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I.C. Engine emissions with varied proportions of mixtures of petrol, diesel, bio-diesel and other organic fuels

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Abstract
The numbers of Internal Combustion engines are increasing day by day. The undesirable emissions generated in the combustion process in IC engine pollute the environment which contributes to global swarming, acid rain, smog, respiratory and other health problems. The major causes of these emissions are non-stoichiometric combustion, dissociation of Nitrogen, and impurities in the fuel and air. The emissions of major concern to health are hydrocarbons (HC), carbon monoxide (CO), Oxides of Nitrogen (NOx), Sulphur and solid carbon particulates. Ideally, engines and fuel systems could be developed in such a way that very few harmful emissions would be generated, and these could be exhausted to the surroundings without a major impact on the environment. With present technology this is not possible, and hence after-treatment of the exhaust gases to reduce emissions is very important. This consists mainly of the use of thermal or catalytic converters and particulate traps.

Keywords: I.C.Engine, petrol, diesel

THE BAD EFFECT OF HC, CO, NO_x

HC- When hydrocarbons emission gets into the atmosphere, they act as irritants and odorants and some are carcinogenic. These hydrocarbons react with atmospheric gases to form photochemical smog.

CO- Carbon monoxide has little effect on property, vegetation or materials. But it can seriously affect human metabolism, due to high affinity for hemoglobin (Hb). It reacts with the hemoglobin of blood and displaces Oxygen to form Carboxy- hemoglobin (CoHb), thus, reducing capability of the blood to carry Oxygen. Since the affinity of hemoglobin for CO is about 200 times more than for Oxygen, therefore, carbon monoxide can seriously impair the transport of Oxygen even when present at low concentrations. The health effects observed in persons exposed to CO, if CO level is between 200 – 400 ppm, it causes unconsciousness and it CO level is 400-750 ppm, person may die.

Among the above pollutant the bad effect of CO is highly dangerous and it affects directly to human life.

Thus the I.C. engines both gasoline and a diesel engine are major contributors to the air quality problem of the world and the situation of air pollution is out of control. Vast improvements have been made in reducing emissions given off by I C engine. If a 30% improvement is made over a period of years and during the same time the number of IC engines in the world increases by 30%, there is no net gain.

India imports 70% of the required fuel, spending 30% total foreign exchange earnings on oil imports.

In today's world mostly I.C. Engines are dependent on gasoline and diesel. Hence in coming future there will be scarcity of gasoline and diesel. Also, they cause more gaseous pollution. So, there is a need to find an alternative fuels for I.C. Engines.

Alcohols are an attractive alternate fuel because these can be obtained from a number of sources, both natural and manufactured. Methanol (methyl alcohol) and ethanol (ethyl alcohol) are two kinds of alcohol that seem most promising and have had the most development as engine fuel.

Aim of the project

The aim of this project is to mix organic fuel like Alcohol and bio-diesel in different proportion in Petrol and Diesel and then the exhaust emissions are tested and simultaneously the performance of the engines are tested. If the exhaust emissions are lower and the performance of the engines are better than the conventional petrol and Diesel then we can add the alcohols like ethanol and methanol and bio-diesel with petrol and diesel to control the air pollution and to reduce the consumption of petroleum fuels.

Experimental set-up for petrol & diesel engines

The experimental set up for experimentation is engine 100 cc 2 strokes, single cylinder SI engine loaded by a rope toll dynamometer. There is list of some of the important specification of the engine under test. The schematic layout of the experimental set up is shown in figure1. Fuel consumption was measured by using a calibrated burette and a stopwatch with an accuracy of 0.2sec.

