The reaction chamber enough strong and tough to sustain such a corrosive reactions which are going to takes place at the reaction chamber. The exact injection of spray of solution must flow through the pipes to the reaction chamber so there are two 6 V DC submersible pumps are working simultaneously at equal speed and velocity.

The flow of two different solutions must stop while at rest of engine and must start flow of solution while in speed. The velocity of injected spray must be vary with speed of engine and only for that purpose use of 6 V DC submersible pump is must in this mechanism.

Desired sound

The exhaust system of a generator has several inherent design problems that must be considered. These characteristics impose severe limitations on what can be done to silence the engine exhaust noise: n Very High Noise (100 to 120 dBA @ 1 m) n High Temperatures (950 to 1050 o F) n High Velocities (5,000 to 15,000 fpm) n Combustion By-Products (soot & corrosion) n Pipe Thermal Expansion

Engine exhaust noise varies significantly with loading. Typically the noise level at full load is about 10 dB higher than the no-load condition. The next slide shows typical engine exhaust sound levels at different loads. The curves also show that the majority of the engine exhaust noise is at low frequencies.

Some vehicle owners remove or install an aftermarket muffler when engine tuning in order to increase power output or reduce fuel consumption because of economic or environmental concerns, recreational pursuits such as motorsport and hyper milling and/or for personal aesthetic acoustical preferences. Although the legality of altering a motor vehicle's OEM exhaust system varies by jurisdiction,

in many developed parts of the world, modification of a vehicle's exhaust system is usually highly regulated if not strictly prohibited.

Exact solution required

The solution required for controlling the emission which is caused by vehicles

Speed control of DC pump

It is seen that speed of the motor is inversely proportional to flux. Thus by decreasing flux speed can be increased and vice versa. To control the flux, a rheostat is added in series with the field winding, as shown in the circuit diagram. Adding more resistance in series with field winding will increase the speed, as it will decrease the flux. Field current is relatively small and hence I^2R loss is small, hence this method is quiet efficient. Though speed can be increased by reducing flux with this method, it puts a limit to maximum speed as weakening of flux beyond the limit will adversely affect the commutation.

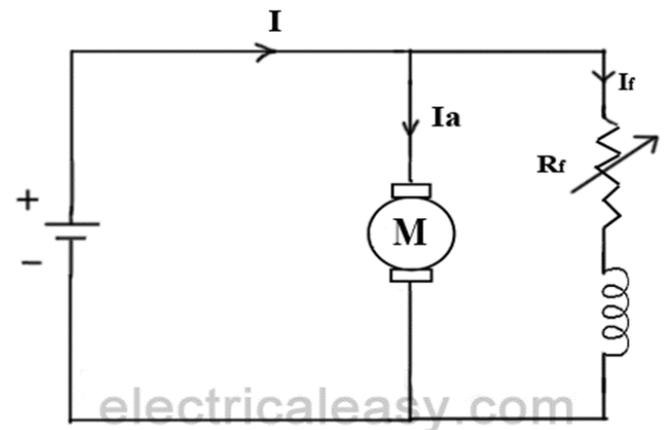


Fig no. speed control of DC pump

Corrosion of reaction chamber

Silencers in the automobiles are affected by the corrosion due to exposure to atmospheric conditions and internal flue gases. The main reason behind the premature muffler failure is because of the corrosion, fatigue or combination of the both. About 80% of the failure is due to corrosion and rest is by fatigue. The exhaust system of an automotive muffler has lots of prerequisite to accomplish. The foremost one is to reduce the noise level produced by the engine, adequate insertion loss, to access the waste gases out from the rear part of automobile system, to play down the reduction in engine performance, to have a satisfactory service life, back pressure, shape, style, and cost. Thus need for the corrosion resistant materials for the silencer has increased a lot. Thus different corrosion resistant materials can be analyzed and proper material can be taken for the production of silencer.

