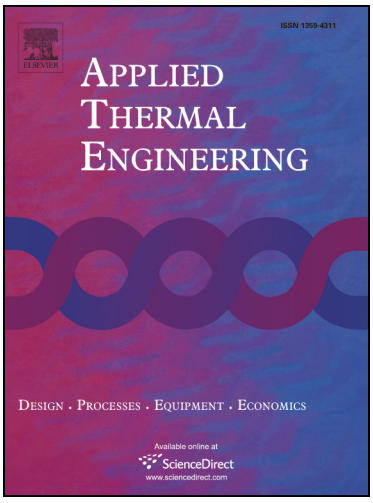

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Han Li, Wenming Yang, Dezhi Zhou, Wenbin Yu

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Numerical study of the effects of biodiesel unsaturation on combustion and emission characteristics in diesel engine

Han Li, Wenming Yang[1], Dezhi Zhou, Wenbin Yu

Department of Mechanical Engineering, Faculty of Engineering, National University of Singapore, 9 Engineering Drive 1, Singapore 117576, Singapore

Abstract: Biodiesel from different feedstocks has different physicochemical properties. As one of the most important properties, the degree of unsaturation (DU), which is characterized by the number of double bonds in biodiesel composition, could significantly affect its combustion and emission formation process in diesel engines. This study adopted the definition of the degree of unsaturation and aimed to investigate its effect on combustion and emissions in a diesel engine fueled by different biodiesels with different DU. Methyl decanoate (MD), methyl-9-decenoate (MD9D) and n-heptane were adopted as the surrogate fuels to model biodiesel fuels in this study. The different DU in different biodiesel is represented by varying the relative fraction of those three surrogate components when coupling the reaction mechanism into CFD KIVA4-CHEMKIN codes. Numerical modeling was performed to predict the differences in combustion process and the soot, NO and CO emissions in a diesel engine fueled with five typical types of biodiesel under 10%, 50%, and 100% engine loads. The results show that the DU value has a tangible impact on the ignition delay and the emission formation of biodiesel fuels at all engine loads while a negligible impact on the total heat release and the in-cylinder pressure profile at medium-high engine load. The increase of biodiesel unsaturation level alters the viscosity, oxygen contents of fuel, thereby leading to better fuel-air mixing, higher local temperature, and thus promoting the NO emission production while reducing the CO emission. Furthermore, higher unsaturated

[1] Corresponding author: Tel: (+65) 6516 6481
Email address: mpeywm@nus.edu.sg