



Research Article

## Performance of phase changing material in an artificially created cold region to promote latent heat thermal energy storage

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### ABSTRACT

In the present contribution, the authors investigate the peculiarity of Phase Changing Material for accumulating heat in the region equivalent to the hilly area by creating its atmosphere, having 20° C DBT and 18° C WBT. A water cooler is used in 5\*7 feet bathroom to conceive the above-intimated temperature, measured by a sling psychrometer. In particular, in this study, trials are carried out in the LHTES tank where water is charged from ambient temperature to 55° C with the aid of an Immersion water heater rod of 1000W,230V thereby liquifying PCM and then discharging to ambient temperature. Two Orientations namely, Circular and Cross are appropriated into the study, where Circular Orientation poses better results articulating the charging in an hour and discharging in 25 long hours, whereas Crossed Orientation represents charging in an hour and discharging in 23 hours. The volume of PCM and the net heat transfer surface have been kept constant in both cases, to compare them in the same operative conditions. The reason for the detour is manifested.

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### INTRODUCTION

Renewable sources such as solar, wind, biogas, tidal may be harnessed to store energy to a greater extent since energy saving has become a primary priority for future generations. Since renewable sources are a source of intermittent supply, enriching existing technology of storing heat in the LHTES form has become a common concern of discussion due to its advantages of storing a large amount of heat even with small temperature changes and high storage density.

More particularly, LHTES incorporated with PCM has been a popular approach for TES application but, PCMs are limited by their low thermal conductivity which is generally less than 0.5 W/mK. To enhance the heat transfer from the heat source to the PCM, many methods like using acetamide [1], tetradecane[2], heat exchanger pipes[3,4] commercial paraffin [5–8] as PCM have been developed. Many applications also use a single fin[9–13] or multiple aluminum fins

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ORIGINAL ARTICLE

# Parametric optimization of engine performance and emission for various n-butanol blends at different operating parameter condition



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## KEYWORDS

Butanol;  
C I Engine;  
Taguchi;  
Optimization;  
Emission

**Abstract** In present work, study of effect of different n-butanol diesel blends (5–20% v/v) on engine performance and emission were performed for different engine operating parameter. Optimization was carried out with help of Taguchi DoE method. Single Cylinder VCR Compression Ignition Engine was fuelled with different blend of diesel and n-butanol and tested at different engine settings of CR, FIP and FIT for different load conditions (Idle, 1/3, 2/3 and full load). Normality analysis was performed to check the distribution of response data and then regression analysis was performed to derive the mathematical model for the chosen responses (BSFC, BTE, NOx and Smoke) based on n-butanol and engine parameters. During the optimization analysis, it is found that n-butanol of 15% concentration in diesel with engine settings, CR of 15, FIP of 260 bar and FIT of 25°bTDC give optimize BTE, BSFC and low smoke but resulted in higher NOx formation due to tradeoff between NOx and smoke control. The use of 15%v/v of n-butanol was found to be most suitable blend proportion with diesel as it resulted in favorable engine performance and low emission for all test load conditions. Also during this study, it was observed that Taguchi method is highly effective when individual response parameter need to be optimized for different engine responses and to identify the significant factor from multiple design factors. But for optimization of multiple design factors for most favorable responses simultaneously, use of advanced optimization methods from MADM (Multi Attribute Decision Making) approach to be implemented.

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**Abbreviations:** BSFC, Brake Specific Fuel consumption; BTE, Brake Thermal efficiency; CR, Compression Ratio; DoE, Design of Experiments; FIP, Fuel Injection pressure; FIT, Fuel Injection Timing; HCCI, Homogeneous Charge Combustion Ignition; NOx, Nitrogen oxides; PCCI, Premixed Charge Combustion Ignition; S/N, Signal to Noise Ratio; VCR, Variable Compression Ratio.

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researchgate.net/publication/330437645\_Optimization\_of\_application\_of\_2-ethyl-hexyl-nitrate\_on\_partial\_substitution\_of\_ethanol\_in\_CI\_engine\_for\_fuel\_economy\_and\_emission\_control\_using\_MADM\_method

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### Optimization of application of 2-ethyl-hexyl-nitrate on partial substitution of ethanol in CI engine for fuel economy and emission control using MADM method

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Abstract and Figures

The present study is performed to identify the blending proportion of cetane improver for partial substitution of ethanol with diesel to achieve fuel economy and emission control. This is case of multiple attribute decision making problem which is solved using Taguchi GRA.