Experimental set-up for petrol engine

Fig1.Experimental Set-up for petrol engine

Experimental set-up for diesel engine

Fig 2. Experimental set up for diesel engine

Procedure for experimentation

The engine was started and allowed to warm up for a period of 15-20 min. The fuel consumption was constant at 10 cc for each performance. Engine test were performed by constant speed and varying the loading condition for each individual fuel. Before running the engine to a new fuel blend, it was allowed to run for sufficient time to consume the remaining fuel from the previous experiment. For each experiment, four runs were performed to obtain an average value of the experimental data.

Detailed Steps for tests

1. Before starting the engine check the fuel supply, lubrication oil.
2. Set the dynamometer to zero load condition
3. Run the engine till it attains the working temperature and steady state condition.
4. Adjust the dynamometer load to obtain the desired engine speed. Note down the fuel consumption rate.
5. Adjust the dynamometer to the new value of the desired speed. Note and record the data as in step 4.
6. Repeat the experiment for various loads up to the rated speed of the engine and various proportions of Petrol and Methanol for petrol engine testing and Bio-diesel, Methanol, Ethanol with Diesel for diesel engine testing.
7. Do the necessary calculations.

Precautions were taken to calibrate all the instruments against standard equipments and instruments like dynamometer, thermometer, tachometer, petrol measuring system, stop watch etc.

The test is performed in two-stroke petrol I.C. Engine and four stroke diesel I.C. Engine with 20%, 30% and 40% addition of bio-diesel, ethanol and methanol. The petrol and diesel is tested separately and it is found that the addition of 10% to 15% ethanol gives the best results. The emissions are lower and performance of engine is better than the conventional petrol and diesel fuels. The inference of this project is that the addition of 10-15% of ethanol in petrol and diesel can control the air pollution and save the consumption of petroleum products.

Large numbers of experimental data have been obtained with different mixtures of alcohols with diesel and petrol. A few sample tests have been given below

Test No. 1

Table 1. Table for measurement of CO with 100% Diesel and 0% Biodiesel

Exhaust gas Temperature (^{0}C) after calorimeter	CO ppm	RPM	Load (N)
37	263	1491	40
39	233	1493	20

Test No. 2

Table 2. Table for measurement of CO with 80% Diesel and 20% Biodiesel

Exhaust gas Temperature (^{0}C) after calorimeter	CO ppm	RPM	Load (N)
39.3	220	1500	20
38.2	184	1499	30
40	231	1491	10
40.8	247	1496	40

Test No. 3

Table No. 3. Table for measurement of CO with 60% Diesel and 40% Biodiesel

Exhaust gas Temperature (^{0}C) after calorimeter	CO ppm	RPM	Load (N)
40.4	236	1496	40
40	227	1495	30
40.3	233	1500	20
40.4	248	1496	10

Test No. 4

Table 4. Table for measurement of CO with 80% Diesel and 20% Ethanol

Exhaust gas Temperature (^{0}C) after calorimeter	CO ppm	RPM	Load (N)

40.2	242	1500	10
40.8	286	1496	20
39.1	243	1493	30
38.5	225	1493	30
38.8	232	1491	40

Test No. 5

Table 5. Table for measurement of CO with 80% Diesel and 20% Methanol

Exhaust gas Temperature (^{0}C) after calorimeter	CO ppm	RPM	Load (N)
30.8	220	1422	10
38	230	1397	20
38.2	251	1445	30
37	204	1445	30
37.1	207	1472	40

CONCLUSION

1. Alcohols up to 10-15% can be added to pure diesel in engines giving better performances in increasing the B.P., thermal efficiency and also resulting in a significant decrease in pollution like CO and HC.
2. There has been no requirement to make the basic engine design change when alcohols are mixed with the Diesel up to 10-15% addition of alcohol.
3. Addition of Bio-diesel also gives similar performance as above.

SUGGESTIONS

1. Luckily, India is a rich producer of sugarcane, and hence alcohols are also available is large quantities. These must be compulsorily added to Diesel and Petrol to save the foreign exchange, and also to reduce I.C. Engines pollution.
2. Design of engine cylinder requires some modification. This also must be tried.

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