# Experimental Investigation of combustion characteristics, Performance, and emission of a Spark Ignition Engine with 2nd Generation bio-gasoline and ethanol fuels


## Abstract

Climate change mitigation is the main challenge for the automotive industry, as the government issues legislation to combat CO2 emissions. In addition to electrification and battery electric vehicles, the use of low carbon and zero carbon fuels in Internal Combustion (IC) engines can also be an effective way to reach net zero carbon transport.

This study investigated and compared the combustion characteristics, performance and emissions of a highly boosted spark ignition (SI) engine fuelled with blends of second-generation bio-gasoline with different ethanol contents of 5% (E5), 10% (E10), and 20% (E20). The single-cylinder SI engine was equipped with a centrally mounted high-pressure injector and supplied with externally boosted air. Engine experiments were conducted at 2000RPM and 3000RPM with both low and high load operations.

The overall finding indicates that increasing the ethanol content of second-generation biofuels from 5% to 20% improves the indicated thermal efficiency at low load by 2.1%, and increases the knock resistance by 16.8% at high load operation as well as a reduction by 0.7% on cycle-to-cycle variation. The engine emissions were found mostly affected by the engine operating conditions and no consistent correlation could be found between the ethanol content and emissions. However, it was noted that the average NOx and THC emissions were increased by 11.02% and 66%, respectively, at the low load operation when the ethanol content was increased from 5% to 20% at the same fuel injection timing of 350 BTDC.