OPEN ACCESS Freely available online

Natural Products Chemistry & Research

Studies on the effects of Nano-additive based biodiesels on low- and high-pressure injection assisted diesel engine performance, combustion and emission characteristics

N. R. Banapurmath

KLE Technological University, India

Abstract

The potential of use nanoparticles like aluminium oxide, grapheme oxide, Zinc oxide, Cobalt and Manganese as fuel additives was investigated on different non-edible derived biodiesels and their blends with diesel. The biodiesels such as dairy scum oil methyl ester (DSOME), Honge oil methyl ester (HOME) and Simarouba oil methyl ester (SuOME) were selected for the study and their B20 blends were prepared using diesel respectively. The Nano-fuel blends were prepared by dispersing different nanoparticles in varying quantities in a B20 blends (20% biodiesel and 80% diesel). Sodium dodecyl sulfate (SDS), an anionic surfactant, was used for a stable dispersion of different nanoparticles in the fuel blends. Biodiesel (B20) fuels with concentration levels of 20, 40, 60 and 80 ppm of different nanoparticles (Biodiesel20, Biodiesel2040, Biodiesel2060 and Biodiesel2080) with varying ratios of SDS surfactants were prepared using ultrasonication technique. The investigated properties of diesel, biodiesel and the Nano-fuel blends were found to be in good agreement with the ASTM D6751-15 standards. The dispersion and homogeneity were established and characterized by using the Ultraviolet Visible (UVeVis) spectrometry. The UVeVis spectrometry results illustrated an increase in absorbance level with a relative increase in the concentration of the surfactant. The highest absolute value of UV-absorbency was observed for a mass fraction of 1:4 (NPs to SDS ratio). Experimental investigation was performed in a modified diesel engine operated at both low (200-260 bar) and high pressure (600-900 bar) injection of Nano-biodiesel blends at a constant speed of 1500 rpm, demonstrated an overall improvement in the engine parameters, the brake thermal efficiency (BTE) enhanced by 11.25%, while there was a decline in brake specific fuel consumption (BSFC) by 12.25% and the engine exhaust emission: HC, CO, and smoke reduced by 27.52%, 47.63%, and 23.44%, while the NOx increased by 11.15%. Higher injection pressures of 900 bar showed further improvements in the results. Among the Nano-particles used addition of graphene nanoparticles in biodiesel fuel blends resulted in significant reduction in the combustion duration, ignition delay period, improvement in the peak pressure, heat release rate, and cylinder pressure at maximum loading condition. It is concluded that a dosage of 40 to 60 ppm of Graphene NPs in Biodiesel 20 had the ideal enhancement in the overall characteristics of engine performance and emissions.

Biography

N.R. Banapurmath Currently, working as Professor of School of Mechanical Engineering B.V. Bhoomaraddi College of Engineering and Technology and Professor and Head at Centre for Material Science (CMS), K.L.E. Technological University (Previously known as B.V. Bhoomaraddi College of Engineering and Technology) Hubballi. Received Doctor of Philosophy in Mechanical Engineering from Visvesvaraya Technological University (VTU) and Master's degree in Heat Power Engineering, National Institute of Technology Karnataka (NITK), Surathkal and Bachelor's degree in Mechanical Engineering. 24 years of Research and Teaching experience published International Journals: 152, International conference: 82, National conference: 23, 7 Patents (filed), 13 Book and Book chapter publications. Several funded projects from State and Central Govt. of INDIA. Produced PhD.:10, guided MTech.:30. Reviewer for many international journals.

2nd International Conference on Petro Chemical Engineering and Natural Resources | February 10-11, 2021

Citation: N. R. Banapurmath, Studies on the effects of nano-additive based biodiesels on low- and high-pressure injection assisted diesel engine performance, combustion and emission characteristics, Petro Chemistry 2021, 2nd International Conference on Petro Chemical Engineering and Natural Resources, February 10-11, 2021, 03