Effects of Biodiesel Contamination on Oxidative and Storage Stability of Neat and Blended Hydroprocessed Renewable Diesel

The US military is the largest consumers of middle distillate fuels in America. Many schemes have been proposed to decrease the military reliance on fossil resources by utilization of renewable sources. Second generation renewable fuels synthesized through hydroprocessing renewable feedstocks has many advantages over first generation renewable fuels, such as bioethanol and biodiesel. Hydroprocessed renewable diesels (HRD) are currently in production for large-scale testing by the U.S. Navy, and has been demonstrated as a compatible replacement or blending stock with marine diesel. The usage of biodiesel has been prohibited by the U.S. Navy in all ships and tactical platforms. Biodiesel, however, is still used as blending stock for Navy ground transportation. Concern has been raised about the potential biodiesel contamination of marine diesel, HRD, and marine/HRD blends from the use of common fuel handling systems. The present study investigates the influence of biodiesel contamination on conventional and renewable marine diesels, i.e. NATO F-76 and HRD-76. The physical properties and chemical composition of HRD-76 and biodiesel were measured. Long-term (ASTM D4625) and accelerated (ASTM D5304) test methods were used to investigate the influence of biodiesel on storage stability of HRD-76, F-76 and their blends and on fuel physical properties after long-term storage. In addition, ASTM D2274 test was conducted to study the effect of biodiesel contamination on oxidation stability of neat and blended fuels. Extended ASTM D2274 tests were also conducted to investigate the influence of long-term oxidation on fuel physicochemical properties. The oxidation precursors of fuel samples were identified using GC/MS.