Cloud Point Studies for Mixtures of Diesel and Jet Fuels with Bio-derived Fuels

Anne Lown [S], Lars Peereboom, Dennis Miller and Carl Lira [C]
Michigan State University, Chemical Engineering and Materials Science, East Lansing, MI, U.S.A.
lira@egr.msu.edu

Alternatives to petroleum based fuels are essential for the future transportation industry. For a fuel to be a viable replacement for a petroleum fuel it must meet a number of specifications. This work considers the compatibility of potential biofuels with diesel and jet fuel and focuses on low temperature properties. Cloud point measurements are presented for additives in two test diesel blends and jet fuel. Additive functionalities studied include, diesters, esters, ketones, ethers, and alkanes. Diesters, as a class, appear to create liquid-liquid immiscibility and a cloud point higher than that of either the base fuel or the pure diester. Esters decrease the cloud point of diesels fuels, as do most ketones. Ethers and alkanes respectively decrease the cloud point even more. These results are consistent with the precipitation of a component of the petroleum fuel, rather than an additive, and the decrease in cloud point is due to a dilution effect. For some ketones, a different effect is observed. Based on the pure component melting temperature of the ketone, the compounds cause either decreases or increases. Long chain ester components were also tested. These additives have higher cetane numbers than other potential fuel components, and are therefore more desirable as a diesel fuel component. Ketones and ethers of similar lengths were also tested, and have the same behaviors as described above. The behavior of potential fuel additives seems to be more related to the oxygen containing functional group rather than extent of branching or size of the alkane groups. Experimental results will be interpreted with thermodynamic models using modified surrogates.