World Academy of Science, Engineering and Technology
International Journal of Energy and Environmental Engineering
Vol:10, No:12, 2016

Fatty Acid Structure and Composition Effects of Biodiesel on Its Oxidative Stability

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Abstract : Biodiesel is as a mixture of mono-alkyl esters of long chain fatty acids derived from vegetable oils or animal fats. Recent studies in the literature suggest that end property of biodiesel such as its oxidative stability (OS) is highly influenced by the structure and composition of its alkyl esters than by environmental conditions. The structure and composition of these long chain fatty acid components have been also associated with trends in Cetane number, heat of combustion, cold flow properties viscosity, and lubricity. In the present work, detailed investigation has been carried out to decouple and correlate the fatty acid structure indices of biodiesel such as degree of unsaturation, chain length, double bond orientation, and composition with its oxidative stability. Measurements were taken using the EN14214 established Rancimat oxidative stability test method (EN141120). Firstly, effects of the degree of unsaturation, chain length and bond orientation were tested for the pure fatty acids to establish their oxidative stability. Results for pure Fatty acid show that Saturated FAs are more stable than unsaturated ones to oxidation; superior oxidative stability can be achieved by blending biodiesel fuels with relatively high in saturated fatty acid contents. A lower oxidative stability is noticed when a greater quantity of double bonds is present in the methyl ester. A strong inverse relationship with the number of double bonds and the Rancimat IP values can be identified. Trans isomer Methyl elaidate shows superior stability to oxidation than its cis isomer methyl oleate (7.2 vs. 2.3). Secondly, the effects of the variation in the composition of the biodiesel were investigated and established. Finally, biodiesels with varying structure and composition were investigated and correlated.

Keywords : biodiesel, fame, oxidative stability, fatty acid structure, acid composition
Conference Title : ICBB 2016 : International Conference on Biofuels and Bioenergy
Conference Location : Paris, France
Conference Dates : December 29-30, 2016