

Effects of Biodiesel By-Products on Interfacial Tension and Water Separation Properties of Biodiesel-Ultra Low Sulfur Diesel Blends

F. Diani Pangestu* and Christine M. Stanfel
Ahlstrom Filtration, LLC

Abstract

Triglycerides react with methanol in the presence of sodium or potassium hydroxide catalysts to produce fatty acid methyl esters (FAME), or biodiesel and glycerol. This process does not usually go to 100 % conversion and contamination of biodiesel by fatty acids, methanol, and glycerol, as well as incompletely reacted mono-, di-, and tri-glycerides, cannot be avoided. The presence of biodiesel in fuel blends has an established negative impact on the ability of commercial fuel-water separation devices to remove water from diesel fuel. This is expected, as biodiesel is a surfactant, and surfactants enhance emulsion stability. However, biodiesels from differing manufacturing processes and raw material sources have been found to exert varying levels of negative impact on water separation. This variation suggests that other species within the biodiesel may be responsible for some of the emulsion-stabilizing properties; and these species affect the interfacial tension (IFT) and water separation properties of the blend. The work presented here investigated the influence of raw materials and reaction by-products from the biodiesel manufacturing process on the interfacial tension of biodiesel and ultra low sulfur diesel blends. In addition, the impact of these contaminants on the performance of fuel water separation media in biodiesel and ultra low sulfur diesel blends was studied. Hence, results of the work target development of biodiesel composition/quality standards that are sensitive to filtration and separation needs of the diesel engine. A series of B40 samples were created with varying levels of fatty acid, mono-glyceride, glycerine, and methanol by-product. Mono-glyceride was found to have greatest impact on IFT, lowering the IFT of Ultra Low Sulfur Diesel (ULSD) 55%. Fatty acids were found to have minimal impact on IFT and water separation measured in flat sheet SAE J1488 tests.