Biodiesel vs. Petro-diesel: a comparison of particle number emissions at 80% load

Diesel on-road vehicles are main contributors to particulate matter pollution in urban areas. Subsets of the diesel vehicle fleet are currently utilizing blends of petro-diesel and biodiesel for fuel. As time goes on, the number of these vehicles is projected to grow.

The amount of particles emitted from a diesel engine running on biodiesel is different than that of the same engine running on petro-diesel. It has been shown that ultra-fine particles (UFP, diameter < 100nm) cause adverse health effects in humans which include aggravated asthma, decreased lung function, irregular heartbeat, and even nonfatal heart attacks. Because of their small size, these particles do not contribute substantially to the standard measurement of particulate matter, Particle *Mass* (PM). For this reason, the Particle *Number* (PN) metric, which counts the number of particles in different diameter ranges, presents a clearer picture of the particles that likely cause the most harm.

The objective of this research was to determine whether an engine running on neat biodiesel emits more or less UFP than the same engine running petro-diesel. Here, PN distributions were measured from a 1.9L Volkswagen diesel engine in real-time for neat petro-diesel (B0) and neat soybean oil based biodiesel (B100) with an Engine Exhaust Particle Sizer (EEPS, 32 channels, 5.6 – 560nm range). For these experiments the engine was run at a constant 80% load (2200 RPM, 67% throttle, producing ~104Nm of torque). The results show that operation with B100 tends to emit more nanoparticles in the 10nm diameter range than for petro-diesel, however, there also seems to be a decrease in the number of nanoparticles with diameters centered at 45nm.

Future research will continue to explore PN emissions of petro-diesel and biodiesel as the engine is subjected to a transient drive cycle. The results will more accurately represent real-world, on-road emissions.