CHAPTER 9

CONCLUSION

The experimental investigation was performed to study the effect of using waste plastic oil with diesel, Jatropha methyl ester and Emulsion blends on the Combustion, Performance and Emission characteristics of a compression ignition engine at different load conditions in a DI diesel engine. Based on the experimental results the following major conclusions have been drawn.

BTE of WPO is 22.61% and its blends are lower compared to the diesel and due to higher heat loss, while EGT is marginally 10°C higher than that of diesel. BTE, increased by about 5.79% with PD20 operation at full load compared to WPO. Diesel blends with WPO have a significant effect on the UBHC, NOX and CO emissions. The NOX emission increases with increase in percentage of the WPO in blends and increases with an increase in engine load. WPO of UBHC has increased by 19 ppm compared to diesel. UBHC emission for PD10 and PD20 operation is about 8.33% and 18.75% lower than WPO at full load. The CO emission is higher value 0.26 Vol at full load for WPO as compared to 0.22 Vol at full load for diesel. CO emission for PD20 operation is about 7.7% lesser than WPO at full load. CO emission increases with WPO blend ratio and engine load. Smoke emission is decreased by about 3.8% in the case of PD20 compared to WPO at full load. WPO exhibits a higher cylinder peak pressure compared to diesel due to evaporation of WPO inside the cylinder through absorbing of heat from the
combustion chamber. The heat release rate with WPO is higher compared to Diesel due to better combustion.

BTE, increased by about 7.7% with PJ20 operation at full load compared to WPO. With increase in percentages of JME, NOx increase due to the presence of Oxygen molecule in biodiesel, that lower heat release rate and combustion temperature. NOx emission is 1.31% and 2.91% higher for PJ10 and PJ20 than WPO at full load. UBHC emission for PJ10 and PJ20 operation is about 20.83% and 22.91% lower than WPO at full load. CO emission for PJ20 operation is about 50% lesser than WPO at full load. Smoke emission was decreased by about 21% in the case of PJ20 compared to WPO at full load.

BTE of PW30 emulsion was increased up to approximately 20% from WPO at full load operating conditions, when it is increasing in percentage of emulsion in the WPO. NOx emission was a 63.94% reduced while operating with PW30 compared to WPO. The UBHC emission for the WPO-emulsions was higher than that of WPO and diesel at all engine load conditions. CO emission of WPO-emulsions were seen as almost similar to diesel up to 75% load, but only increased at full load condition. Smoke opacity of PW30 was 44.7% lesser than WPO at full load conditions. Gradually, it decreased, Smoke Emission when increasing emulsion percentage into the WPO. It was found that, PW30 has shown better performance than the other blends. Thus, it can be used as an alternate fuel in a DI diesel engine without any engine modification.

Response surface methodology, BTE and NOx have been considered as responses and various machining parameters such as different type of fuel blends and engine load are treated as inputs of the model. A mathematical model has been developed for the responses like BTE and NOx using RSM and the model was analyzed through ANOVA. BTE increases
with increase in load and different fuel blends shows different BTE values. PW10, PW20 and PW30 show highest BTE at full load. Meanwhile, PD10 and PD20 shows a lower BTE at engine full load. NO\textsubscript{X} increases with an increase in engine load for the entire test fuel blends. Higher NO\textsubscript{X} were shown for the blends PD10 and PD20 at full load operation. Optimized process parameters for the optimum responses were identified, such as, A= PW30 fuel blend, and B= 70% engine load with optimum parametric combination, BTE can be achieved as high as 27.16% and NO\textsubscript{X} can be achieved as low as 217.2 ppm. The confirmation study shows the predicted values for BTE and NO\textsubscript{X} as very close with the experimental values. It is clear from the fact that the points are scattered very close to the best fit line.

9.1 SCOPE OF THE FUTURE WORK

Based on this research work and its results, the recommendations for the future works are given below.

- A WPO-JME blend is investigated up to 20%. The further blend percentage could be increased.
- Different types of biodiesel blend with WPO could be studied.
- Effect of Nano particle added in WPO could be carried out in detail.
- By using WPO in diesel engine varying process parameters such as injection pressure, injection timing and compression ratio can be studied.