EXPERIMENTAL PARAMETERS OPTIMIZATION OF DIETHYL ETHER-JATROPHA BIODIESEL BLENDED FUEL WITH DIESEL IN VARIABLE COMPRESSION RATIO C.I. ENGINE USING GRAY RELATIONAL ANALYSIS

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ABSTRACT

Experimental analysis is done for different fuel blends Jatropha-10% Diethyl Ether (DEE)-10%+ Diesel - 80% (A_1), Jatropha-15% +DEE-10% + Diesel -75% (A_2), Jatropha-20% +DEE-10% + Diesel -70% (A_3), and diesel using different compression ratios (CR) (16, 17, and 18) and at various loads (3 kg, 6 kg, 9 kg, and 12 kg) on constant speed VCR diesel engine. The experimental analysis was carried out to study the effects of load and CR on output parameters brake thermal efficiency (BTE), brake specific fuel consumption (BSFC), emission parameters like CO, HC, NOx, and smoke density on all the fuel blends, and diesel fuel (HSD). The present work aims to optimize the combination of fuel blends, CR, load of DEE, Jatropha, and diesel fuelled single-cylinder constant speed diesel engine to improve the performance and to reduce the emission characteristics. An orthogonal array L_{27} was used to arrange the input factors and their levels in twenty-seven numbers of experiments. Grey based Taguchi method (GTM) has been used to optimize the responses and to identify the best combination of input parameters. The Minitab 17® software was employed for the analysis of experimental results. Further, the method of TOPSIS confirms the optimized results of GTM. This work has used two methods of optimization techniques for accuracy as well as for confirmation about the optimized operating parameters of the unmodified engine. Operation number 27 is the combination of fuel A3 with CR 18, and load 100% (3.4 KW) which gives the best performance and emission characteristics.

Keywords: *Diethyl Ether, Jatropha, CR, BTE, BSFC, VCR, Grey based Taguchi method, emissions.*

Introduction

Diesel engines have been used widely in various engineering applications such as automobile and shipping equipment. The diesel engine has different types of emissions such as CO, HC, NOx, and smoke etc. The alternative fuels have now become a major research area in the engine design due to an increase in fuel economy, and more stringent emission regulations [1, 2].

The required emission regulations are difficult to obtain only with advanced diesel engine technology. It can be achieved by exhaust gas after-treatment, and by using different green fuels for the diesel engines [3]. Generally, alcohol fuels are decreasing engine emissions [3, 4].

Ethanol can be used as substitute fuel for engines [5]. The drawbacks of using ethanol for diesel engines are limited solubility with diesel, low cetane number, and lower viscosity than diesel [6]. To overcome these difficulties, Cetane number enhancers and co-solvent additives have wide scope as a diesel fuel blend for diesel engines [7]. The additives are employed to improve the properties of fuel blends. Additives are used to compensate for a certain number, improve the viscosity and stabilize the fuel blend mixture [4].

It is also proved that vegetable oil fuels are found best alternatives as their properties are equivalent to diesel fuel and are produced from various crops which are easily available. Also, because of its high cetane number, it can be used in diesel engines without alterations in engine [18].