B. Effect on Brake Specific Fuel Consumption

The specific fuel consumption is changed with load at different pressures for diesel and B20 CNSL oil was presented in fig.4. The BSFC is decreases with increasing loads for all pressures. This result may due to poor mixture formation CNSL and effect of higher viscosity. The specific fuel consumption of B20 blend is lesser than that of diesel for 3rd and 4th loads at 210bar compared to other injection pressure for both sources. This result caused when increasing the injection pressure the fuel droplets size decreases and then the fuel droplets momentum increases. And they have collided on the engine cylinder wall then produce same power, the fuel consumption also increased. From all pressure the diesel has lower BSFC value at 180 bars at full load condition.

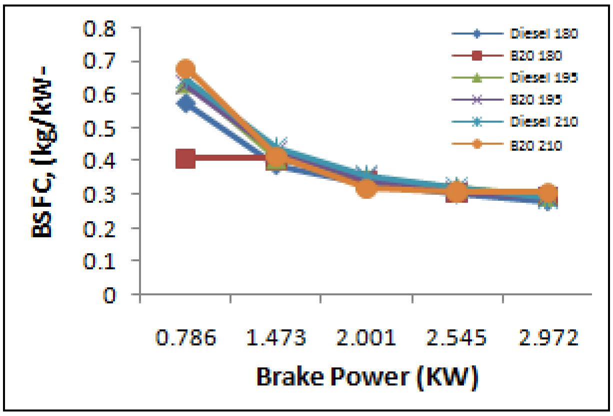

Figure 4: Comparison of specific fuel consumption

C. Unburned Hydrocarbon Emissions

The Unburned hydrocarbons are varied at three different injection pressures for diesel and B20 CNSL shown in fig.5. As the opening pressure increases the HC emissions are reducing because, higher injection opening pressures will lead to proper spray while the injection starts. This will enhance the performance with B20 CNSL oil have higher viscosity. This is probably because of the improvement in the spray, which can lead to a lower physical delay. The improved spray also leads to better combustion and thermal efficiency. The unburned HC Emission is highest in the case of 180 bars and is least in the case of 210bar. This is because at 210 bar proper diffusion and combustion of the biodiesel takes place which results in lower emissions. At 180bar and 210bar there is very less time for the diffusion of the fuel to takes place which leads to increase in emissions. The concentration of biodiesel increases in the blend the unburned hydro carbons are decreases due to that the oxygen content present in the biodiesel is higher this leads to complete combustion in the cylinder.

D. Carbon Monoxide (CO) Emissions

The variation of carbon monoxide emissions with load at different injector pressure, when pure diesel and B20 CNSL are used as a injected fuel, is shown in fig.6. At full load, for the injector opening pressure of B20 CNSL oil, due to higher injection pressure, atomization and mixing process are improved. Due to high viscosity of CNSL oil compared to diesel, high injection pressure are required for improving atomization and better mixing process resulting in low CO emissions. The CO emissions are decreased when increasing loads at all pressures. The CO emissions20 CNSL oil is lower if compared to pure diesel. The CNSL oil produces a greater combustion efficiency leading to lower amounts of CO. The CO emissions are very less at 180 bars for B20 Blend compared to diesel at all pressures and higher for diesel at 180 bars.

