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Numerical investigation of combustion performance utilizing envo-diesel blends

Abstract

Alternative fuel and renewable energy is needed to fulfill the energy demand of the world. The use of envo-diesel fuels for power generation seems a viable solution for the problems of decreasing fossil-fuel reserves and environmental concerns. The use of envo-diesel in gas turbines would extend this application to power generation field. Envo-diesel is considered as better option because of its environmental friendly characteristics while giving almost the same functional properties like a fossil fuels. The gas turbine combustion performance that utilizes palm envo-diesel fuel is investigated. This study is to perform a detailed simulation of combustion and thermal flow behaviors inside the combustor. The simulations are conducted using the commercial Computational Fluid Dynamics (CFD) package software to determine the spray flames and combustion characteristics of commercial diesel fuel, envo-E5 and envo-E10. The diameter and temperature of the fuel droplets; and temperature contour, mass fraction of diesel and mass fraction of carbon dioxide (CO2) of the combustor were obtained for commercial diesel fuel, envo-E5 andenvo-E10. Diesel fuel displayed higher rates of droplet evaporation compared to E5 and E10 with SMD differential about 30 to 40 μm while mass fraction for E5 and E10 slightly lower than conventional diesel.

Keywords

CO2 emissions; Combustion; Computational fluid dynamics (CFD); Envo-diesel