

## ABSTRACT

In the present investigation, experimental work has been carried out to estimate the performance, emission and combustion characteristics of a single cylinder, four stroke variable compression ratio multi fuel engine fuelled with tamanu oil methyl ester blended with standard diesel. Tests has been conducted using the biodiesel blends of 10%, 20%, 40% and 60% biodiesel with standard diesel (on a volume basis) are examined and compared with standard diesel. The experiment has been conducted at a fixed engine speed of 1500 rpm, 50% load and at compression ratios of 16:1, 17:1, 18:1, 19:1 and 20:1. With different blends and for selected compression ratio, the performance parameters includes brake thermal efficiency, specific fuel consumption, brake power, indicated mean effective pressure, mechanical efficiency and exhaust gas temperature are calculated and recorded. The exhaust gas emissions such as carbon monoxide, hydrocarbon, nitrogen oxides and carbon dioxide are measured. At each operating conditions, the impact of performance, exhaust emission levels and combustion characteristics has been investigated and presented.

The actual density, viscosity, fire point, flash point and gross calorific value for the bio diesel have been found. The variation of performance and emission for different compression ratios and for different blends is taken, and optimum compression ratio which gives best performance has been identified. The results are confirms that there is considerable improvement in the performance parameters as well as exhaust emissions. The results indicate higher rate of pressure rise, longer ignition delay, maximum mass fraction burnt and minimum heat release rate at higher compression ratio for tamanu oil methyl ester when compared with standard diesel. The blend B40 for tamanu oil methyl ester is found to give maximum brake

thermal efficiency at 50% load. The blends when used as fuel results in reduction of polluting gases like hydrocarbon, carbon monoxide and increase in nitrogen oxides emissions.

The experimental work is extended for the optimum compression ratio of 19:1 for different loading conditions, at an engine speed of 1500 rpm. The performance parameters includes brake thermal efficiency, specific fuel consumption, brake power, indicated mean effective pressure, mechanical efficiency and exhaust gas temperature. The exhaust gas emissions contain carbon monoxide, hydrocarbon, nitrogen oxides and carbon dioxide are studied for various loads. The result of the experimental works has been compared with standard diesel and it concludes considerable improvement in the performance parameters, heat release rate as well as exhaust emissions. From the result the emission rate of carbon monoxide, hydrocarbon and carbon dioxide are reduced with the increase of nitrogen oxides emissions. The combustion characteristics of tamanu oil methyl ester and its diesel blends are closely follows the standard diesel.

A separate ANN model is developed for performance and emission characteristics in which to train the network, compression ratio, blend percentage and load percentage were used as the input parameter where as brake thermal efficiency, specific fuel consumption, brake power, indicated mean effective pressure, mechanical efficiency exhaust gas temperature, carbon dioxide, carbon monoxide, hydrocarbon and nitrogen oxide were used as the output parameter. This study shows that there is a good correlation between the ANN predicted values and the experimental data for different engine and emission parameters.

The effect of bio diesel with additives inferred that best performance and emission in diesel engines particularly with emission of nitrogen oxide. Thus the further study is to investigate the performance,

emissions characteristics of a single cylinder four stroke direct injection unmodified diesel engine fuelled with tamanu oil methyl ester (TME) 20%, diesel and diethyl ether (DEE) as additive in 5%, 10% and 20% (on volume basis) are investigated and compared with that of standard diesel. Engine tests have been conducted at a rated speed of 1800 rpm and different loading conditions. The comparative measures of brake specific fuel consumption (BSFC), brake thermal efficiency (BTE) and emissions such as HC, CO, NO<sub>x</sub> and Exhaust gas temperature to evaluate the behavior of TME, DEE and diesel in varying proportions and loading. The results indicate that the blends of TME, DEE with diesel up to 20% and 20% by volume provide better engine performance increased up to 3 - 4% and the reduction in exhaust emission.