Carbons and PAHs emitted from a diesel generator fuelled with soy-biodiesel blends

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Increasing attention has been paid to biodiesels used as alternative fuels for diesel engines and generators. The use of biodiesels in diesel engines has been extensively studied. However, little is known about the emission of total carbons (TCs, including organic/elemental carbons) and polycyclic aromatic hydrocarbons (PAHs) from diesel generators fuelled with soy-biodiesel blends. In this study, therefore, the particle-bound organic and elemental carbons and PAHs emitted from a biodiesel-fueled generator were investigated.

A premium diesel fuel (B0) and three soy-biodiesel blends (B10, B20, and B50) were tested at four loads (unload, 5 kW, 7 kW, and 10 kW). TC, EC and OC were found to exhibit the lowest and highest concentrations when using B20 and B50, respectively, at 0, 5, and 7 kW operations of the generator; however, if the generator was operated at the load of 10 kW, the OC emission was the lowest when using B10 (Figure 1). At all the loads, the B50 blend produced the highest content of OC. The TC, EC and OC concentrations increased as the load increased, regardless of the amount of soy-biodiesel in the blend. Sharma et al. (2005) indicated that EC content increased with increasing load and showed a maximum of 48% at a 70% load and a minimum of 25% at idling. However, they observed an opposite trend for OC that displayed a content of 35% at idling and decreased with increasing load.

Figure 1. Concentrations of the carbons emitted from the generator.

Figure 2 shows that total-PAH concentration in the exhaust of generator increased with increasing load. This phenomenon is mainly related to the increasing fuel consumption with increasing load. In addition, total PAH and BaPeq emissions were higher when using B0 than using B20, except the case of total-BaPeq at 5 kW. This finding is chiefly associated with the fact that almost no PAH was present in the soy-biodiesel. Similar results were found in our previous researches (Lin et al, 2006a; Lin et al, 2006b; Yuan et al, 2007).

Diesel generators are usually operated at high loads. At ~90% load of 10 kW, the mean reductions in total PAH and BaPeq were 11.9% and 26.5%, respectively, when using B20 in place of using B0, whereas these values were 19.8% and 23.2%, respectively, at ~60% load of 7 kW. Conclusively, the soy-biodiesel may be used as an alternative fuel for diesel generators that can reduce PM, carbon, and PAH emissions when compared with the premium diesel fuel.

Figure 2. Concentrations of PAHs and BaPeq emitted from the generator.