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Numerical investigation on combustion process and emissions characteristics of biodiesels with different saturation level in diesel engines

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Biodiesel is regarded as one of the most promising alternates to fossil diesel for transportation due to its inherent advantages such as carbon neutral and renewable. However, the knowledge on the combustion characteristics and emissions formation of biodiesel with different fatty acid methyl ester proportions is still not very clear. To capture the effect of varying fatty acid methyl ester proportion on biodiesel ignition and combustion process, a skeletal four-component biodiesel combustion mechanism comprising methyl decenoate (MD), methyl-5-decenoate (MD5D), *n*-decane and methyl linoleate (ML) has been developed by us. In this mechanism, MD is used to represent saturated component of biodiesel, MD5D is used to represent the unsaturated FAMEs with one double-bond, and ML is used to represent unsaturated FAMEs with two double-bond, while *n*-decane is used to match the input energy and the C/H/O ratio of the biodiesel. The generated mechanism consists of 106 species and 263 reactions. After going through a lot of validations, the mechanism was used to investigate the performance of diesel engine fueled by biodiesels with different fatty acid methyl ester proportion. The results indicate that higher saturation level could shorten chemical ignition delay time, but the higher saturation contents like C16:0 and C18:0 together with C18:1 (a single double bond methyl ester) would increase the kinetic viscosity, resulting in poor fuel-air mixing and evaporation process. Lower kinetic viscosity methyl esters like C18:2 and C18:3 were favorable for better fuel-air mixing and subsequent combustion, however, a higher NO_x emission was discovered.

Biography

Yang Wenming obtained his PhD degree from the Department of Mechanical Engineering, Jiangsu University in 2000. Since then, he has been employed as a Research Fellow, followed by an Instructor and Assistant Professor with the Department of Mechanical Engineering, National University of Singapore. His research interests include biodiesel production and characterization from various feedstocks, combustion and emissions control of IC engines, microscale combustion and micro power generators. So far, he has published more than 200 papers in international referred journals and international conferences.

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