BIOFUELS OBTAINED FROM PYROLYSIS AND ALCOHOLYSIS OF SOYBEAN OIL AND THEIR BLENDS WITH PETROLEUM DIESEL

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The use of biobased fuels has dramatically increased in recent years, and with the cost of petroleum continuing to increase, the biofuel movement is unlikely to end soon. Although biodiesel (BD) is the most popular biobased diesel fuel, it has some drawbacks, such as it requires high quality raw-material and a large amount of alcohol. As a consequence, the higher price of these materials still leaves diesel more cost competitive. Thus, alternative routes to a biobased fuel have been studied, such as the cracking of fatty materials. The main advantage of this process is that it is possible to use both edible and inedible feedstocks. However, there are several studies which should be performed before the pyrolytic diesel-like product can be used as fuel. In this work a diesel-like fuel, pyrodiesel, was synthesized by a pyrolysis method using soybean oil (PD) and soybean soap-stock (SD) as starting materials and compared with soybean biodiesel (BD). All these biofuels (PD, SPD and BD) and their blends with high sulfur (HSD) and low sulfur (LSD) diesel fuels were evaluated by measuring several fuel properties. It was observed using different methods that the lubricity of biobased fuels obtained after the transesterification or pyrolysis of soybean oil is superior to LSD and HSD and also that the lubricity of diesel fuels are enhanced when either BD or PD are added. The kinematic viscosities at 40 ^{o}C were 4.5 mm^2 s^{-1} for PD and 3.8 mm^2 s^{-1} for SD, which were reduced in a linear fashion by addition of HSD or LSD. The densities of the fuels at 40 ^{o}C were 0.853, and 0.844 g mL^{-1}, which is very similar to the density of HSD. The surface tensions of the compounds, also at 40 ^{o}C, were 27.1 mN m^{-1} for PD and 26.2 mN m^{-1} for SD. Compared to BD blends, PD and SD and their blends were found to have superior oxidative stability. Although PD and SD showed inferior acid values, all of the biofuels and their blends met the copper corrosion requirement prescribed by US and European standards. SD and its blends have better flow performance at low-temperature compared to BD and PD blends.

Based on the results reported here, we conclude that pyrodiesels from these two-different feedstocks are viable alternatives to BD for blending with fossil fuels for use in compression-ignition engines.

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