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2nd International Conference on Materials Manufacturing and Design Engineering

### A Taguchi Approach on Influence of Graphite as an Anti-Wear Additive on the Performance of Lithium Grease

Prashant Nagare<sup>a\*</sup>, Hari Kudal<sup>b</sup>

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#### Abstract

An Influence of graphite powder as an extreme anti-wear additive on the tribological performance of lithium grease was identified by conducting tests as per ASTM 2266 standard. Signal to noise ratio analysis was done to identify the levels for optimum wear scar diameter. Analysis of variance was done to identify significant factor which affects wear scar diameter. For optimum levels, wear scar diameter was predicted.

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**Keywords:** Antiwear additive, ASTM D 2266, Signal to noise ratio, Analysis of variance

#### 1. Introduction

Greases are semi-solid substances composed of lubricating oils and soaps or thickeners. Soaps of lithium, calcium, sodium, aluminum are commonly used thickeners. Greases are popularly used as lubricant; however without additives greases cannot fulfill particular application lubrication requirements. For heavily loaded applications graphite can be effectively used as an extreme pressure and anti-wear additive in greases. The grease should have consistency to carry load during bearing operation and should not thin during entire operation cycle [3]. The lithium soap grease is resistant to water and oxidation. The lithium soap grease shows good shear stability at high temperature.

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# Exergy Analysis of a Compression Ignition Engine Using Biodiesel Blends: A Review

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### Abstract

It is the necessity of time to reduce consumption of energy and promote the use of renewable resources like biodiesel. Biodiesel is gaining popularity as an alternative fuel in diesel engines due to its use without any engine modification. This review collects and analyzes some published papers concerning exergy analysis of diesel engine fuelled with biodiesel blends and it is found that exergy analysis is one of the best method to understand and improve the actual efficiencies of diesel engines fuelled with biodiesel blends.

### 1. Introduction

Exergy is defined as the maximum theoretical work output, which may be obtained from a system as it reaches to a state of equilibrium with environment of reference. The exergy content of a natural material input can be construed as a criterion of its quality and its ability to perform useful work. Exergy analysis is being used in simulation, design and assessment of thermal system performance. Various studies which involve the occurrence of losses in engines and methods to improve performance, which is based on second law of thermodynamics have been conducted by researchers [1].

Identification of energy losses can be done with energy analysis, but it cannot identify irreversible losses and their location. Modeling of engine processes can be done with the help of energy analysis, but it often does not determine the best engine operation. Actual efficiencies of the whole system can be understood and improved by exergy analysis. Exergy analysis is useful as it is based on the possibilities to determine the value of irreversibilities associated with the process. Exergy analysis is also called second law analysis or availability analysis [2]. Unlike energy, exergy may not be conserved. It may be generated, stored and destroyed. Energy is usually destroyed when heat transfer takes place at lower temperatures and in the chemical reactions [3-4]. Exergy may be considered as a potential measure of a material for causing undesirable effects. This unutilized exergy may cause unwanted effects in the environment during conditions of non-equilibrium after interaction with its surroundings. An indication is given by the exergy content for ability of input in natural material to do useful work [5].

According to the first law of thermodynamics, fuel energy injected into the cylinder of a diesel engine should emerge as brake power output, as the heat given to coolant or as sensible and chemical energy in the exhaust. If the rejection of heat to the coolant is eliminated by cylinder insulation, then the energy which would be

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# Biodiesel Production from Mixture of Oils – a Review

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**Abstract**—Effective production of Biodiesel from non-edible oils is one of the challenging issues for researchers. There are various production methods which can be used, but the non-edible vegetable oils contain high level of free fatty acid which make it difficult to produce biodiesel from it. In this review, it is reported that biodiesel produced from a mixture of oils is one of the best methods to improve the properties of biodiesel produced and also its yields.

**Keywords** - Biodiesel, Mixture of oils, Production

## I. INTRODUCTION

Biodiesel is a mono-alkyl esters of long chain fatty acids, which is derived from renewable sources. It is an oxygenated fuel derived from renewable biological sources and it may be used in diesel engines without any modifications in diesel engine [1]. Biodiesel is highly biodegradable and has decreased levels of toxicity. Biodiesel emits a very less quantity of harmful emissions like carbon monoxide, particulate matters, smoke, hydrocarbon emission. Biodiesel does not emit sulphur and net carbon dioxide [2-3].