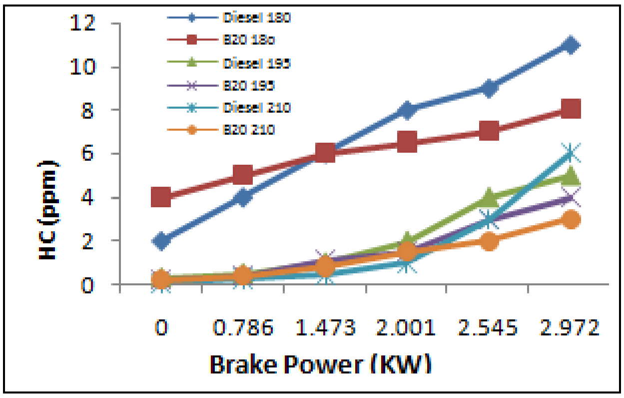

Figure 5: Comparison of HC emissions

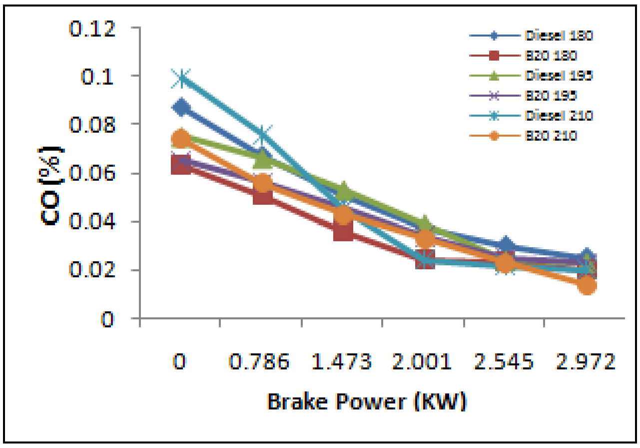

Figure 6: Comparison of CO emissions

E. Oxides of Nitrogen (NOx) Emissions

Fig.7 shows NO_x variation with increasing loads at all pressures for B20 CNSL oil pure diesel. From graph the NO_x emissions are increased with increasing loads for all pressures due to the increase in combustion temperature. . The important factor that causes NO_x formation is due to high combustion temperatures and availability of oxygen. The NO_x graph indicates that B20 blend of CNSL contain lower NO_x emission when compared to pure diesel fuel. This is due to poor atomization of CNSL oil leads to poor combustion and lead lower NO_x emission. The NO_x emissions are increased with increasing the load for both fuels. But less NO_x emissions are obtained for B20 CNSL oil than that of diesel at all pressures. The reasons may be due to:

(I) Smaller calorific value of blend
(II) Lower localized gas temperature in the cylinder, (III) oxidation rate
(IV) Poor atomization due to high viscosity

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The diesel fuel contains high volatile nitrogen compounds in their composition which contributes to a higher level of nitrogen concentration in the combustion chamber. Since diesel engine operates primarily in the lean region when diesel fuel is consumed, there is excess air and oxygen for nitrogen compounds to form NOx when the combustion temperature is high.

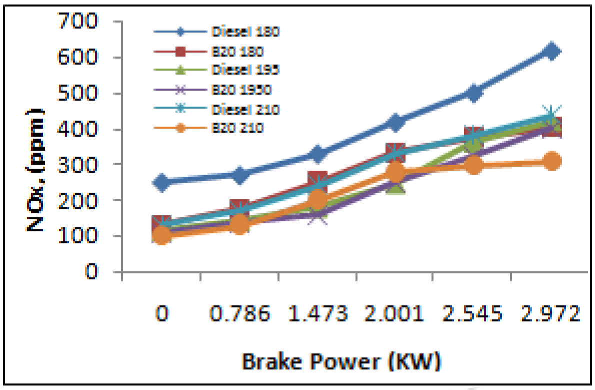

Figure 7: Comparison of NOx emissions

F. Carbon Dioxide (CO_2) Emissions

A variation in the values of CO_2 emissions for diesel and B20 blend at all injection pressures are shown in Fig.8. The CO_2 emissions are increased with increasing loads for diesel and blend for all loads. Carbon dioxide is a desirable byproduct compared to CO emission that is produced when the carbon from the Fuel is fully oxidized during the combustion process. From the graph lower CO_2 emissions obtained for B20 CNSL oil than that diesel at all pressures. The lowest emissions obtained for B20 blend at 195 bars because of lower carbon content of biodiesel and highest emissions obtained for diesel at 180 bars. This is mainly due to improper combustion of fuel efficiency.

