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Performance and emitted pollutants assessment of diesel engine fuelled with biokerosene

Noora Salih Ekaab[a,*], Noor Hussein Hamza[a], Miqdam T. Chaichan[b]

[a] Mechanical Eng. Dept., University of Technology, Iraq
[b] Energy and Renewable Energies Technology Center, University of Technology, Iraq

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ABSTRACT

Iraq is suffering from kerosene surplus in the summer because kerosene consumption is significantly reduced. This product contains less sulphur than diesel, and it gains viscous and lubrication properties similar to those of diesel when mixed with a small percentage of biodiesel. The possibility of using biokerosene as a fuel instead of conventional Iraqi diesel was investigated. The fuel consumption was relatively increased by 5.56% and 5.19% when the studied biokerosene KB10 and KB20 blends were used while the engine's exhaust-gas temperatures and thermal efficiency were decreased. The biokerosene blends KB10 and KB20 also emitted lower concentrations of particulate matter (22.4%, and 25.63%), hydrocarbon (7.74%, and 21.93%), and carbon monoxide (15%, and 20.31%) compared to diesel at small or medium engine loads. Nitrogen oxide concentrations increased by (2.11% and 4.57%) with KB10 and KB20, while the engine noise measurements were lower than those from diesel by (1.51% and 3.57%) for all tested engine-load ranges. The PM–NOx trade-off for biokerosene was the best among all tested blends.

1. Introduction

Interest in the experience and use of alternatives to fossil fuels is increasing considering the increasing demand for oil products that inevitably leads to fast-paced depletion in the near future. Nevertheless, fossil fuels will continue to dominate the transport and energy sectors in the near future. Presently, the world consumes only 60% of its fuel produced for the transport sector [1]. The total dependence on oil products is accompanied by concerns on fluctuating crude oil prices [2,3], energy supplies, energy security, and climate change [4,5]. The shift to renewable and alternative energies has become a necessity, necessitated by the critical environmental changes experienced by most of the world [6]. For decades, researchers have worked hard to find alternative fuels to run diesel and gasoline commercial engines [7–9]. The greatest effort is that the proposed fuel will not cause significant changes in engine design or vehicle infrastructure. Recent research has focused on two fundamental improvements: reducing specific fuel consumption and engine emissions, particularly particulate matter (PM) and nitrogen oxide (NOx) [10].

Biodiesel and ethanol are at the forefront of fossil fuel alternatives and can now meet an important part of the demand for diesel and gasoline. Ethanol is used as an alternative fuel, in whole or in part, for gasoline in Brazil and the United States. Biodiesel is also used as an alternative to diesel in Scandinavia. The most important benefit of biodiesel may be it reduces sulphur content in fossil diesel [11]. The addition of biodiesel to diesel significantly reduces carbon monoxide (CO), hydrocarbon (HC), and PM emissions but increases NOx emissions and fuel consumption. These results were supported by many researchers in this field [12–15].

* Corresponding author.
E-mail address: 20112@uotechnology.edu.iq (N.S. Ekaab).

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