ABSTRACT

Particulate matter from the engine exhaust undergoes substantial changes when they go out into the atmosphere. These particles (PM) undergo processes such as agglomeration, coagulation, surface condensation, adsorption, and oxidation processes, which tend to modify their original characteristics. It is important to study the physical and chemical characteristics of particulate matter and changes in its composition with change in engine operating parameters such as load, speed, EGR rates, air-fuel ratio, inlet air temperatures etc. In the present study, two different fuels (Gasoline and Diesel) are used in two different engines using an alternative combustion concept called homogeneous charge compression ignition (HCCI). HCCI combustion is hybrid of two most fundamental combustion concepts namely Homogeneous Charge Spark Ignition (Gasoline engines) and Stratified Charge Compression Ignition (Diesel engines). This is a very innovative engine technology with potential to substantially reduce harmful emissions. A partial flow dilution tunnel was used in order to collect the particulate for the chemical analysis. The particles were collected on a 47 mm diameter and 0.45μm pore size filter paper for 30 minutes for every data point and were analyzed for benzene soluble organic fraction (BSOF) and trace metals. The analysis showed that the trace metals detected were comparatively low for the HCCI combustion. It is also seen that the trace metals tend to decrease with the application of EGR in the HCCI engine. BSOF content, which is marker of particulate toxicity, tends to increase when the mixture becomes lean and with increase in EGR rate. The physical analysis of the particulate matter was done using engine exhaust particle sizer (EEPS). It is seen that most of the particulates emitted from the engine are in the ultra-fine range. The number of particles emitted is lowest when EGR is not applied. The number-size distribution curve follows a log normal distribution.