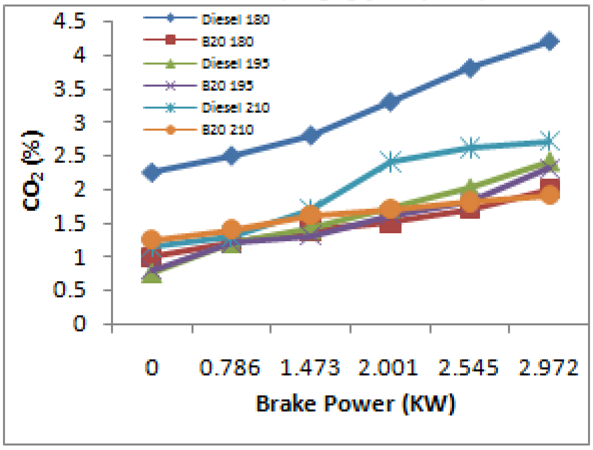

Figure 8: comparison of CO_2 emissions

G. Exhaust Gas Temperature (^{0}C)

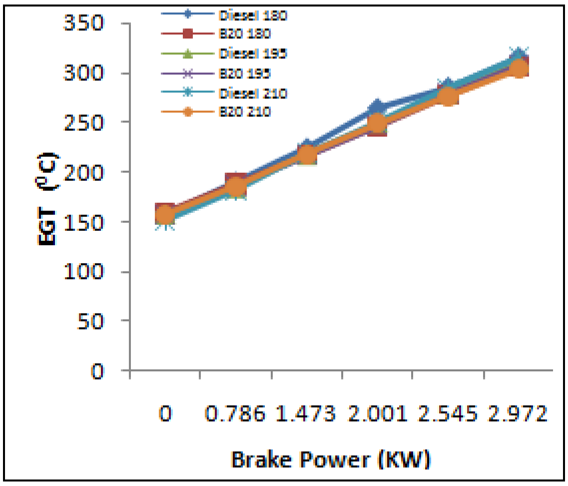

Figure 9: The change of Exhaust Gas Temperature

The change of exhaust gas temperature with varying the applied load for diesel and B20 CNSL oil tested is shown in Fig.9. The fig.9 shows the exhaust gas temperatures of CNSL oil is decreases when compared to neat diesel. From that the exhaust gas temperature is slightly increases for both fuels from 180 to 210 bars injection pressure. The reason behind this the fuel atomization is increases then the complete combustion done in the combustion chamber. The complete combustion was done up to 210 bars injection pressure then decreases when increases the injection pressure. At higher injection pressure than 210 bars the scavenging efficiency is decreases due to that the knocking will occurs in chamber. Because of the fuel pre-ignition will obtain before the compression stroke. Finally it is observed that the exhaust gas temperatures for both fuels are higher at 210 bars of injection pressure.

8. Conclusions

From the experimental study following conclusions were drawn:

- The Brake specific fuel consumption is high for the blend of CNSL oil and diesel mode. As the injection pressure increased, the Brake specific fuel consumption is decreased.
- The BSFC of blend taken was minimum at 210 bar injection pressure.
- The brake thermal efficiency of biodiesel is very close to diesel from 180 to 210 bars. However, at 60% load BTE is higher for biodiesel at 210 bars than diesel.
- The mechanical efficiency ofB20 is higher at 180 bars than 195 and 210 bars.
- The CO and CO_2 emissions are low for B20 at 210 bars than diesel.
- Lower exhaust temperatures were observed at higher injection pressures.
- The NOx emissions are very low for B20 than diesel at 210bar when compared to 180, 195 bar injection pressures.
- The UHC emission of B20 is less at all loads compared to diesel.

- Based on the experimental investigation it can be concluded that B20 of CNSL oil can be adopted as an alternative fuel for existing conventional engine without any major modification required in the system hardware.

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