# Combustion characteristics, engine performances and emissions of a diesel engine using nanoparticle-diesel fuel blends with aluminium oxide, carbon nanotubes and silicon oxide

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**ABSTRACT**

This research investigates the effect of nanoparticle-diesel fuel blends on combustion characteristics, performances and exhaust emissions of a four-stroke single-cylinder diesel engine. Three types of nanoparticles employed in this experiment were aluminium oxide, carbon nanotubes and silicon oxide. The nanoparticles were dispersed in a dosage of 25 ppm, 50 ppm and 100 ppm with pure diesel and were labelled as DA25, DA50, DA100 (aluminium oxide blends), DC25, DC50, DC100 (carbon nanotubes blends) and DS25, DS50, DS100 (silicon oxide blends). The ultraviolet-visible spectrophotometer analysis was done for 200 h to quantify the stability of the nanoparticle-diesel fuel blends. The blended fuels were experimentally tested with YANMAR TF120M diesel engine at engine loads of 0%, 25%, 50%, 75% and 100% at a constant 1800 rpm engine speed. The results revealed that the brake specific fuel consumption reduced by up to 19.8% and brake thermal efficiency enhanced by 18.8%. Silicon oxide blends show better results than aluminium oxide blends in many aspects, such as higher combustion pressure, lower brake specific fuel consumption and lower carbon monoxide emissions. Aluminium oxide and silicon oxide show stable blend conditions with 28.1% and 22.0% absorption ratio at 200 h sedimentation time, while carbon nanotube blends were least stable with absorption ratio reducing to less than 30% after 10 h. Combustion analysis of carbon nanotube blends with diesel show that carbon nanotubes have the potential to be further researched as an additive for diesel fuel due to significant combustion improvement in $NO_x$ emissions. However, the issue on the stability of carbon nanotube blends must be resolved before its potential can be fully utilized.

**KEYWORDS:**

Diesel; Combustion; Nanoparticles; Stability analysis; Exhaust emissions