II. DESIGN OF MODEL

It consist of 4-stroke engine run on petrol, silencer, 2 convergent and divergent cone fitted into the silencer called as reaction chamber , two 6 volt DC submersible pump and solution reservoirs which contains the two different solutions as tabulated below.

Solution used: Liquid ammonia with distilled water and human urine, human urine and purified urea with distilled water.

III. RESULTS AND DISCUSSION

The system which aim to control the environmental pollution. Test conducted by using PUC tester and the results are as tabulated below.

Before connection of model and system:

GenMaint Exoscan - V

4 Stroke Petrol

TEST REPORT

CO %VOL: 3.79
 HC ppm: 1448
 CO2 %VOL: 4.00
 O2 %VOL: 12.98
 P. E. F.: 0.500
 LAMBDA : 0.0.R
 AFR : 0.0.R
 RPM : 0

NON-BS2/BS2/BS3/BS4
 CERT. NO.:
 DATE 04/04/17
 TIME : 11:49
 SIGN :
 OPERATOR'S NAME:

GenMaint Exoscan - V

4 Stroke Petrol

TEST REPORT

CO %VOL: 3.79
 HC ppm: 1448
 CO2 %VOL: 4.00
 O2 %VOL: 12.98
 P. E. F.: 0.500
 LAMBDA : 0.0.R
 AFR : 0.0.R
 RPM : 0

NON-BS2/BS2/BS3/BS4
 CERT. NO.:
 DATE 04/04/17
 TIME : 11:49
 SIGN :
 OPERATOR'S NAME:

After connecting model and system:

GenMaint Exoscan - V

4 Stroke Petrol

TEST REPORT

CO %VOL: 1.38
 HC ppm: 509
 CO2 %VOL: 13.80
 O2 %VOL: 14.41
 P. E. F.: 0.500
 LAMBDA : 0.0.R
 AFR : 0.0.R
 RPM : 0

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According to above given results could justify how much amount of CO and HC can be controlled by using of designed model and system. Before connecting the given system CO was 3.79 and after connecting system CO was 1.38, above 2000 rpm of engine the CO was 2.29.

By analysing all results and design the system is useful for controlling the emission of vehicles and could control the emission of diesel engines also.

IV. ADVANTAGES AND DISADVANTAGES

Advantages

1. With the help of this system we can reduce the Emission.
2. Solution is easily available.
3. It is eco-friendly and not harmful human beings as well as animals.
4. Cost of solution is low.
5. We can adopt this technique also for diesel and petrol base engines.
6. Running cost is very low.
7. Space required for this system is less.
8. The manufacturing cost is low.

Disadvantages

1. Erosion and corrosion may take place in system.
2. Some time back pressure may be created in to the system.
3. Cannot determine the appropriate value of solution required for setup.

V. CONCLUSION

On above all experimental project and result we conclude that:

1. We can achieve BS5 norms with help of this equipment.
2. This reduces the percentage of HC and CO in at high rate.
3. The results obtained are better than that of Catalytic converter.
4. It is more efficient and reliable method for reducing pollution.
5. We can use this system in diesel engines.

VI. APPLICATIONS

1. The working model can be used in any two wheeler bike.
2. The working model can be used in light motor vehicles.
3. The designed model most useful for buses and trucks.
4. The modified model can used in generator by making some changes.

VII. FUTURE SCOPE

In catalytic converter platinum plates are used. After the start of engine 3 min late it gets hot and then in working start. The platinum plate according to its property reduces smoke from the exhaust after 3 min of engine start. Instead of this we can use the step up transformer can heat the plate after 0.8 min and thus they can definitely reduce the smoke as early as possible.

By using the reaction chamber we can control the vehicles emission by using human urine solution instead of catalytic converter and achieve the emission control in effective manner.

For controlling flow from the pump we can use the flow control valve which is operated by accelerator pedal the solution can be forwarded. Thus due to this emission that is emitted from the vehicle is reduced after pressing the pedal can mix the solution and give the results like this experiment.

VIII. REFERENCES

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