Paper (5)

# Effect of HHO gas enrichment on performance and emissions of a diesel engine fueled by biodiesel blend with kerosene additive

**M.S. Gad[b], M.K. El-Fakharany[b], E.A. Elsharkawy[b]**

[a]Mechanical Engineering Department, Faculty of Engineering, Fayoum University, Egypt
[b]Faculty of Engineering, Kafrelsheikh University, Kafrelsheikh 33516, Egypt
**Fuel, Vol. 280: 118632, 2020.**

## Abstract

In recent work, biodiesel from cottonseed oil was prepared by transesterification. Then, it was mixed with crude diesel in 20% volumetric percentage producing B20 blend. Moreover, Kerosene was used as an additive to the blend to reduce the cold start problem at low temperature operation in volume percentages of 5% and 10%. HHO gas was developed by water electrolysis with sodium bicarbonate hydroxide catalyst. HHO was developed at a flow rate of 0.3 LPM. The emissions and performance study of diesel engine using cotton ethyl ester blend enriched with HHO gas and kerosene additives was explored in this research. HHO gas with kerosene blends accompanied by ethyl ester cotton oil lessened the brake specific fuel consumption and increased the brake thermal efficiency by 17% and 26.2%, respectively compared to the biodiesel blend B20. The decreases in exhaust gas temperature, $CO_2$, CO and increase in NOx emissions reached to 20.6%, 11.7%, 11% and 14%, respectively by the addition of HHO and 5% kerosene. While, blending 10% of kerosene with HHO gas to the blend resulted in the highest decrease in specific fuel consumption, exhaust gas temperature, $CO_2$ and CO by 17, 20.7, 17.45 and 32.65% relative to B20. Biodiesel blend with HHO and 10% kerosene displayed the maximum increases in thermal efficiency and NOx emissions based on B20 by 19% and 11.9%, respectively. HHO enriching is favorable in the combustion characteristics improvement but kerosene enhanced the cold flow properties of biodiesel.