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Improving thermal performance of the CI engine using a bio-diesel with nano-additives

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ABSTRACT

The globe is becoming more energy-dependent. The speed of using fossil fuels is increasing every day, necessitating the exploration of alternate fuels to meet the global energy needs. In today's society, biofuel has become the greatest energy choice. The current study aims to analyze the performance of a single cylinder four stroke diesel engine at variable compression ratio (SCDE-VCR) with the aid of biodiesel in different fraction of magnesium oxide nanoparticles (nano-MgO). The biodiesel was prepared by unifying 25% of cotton seed oil in diesel. The mass fraction of nano-MgO was chosen as 0%, 0.25%, 0.5% and 1.0%. The engine was investigated for its specific fuel consumption (SFC) and brake thermal efficacy (BTE) at the compression ratio (CR) of 17.5 and 20.5 in different engine loading. The results proved that the inclusion of nano-MgO enhanced the SFC and BTE of the engine. Especially, at the nano-MgO mass fraction of 0.5% in biodiesel, the SFC and BTE have shown the highest improvement. It revealed that the thermal quality of the cotton seed oil blended diesel was significantly enhanced with the diffusion of nano-MgO.

Selection and peer-review under responsibility of the scientific committee of the International Conference on Newer Engineering Concepts and Technology.

1. Introduction

The rise in international use of petroleum and dependency upon oil and gas, as well as rising expenses of increased supply, has prompted exploration of alternative and renewable power sources [1,2]. Emerging countries rely heavily on petroleum fuels, especially in the manufacturing and construction industries. Wind and solar power have become progressively crucial due to a limited petroleum reserve, rising international oil costs, and ecological reasons [3,4]. Oil from biological substances possess qualities that are similar to conventional diesel and most have been recognized to have numerous benefits beyond carbon fuels, including being ecologically benign, harmless, and compostable, and hence aiding in the establishment of ecological balancing [5,6]. Its cetane value and vaporization pressures are nearly identical to the conventional diesel. Biodiesel's chemical composition has additional oxygen molecules, which supply oxygen to help with burning fuels [7,8]. In spite of its many benefits, biofuel does have some drawbacks, including viscosities, poor fluidization qualities and attributes, and a decreased calorific value [9,10].

The use of gasoline additives is a newly found approach for improving burning rate and oil qualities. Alcohol-based admixtures, including methanol, n - propanol, ethyl alcohol and petroleum ether, have been increasingly popular in biofuel mixtures during the last century [11,12]. Alcoholic admixtures increase the amount of respiration in the combustor to cut pollution, but they also decrease the heating value attributed to the generation of an elevated oxygen content in the fuel, when blended with increased auto igniting temperature and reduced lubricating characteristics, causes combustion degradation and lowered functional properties. As a result, scientists had looked at the possibility of microscale as well as nanoscale additions. Micro-sized particle's additions helped improve engine performance, although they prone to clump together. Nanotechnological developments have found uses in a variety of industries, including manufacturing, industrial and

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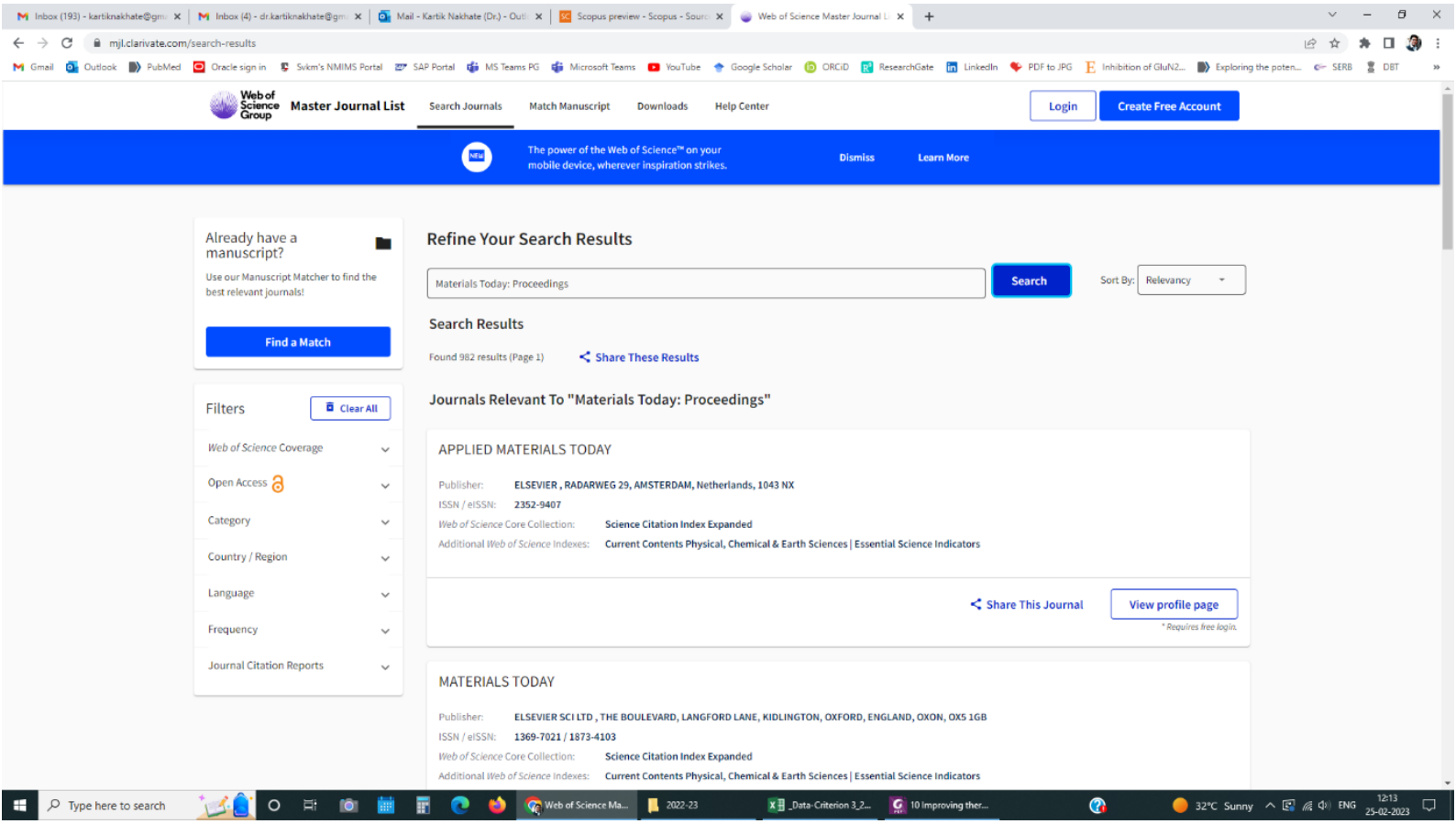
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