

Abstract

To meet stringent vehicular exhaust emission norms worldwide, several exhaust pre-treatment and post-treatment techniques have been employed in modern SI and CI engines. Exhaust Gas Recirculation (EGR) is a technique, which is being used widely to reduce and control the NO_x emission from diesel engines. However the use of EGR leads to rise in soot emission. This EGR generated soot leads to lots of other problems inside the engine like degradation of the lubricating oil, enhanced engine wear etc. In the present research work, an experimental investigation has been carried out to investigate the effect of EGR on emission pattern, lubricating oil and on wear of various vital engine parts.

A two cylinder, air cooled, constant speed DI engine of 9kW rating was used for the experiments. An experimental setup of employing EGR was setup on the engine and the test setup was run for 96 hours with a predetermined engine loading cycle using EGR and also without EGR (Under normal operating conditions). Temperature and smoke opacity of exhaust gas was measured to estimate the emission pattern. It was observed that with the use of EGR, percentage reduction in exhaust gas temperature was more than percentage increase in soot.

The lubricating oil of the engine was analyzed for metal addition after every 24 hours interval. Higher metal contents were found in the lubricating oil drawn from the engine using EGR. The generation of soot was qualitatively analyzed by taking pictures of in-cylinder engine parts. Higher carbon deposits were observed on the parts from the engine operating with EGR.

Higher wear was observed on piston rings of engine operated with EGR. The wear of cylinder liner was more at BDC compared to the TDC in EGR operated engine whereas in the normally operated engine (Engines without EGR), higher wear was observed at TDC. The possible reason of high metal content in lubricating oil and higher wear in the EGR system may be the high soot content in the lubricating oil from the engine employing EGR.