

## **A comparative study on the effect of nano-additives on the performance and emissions of a diesel engine run on Jatropha biodiesel**

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### **Abstract**

Increasing energy demands coupled with the depletion of fossil fuel and increased rate of fuel consumption along with the production of harmful emissions led to the intensive research on alternative fuels. Biodiesel was derived from Jatropha oil by acid esterification, followed by a trans-esterification process. Jatropha biodiesel blend of 20 % volume percentage was prepared by mixing diesel and biodiesel oils. Nano additives such as CNTs, TiO<sub>2</sub>, and Al<sub>2</sub>O<sub>3</sub> are used for enhancing the fuel characteristics. These additives were blended with biodiesel blend at the rate of 25, 50, and 100 ppm, respectively. This paper aims to evaluate the performance and exhaust emissions of a diesel engine utilizing Jatropha biodiesel blend by including the nano additives. An experimental test rig was mounted on a single-cylinder diesel engine to measure performance and emissions at various engine loads. Tests showed that, biodiesel blend with nano Al<sub>2</sub>O<sub>3</sub> as J20Al100 led to a maximum improvement of 6.5% in thermal efficiency compared with all other fuels experimented. Jatropha biodiesel blend with CNTs as J20C50 produced higher decreases in CO and NO<sub>x</sub> emissions by about 35 and 52%, respectively compared with all fuels. Jatropha biodiesel blend with TiO<sub>2</sub> as J20T25 produced higher reductions in HC and smoke emissions by about 22 and 50%, respectively compared with all other fuels. Jatropha biodiesel mixed with nano particles (denoted as J20Al100, J20T25 and J20C50) achieved improvement in engine performance and emissions reductions compared with the other tested fuels.