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Kinetics of diesel / biodiesel fuels oxidation and evolution of oxidation products formed at different stages of oxidation

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Nowadays, oxidative stress for diesel/biodiesel fuel applications can occur during logistics or on board vehicles, leading to the formation of insoluble's and deposits. Those may induce mechanical components failure involving injectors blockage, filters plugging and pump wear. In the present work, the oxidation stability of diesel, Rapeseed (RME) and Soybean (SME) Fatty Acid Methyl Esters (FAME) and a blend of diesel with 10% v/v RME (B10- RME) were studied. Fuel samples were aged in the PetroOxy test device from 383K to 423 kelvin at 7 bar. Experiments were conducted in oxygen excess and the global kinetic constants were determined. The global kinetic constants for Diesel, B10- RME and RME at 383 K were found 7.92 10-06 s-1, 2.78 10-05 s-1 and 8.87 10 -05 s-1 respectively. Oxidation products formed at different stages of the oxidation were monitored by Fourier Transformed Infrared Spectroscopy (FTIR), Thermal Gravimetric Analysis-Derivative Thermal Gravimetric (TGA-DTG) and GC/MS (Gas Chromatography /Mass Spectrometry). The impact of the FAME feedstock and level of blending on the kinetic rate constant and on the oxidation products were investigated. Results show that RME oxidation forms C19 epoxy as main oxidation product, in addition to methyl ester FAME derivative and short chain oxidation products such as alkane, alkene, aldehydes, ketones, alcohols and acids with carbon number up to C11. FTIR spectra confirm the formation of carbonyl products for all oxidized fuels. The overall amount of oxidation products increases with higher degradation. DTG profiles indicate the formation of high molecular weight product at advanced level of oxidation and for all the oxidized fuels a similar DTG peak was obtained at a temperature around 573K, which may suggest the formation of products having similar molecular weights for diesel, FAME and their blends.

Biography

Bacha Kenza is a PhD student in Chemical Materials Science at the University Haute Alsace. She has a Chemical Engineering degree obtained at The Polytechnic School of Algiers and she holds a Master's degree in Material and Process for Energy at Ecole Centrale de Paris. She is working in partnership with IS2M, IFP Energies Nouvelles and Renault on the oxidation stability of diesel and biodiesel fuels and the impact of the surface properties on the formation and adhesion of fuel deposit.

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