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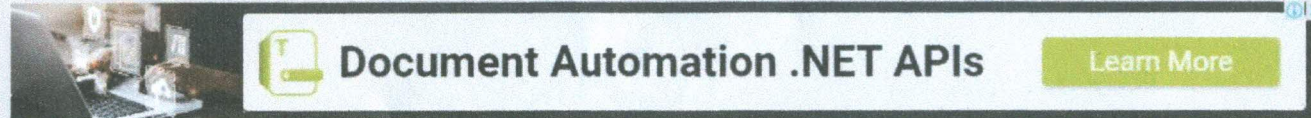
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Chapter

### Design and Testing of Adsorption Column for PSA Process for CI Engine Performance and Emission

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# Vibration Mode Suspension in Canopies Using Elastic Damping Technique

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**Abstract** - The sheet metal structures (Canopy) utilized in dg sets is generally vulnerable subjected to the varied static and dynamic masses throughout their oscillation cycles. Thanks to this, they encountered resonance condition at varied in operation frequencies. Resonance results in harmonic excitation that any introduces the deformation and stresses resulting in the failures of flat solid structures. Reframing of flat solid structure with the assistance of elastic material like rubber, foam, bitumen, NBR latex etc. changes the stiffness of structure. Thus, stiffness alternation results in modification in dynamic characteristics like natural frequency, mode shapes, and harmonic response. Optimum distributions of damping material in shell structures subject to impact masses by topology improvement. The optimization aims at reducing the residual vibration responses once the appliance of impact masses. Above all, the dependence of each structural forced vibration and residual vibration on the damping layer distribution is taken into account by transient dynamic responses-based improvement approach. Until now, optimum distributions of damping material are continually meted out supported frequency domain responses or structural dynamic characteristics. Modal and Fourier analysis are simulated exploitation FEA (ANSYS Workbench). In experimentation, Impact hammer check and FFT analyzer are used for the validation purpose. Natural frequencies for sheet metal structure with and without reinforcement are calculated. Results and conclusion are drawn by scrutiny analytical and experimental values. Appropriate materials are recommended by analyzing the info alongside future scope.

**Key Words:** DG sets, residual vibration, Natural frequencies, FFT analyzer.

## 1. INTRODUCTION

A diesel generator (also called diesel genset) is that the combination of an ICE with an electrical generator (often associate alternator) to come up with current. This is often a particular case of engine-generator. A diesel compression-ignition engine is sometimes designed to run on fuel; however, some varieties are tailored for alternative liquid fuels or fossil fuel. Diesel generating sets are employed in places while not affiliation to an influence grid, or as emergency power-supply if the grid fails, moreover as for additional complicated applications like peak-logging, grid support and export to the ability grid. Correct filler in diesel generators is crucial to avoid low-load or a shortage of

power. Filler is sophisticated by the characteristics of recent physical science, specifically non-linear masses. In size ranges around fifty MW and higher than, associate open cycle turbine is additional economical at full load than associate array of diesel engines, and much additional compact, with comparable capital costs; except for regular part-loading, even at these power levels, diesel arrays are typically most popular to open cycle gas turbines, because of their superior efficiencies.

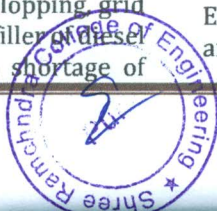


**Fig-1:** Emergency Diesel Generator (EDG) with canopy made up of sheet metal

Viscoelasticity is that the property of materials that exhibit each viscous and elastic characteristic once undergoing deformation. Viscous materials, like water, resist shear flow and strain linearly with time once a stress is applied. Elastic materials strain once stretched and straightaway come back to their original state once the strain is removed. Elastic materials have parts of each of those properties and, as such, exhibit time-dependent strain. Whereas physical property is sometimes the results of bond stretching on crystallographic planes in associate degree ordered solid, consistence is that the results of the diffusion of atoms or molecules within associate degree amorphous material.

## 2. PROBLEM STATEMENT

Canopy is the sheet metal covering used to cover the diesel generators. They restrict dust, water to come directly in contact with the engine assembly. When these EDG Emergency Diesel Generators works at very high rpm, there are a large no of parts inside the whole system working at



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