Abstract

The aims of this study is to investigate the performance, combustion and exhaust emissions of a single-cylinder, air cooled, direct injection (DI), compression ignition engine using biodiesel from non-edible feedstock. In this work, biodiesel (B100) used to lead this investigation is *Citrullus colocynthis L.* methyl ester (CCME) and its blends B30 with diesel fuel. The biodiesel is produced via alkaline-catalyzed transesterification process using methanol (6:1 M ratio), 1% of sodium hydroxide at the reaction temperature of 60 °C for 1 h. The important physical and chemical properties of CCME are close to those of diesel fuel. Fuels (diesel fuel, B100 and B30) were tested on a DI diesel engine at 1500 rpm for various power outputs. The results indicated that B100 and B30 exhibit the same combustion characteristics compared to diesel fuel. However, B100 and B30 display earlier start of combustion. At lower engine loads, the peaks of cylinder pressure and heat release rate (HRR) were higher for B30 than B100 and diesel fuel during premixed combustion period. At higher engine loads the peaks of cylinder pressure was higher for B100 than B30 and diesel fuel, but the HRR during diffusion combustion is more considerable than diesel fuel. The brake specific fuel consumption (BSFC) was higher for B100 than diesel fuel at all engine loads while B30 exhibited comparable trends. The thermal efficiency is slightly higher for B100 than B30 and diesel fuel at low loads and increase for B30 at full loads.
B30 and B100 provided a higher reduction of hydrocarbons emissions up to 50% for B100. Nitrogen oxides and particulate matter emissions were also reduced.