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Experimental analysis of VCR diesel engine exhaust emissions with zirconium dioxide and basalt based catalytic converter using lemon grass oil

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Abstract

The automobile has a significant impact on pollution levels. The primary causes of air pollution are motor vehicle exhaust and fossil fuel burning. Controlling harmful emissions such as CO, NOx, and HC is an essential task for future generations. The goal of the project is to reduce automotive emissions by designing and fabricating a basalt catalytic converter to replace conventional metals such as platinum, cerium, and rhodium. To lower an engine's emissions, various materials are utilised. The many mechanical properties of one material named Basalt are known. This is used to test and evaluate basalt-fiber composite materials to decrease NOx by 8–9.7% and Mean increases in emissions of CO and HC respectively of 7.3–9.78% and 8.6–10.5% have been observed..The composite material for basaltic fiber has been prepared with epoxy resin and cut into circular forms of the required diameter with troughs. The basalt pieces inside the catalytic converter were tested.. Lemongrass oil and diesel in specified amounts were used in the experiment. The NOx levels were significantly reduced as a result of the experiment.

Introduction

There is a continued increase in energy consumption as a result of significant population growth and lifestyle changes. The electricity production and transport sectors are the main energy consumers. Alternative technologies include engine design improvements, fuel pretreatment, alternative fuel utilization, and better combustion are being considered to decrease the emission values. The platinum group of metal catalytic converters is the greatest approach to regulate automotive exhaust emissions out of all the technologies produced so far. This paper addresses the impact of metal-based catalytic converters on vehicle exhaust emission reduction. The chemical vapour deposition (CVD) technology was used to create nanomaterials including nano rhodium and nano palladium [1], [2], [3], [4], [5], [6], [7], [8], [9], [10]. Using the spin coating process, the resultant nanopowder was coated in a honeycomb form. The pollution is decreased by utilizing a nano catalytic converter. The mechanical characteristics of basalt and E-glass fiber composites were compared in this paper. The converter was created from catalytic materials composed of nanoparticles of metal-oxide, for example, aluminium oxide (Al2o3). The performance was calculated as 99.5% for CO and 92% for nitrogen for Al2o3-driven catalytic converters. This investigation was designed to develop a three-way low-cost converter to regulate the exhaust emissions of VCR Diesel engines [11], [12], [13], [14], [15], [16], [17], [18], [19].

Section snippets

Materials and method

The basalt fiber composite is fabricated by using hand layer method. Zirconium dioxide is used as filler in epoxy resin, to make the composite more stronger. The following materials are used to fabricate the catalytic Disc. The following materials are used for fabricate the catalytic convertor and the materials are mention in Fig. 1, Fig. 2, Fig. 3 and Fig. 4.

- Basalt fiber…
- Epoxy resin…
- Lemongrass oil…
- Zirconium dioxide…

…

Sample preparation and experimental setup

The Engine setup is shown in Fig. 10 and its specifications mention in Table 1. After esterification, the biodiesel samples are prepared by the following proportions.
S1-10% Lemon Grass oil+90% Diesel (10LGO90D)…

S2-20% Lemon Grass oil+80% Diesel (20LGO80D)…

S3-30% Lemon Grass oil+70% Diesel (30LGO70D)…

S4-40% Lemon Grass oil+60% Diesel (40LGO60D)…

…

Results and discussion

Diesel and lemongrass biodiesel with a basalt catalytic converter were tested at various load conditions to determine engine output parameters.…

Conclusion

The Engine output parameters of the various samples was compared with neat diesel. The Experiment was done to evaluate basalt property of reducing NOx emission.

- S4 blend consumes lower specific fuel consumption (SFC) compared to neat diesel.…
- The 10LGO90D, 20LGO80D blends give higher BTE compared to neat diesel.…
- The HC values are constant for the blends of lemongrass oil at maximum BP compared to neat diesel.…
- CO emissions got increased to lemongrass diesel blends than diesel.…
- CO_2 emissions got…

…

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.…

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