CHAPTER 5

CONCLUSIONS

In the present work, tests were conducted with biodiesels having 55% 65% and 75% saturation levels and the performance, emission and combustion characteristics were studied in a 5.2 kW engine running at 1500 rpm at full load condition. It was observed that the NOx and hydrocarbon emissions reduced with increase in saturation percentage in biodiesel, while the smoke emissions increased.

As the increase in nozzle opening pressure is known to increase fuel atomization and vapourisation, it was taken up for investigation in the present work with blends of biodiesels with 55%, 65% and 75% saturation levels. The performance and emission tests were conducted at 200, 220 and 240 bar nozzle opening pressures.

The following conclusions are drawn from the present experimental investigation:

1. At 200 bar nozzle opening pressure operation, an increase of 15% in saturated fatty acid, resulted in thermal efficiency increased by about 3% and NOx emissions reduced by about 5%. Among all the fuels, esters with 75% saturated fatty acid composition which are mainly derived from coconut oil emitted lesser NOx emissions. This may be due to the presence of saturated fatty acids like lauric acid(C12:0), myristic acid (C14:0), palmitic acid (C16:0) and stearic acid (C18:0) in their composition. Fuels with high saturated fatty acids have higher
cetane number. High cetane number reduces the ignition delay, pressure and temperature which reduces NOx emissions.

2. At 220 bar nozzle opening pressure the increase in saturated fatty acid by about 15% increased the thermal efficiency by about 4% and reduced NOx by about 3 to 7%. This may be due better atomization and vapourisation of the fuel at higher nozzle opening pressure. When compared to 200 bar operation the thermal efficiency increased by 5% and NOx emission by 6%, which may be due to higher in-cylinder temperature at higher injection pressures.

3. An increase in thermal efficiency by about 5% and reduction of NOx by about 3 to 8% were observed with increase in saturated fatty acid by about 15% at 240 bar nozzle opening pressure operation. When compared to 200 bar operation the thermal efficiency increased by 4%, while the NOx emissions were almost same.

For all the biodiesels, hydrocarbon and carbon monoxide emission were lower with increase in saturation levels. The smoke emission was same for all the biodiesels at 200, 220 and 240 bar nozzle opening pressures. Higher the saturated fatty acids, higher the cetane number and lesser the NOx emission.

The experimental results support that biodiesel having high-saturated fatty acid composition can be used as a fuel in a CI engine with minor modifications to the engine without compromising on thermal efficiency.
5.1 SUGGESTIONS FOR FUTURE WORK

The following are suggested as future work for the investigation on the use of biodiesel with high saturated composition as a fuel in direct injection compression ignition engine:

- The effect of saturated fatty acids in LHR diesel engine can be studied to control the emission of NOx. The use of biodiesel in LHR engine would further enhance the combustion thereby improving the performance of the engine in addition to lowering the carbon monoxide, hydrocarbon and smoke emissions.

- The effect of blending palmitic acid, stearic acid, lauric acid and myristic acid as additives to diesel fuel can be investigated as these acids have higher cetane number. Investigation on the effect of blending acids with higher cetane number is expected to reduce the NOx emissions.

- Investigations can be carried out in a multi-cylinder automotive diesel engines to explore the possibility of commercialising the use of biodiesel with various saturation levels.

- The effect of different engine parameters like compression ratio and injection timing can be studied and optimum values can be found for better fuel economy with different saturation levels of biodiesel blends. Varying the compression ratio and fuel injection timing with varying saturation levels would give better performance with lower hydrocarbon, smoke and oxides of nitrogen emissions.