

ABSTRACT

Biodiesel is a viable alternative to the fossil fuels; however its combustion is always associated with higher NO_x emissions. NO_x emissions can be limited by using low temperature combustion strategies and HCCI seems to be a viable option. Biodiesel, if used in HCCI engine, can limit the NO_x emissions owing to low in-cylinder temperature in HCCI mode of combustion.

In the present research a HCCI experimental setup was developed by modifying a two-cylinder engine. One of the cylinders was modified for HCCI mode of combustion, while the second cylinder operated in conventional CI mode of combustion. A fuel vaporizer was developed and installed for external mixture preparation of biodiesel blends and diesel like fuels, outside the engine cylinder. Experiments were performed on different biodiesel blends with varying relative air-fuel ratios. EGR was used in different proportions to investigate its effect on HCCI combustion. Two-stage combustion was noticed for HCCI combustion, wherein first stage of combustion was dominated by low temperature combustion chemistry while second stage combustion was dominated by high temperature combustion chemistry. It was found that low proportionate biodiesel blending does not have any substantial effect on performance the of HCCI engine. However higher blends showed a slight deterioration in the performance of HCCI engine. Significant reduction in NO_x emissions were observed in the biodiesel HCCI combustion. However reduction in NO_x emission was squared up by a slight increase in CO and HC emissions. EGR plays a significant role in HCCI combustion. An increase in engine performance of lower biodiesel blends was observed upon application of EGR. Substantial reduction in NO_x emission was also noticed upon application of EGR.

The present research suggests that combustion kinetics of diesel HCCI combustion is faster than biodiesel HCCI, however low temperature combustion can limit the main problems of higher NO_x emissions, associated with biodiesel and can enhance the performance of biodiesel combustion with adequate combustion control measures in place.