Global interest in increasing the usage of alternative fuels in internal combustion engines continues to be strong due to environmental concerns and the limited availability of conventional fossil fuel in future. Latest interest has focused on the use of bio-derived fuels in diesel engines. Vegetable oils and their derivatives are alternative diesel fuels and rice bran oil is one of the most important oil in terms of availability. Keeping this in mind a research work has been carried out to investigate the effect of injection timing and injection pressure on a diesel engine with rice bran vegetable oil.

In the present research, the effect of injection timing and injection pressure on performance and emission parameters of a direct injection diesel engine fueled with preheated rice bran vegetable oil is investigated. Experiments are conducted on a single cylinder, four-stroke, air cooled, direct injection and 4.4 kW compression ignition engine. The performance and emission level of diesel engine are studied at different loads by using the fuels like diesel, rice bran oil, rice bran biodiesel derived from rice bran vegetable oil and preheated rice bran oil (using engine exhaust gas). It is observed that viscosity of rice bran oil is equal to that of diesel when heated at 158°C and also equal to that of rice bran based biodiesel when heated at 137°C. From the results it is found that
performance and emissions of preheated rice bran oil are closer to rice bran biodiesel.

The injection timing is varied from $23^\circ$ to $17^\circ$ Crank Angle before Top Dead Centre (CA bTDC) and injection pressure is varied from 200 bar to 240 bar. The tests are carried out in all combinations of injection timing and injection pressure at full load using preheated rice bran oil as fuel and combustion, performance and emission parameters are measured. The values of combustion, performance, and emission parameters are favorable at $21^\circ$CA bTDC of injection timing and 230 bar of injection pressure except for $\text{NO}_x$. The $\text{NO}_x$ is found higher at $21^\circ$CA bTDC of injection timing and 230 bar of injection pressure which is not desired. Except $\text{NO}_x$, all the other parameters are found to be promising at $21^\circ$CA bTDC of injection timing and 230 bar of injection pressure. Hence for the preheated rice bran vegetable oil, the optimum injection timing and optimum injection pressure are evaluated as $21^\circ$CA bTDC and 230 bar respectively. At this optimum injection timing and injection pressure values, performance and emission parameters of the different test fuels i.e. rice bran oil, rice bran biodiesel and diesel are compared. At optimum injection timing and pressure, it is observed that the preheated rice bran oil shown a significant reduction in emission values as compared to diesel ($\text{NO}_x$ reduction 2.32%, CO reduction 26.32%, UBHC decreases
11.41% and smoke decreases by 12.5%). The brake thermal efficiency is relatively inferior (0.8%) with preheated rice bran oil than that of diesel. However, the preheated rice bran oil exhibits almost fair performance with rice bran biodiesel at optimum injection timing and injection pressure. It is concluded that using heated vegetable oils as petroleum fuel substitute is an attractive proposition. Also at modified injection timing and injection pressure the preheated rice bran oil shows a better performance than the rice bran biodiesel in terms of NO\textsubscript{X} emission level (decreased by 6.2%).