ENDURANCE ANALYSIS AND TRIBIOLOGICAL STUDIES OF DIESEL ENGINES FUELLED WITH BIOBUTANOL AND DIESEL

Increasingly stringent emissions regulations and environmental concerns have caused interest in the development of alternative fuels for internal combustion engines. Recently butanol, bioethanol & biodiesel have emerged as an alternative fuels due to their oxygenated nature. This project focused on ascertaining the feasibility of Butanol-biodiesel and diesel blends. The following points give brief about the work has been done:

Five diesel engines test rig developed to study endurance and tribiological characteristics of diesel-biodiesel and butanol blends. Biodiesel production is carried out in our Biodiesel lab. Tribiological study of diesel engine is essential to determine the oil taken out at appropriate interval, so this study requires long duration run of the engine. As we have selected the fuel blends of butanol with diesel fuel for the durability test. To perform the durability test the BIS code 10000 is used which includes 32 cycles of 16 hour run of the engine. Fuel selected are: Fuel 1, 10% Biodiesel+ 5% Butanol+ 85% diesel; Fuel 2, 15% Biodiesel + 10% Butanol + 74% diesel + 1% additive; Fuel 3, 20% Biodiesel + 15% Butanol + 64% diesel +1% additive.

The engine component wear is determined by presence of metal in the engine oil using atomic absorption spectroscopy (AAS). The four metals (Fe, Al, Cr, and Cu) to be tested for the study with reference to this material in the oil the wear of engine component. The results from durability test indicates that the concentration of iron, chromium aluminium and copper were slightly higher in the engine oil taken from the butanol fuelled engine, but they are below one ppm that means the wear of engine component is higher but not the abnormal with the butanol fuel. Viscosity and total acid number were higher for butanol fuelled engine oil that means the degradation of engine oil was higher for the butanol fuelled engine.

Performance and emission testing on blends has been conducted. Throughout the load range the brake thermal efficiencies of the fuel blends were found comparable to that of neat diesel. Fuel 3 (B20) shows the marginal increase in thermal efficiency. It was found 9.8 % more efficient than the neat diesel. It is observed that, with the increase of alcohol and oxygenated contents, the bsfc increases due to the heating values of the blends. For medium and low loads, the blends and neat diesel do not show a large difference in NOx emissions. At high loads, fuel 3 (B20) shows 21% less NOx emission than that of neat diesel and 38.1% less emissions than fuel 1 (B5).

Patent filed: (i)- Fuel Injection system for compression ignition engines of stationary applications, particularly for diesel engines.(Application no. -2792/DEL/2013) and (ii)- Shell and tube type EGR cooler for small off-road diesel engine. (Application no.- 262875).