## II. IMPORTANCE OF BIODIESEL

Fossil fuel reserves are limited in earth and its consumption is a major concern because of its limited availability in the world. Exhaustive uses of fossil fuels in industrial, transportation, farming and domestic sectors may cause its depletion rapidly. Its use also deteriorates the atmosphere, passing on harmful emissions. This trouble can be solved with the increase in the role of alternative fuel in automotive engines. A number of alternative fuels has been recognised such as biodiesel, bio-alcohol, non-fossil natural gas, hydrogen, vegetable oils etc. But biodiesel is

found to be more popular alternative fuel in various cases of diesel engines.

4.1 billion tons of Carbon Dioxide will be passed off to the atmosphere from 2007 to 2020. In addition, 8.6 billion metric tons of carbon dioxide will be passed off to the atmosphere from 2020 to 2035 [2]. Peaceful existence of the world is threatened by Global warming and the energy crisis. This trouble can be solved with the increase in the role of alternative fuel and energy loss minimization in automotive engines. The role of substitute fuels in automotive engines increases in recent years due to hike in prices of liquid hydrocarbon day by day [4].


In a single decade, there is seven fold expansion of biodiesel sectors from 2000 to 2015 at an annual growth of 23% in biodiesel production globally. There is a need to increase the biodiesel production dramatically with strong policy directive, subsidies and trade policies in favour of agricultural interests, rural economic development, energy security and climate [5].

Energy resources will take on an important part in future. In some of the developing countries, 90% of total rural energy is provided by Bioenergy. Various biofuels are being used for Bioenergy conversion with advanced technologies in developed nations to make it competitive with fossil fuels costwise. If renewable energy projects are designed and planned carefully with local input and support, it will facilitate economic and social development in local residential areas. Sustainability, greenhouse gas emissions reduction, regional growth, social structure and agriculture are some of the advantages which may be achieved with the biofuels use. The need to get carbon neutral renewable energy goes up to mitigate the greenhouse gas effect [6]. 88% of primary energy

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Chandrashekhra K. Patil ; M. Husain; N. V. Halegowda

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### QFD for Sustainability and Improved Product (Spring) Design

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**Abstract.** Nowadays, a lot of companies are enlarging their variety of production and this process, as a whole, creates a very competent environment. Capturing a reasonable market share in such an environment requires more than implementing plain production techniques in an effective way. The important step to get ahead in this competition is designing new products in order to create difference and meeting the customer requirements. Meeting customer requirements has also direct relationship with design quality. There are numerous studies on qualitative approaches in industrial design and production issues. Our study mainly focuses on the quality function deployment method to be used in industrial design of a spring. The main idea of quality function deployment approach here is to building a design strategy over the voice of the customer for a helical spring a product of Shri Ganesh Springs, Nashik

#### INTRODUCTION

This is the way toward building ability to meet customer requests, understanding the market, knowing the different customer sections and how well extraordinary suppliers of items address these advantages is a portion of the key antecedents to a successful QFD [1]. The main approach is particularly at fulfilling the customer. It develops client intricacy to gather consumer work as investigate the client desires in a service product. It is an approach for taking the "VOC" and utilizing that data to drive parts of product advancement. It is consumed by the cross-functional group's determination with providing products, procedures, as well as methodologies which resolve fulfill their consumers. QFD additionally establishes an association amongst customers and providers. Organizations are consequently creating products or administrations with clear understanding of the customer requirements, they remotely engaged, with always satisfies the business endurance with customer. The following figure 1. represents the diagram of QFD and it is explained below.

#### History of QFD


"QFD" be first urbanized by Shigeru Mizuno along with Yoji Akao. For satisfying consumer, the important process is through "QFD" for plan a product. His technique utilized a course assertion matrix chart to recognize client necessities (impact) that recognize plan quality attributes and causes which is anticipated to control and measure it.

The common arrangement is to guarantee quality in all stage of the design procedure, which incorporates the utilization of other conceivable arrangement applications inside the QFD procedur [1]. Today, QFD keeps an rousing strong enthusiasm in the world, producing new application, professionals and specialist. Around then, the accompanying two issues the QFD were imagined.

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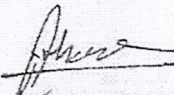
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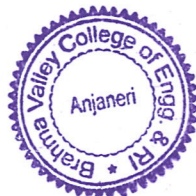
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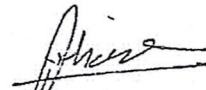
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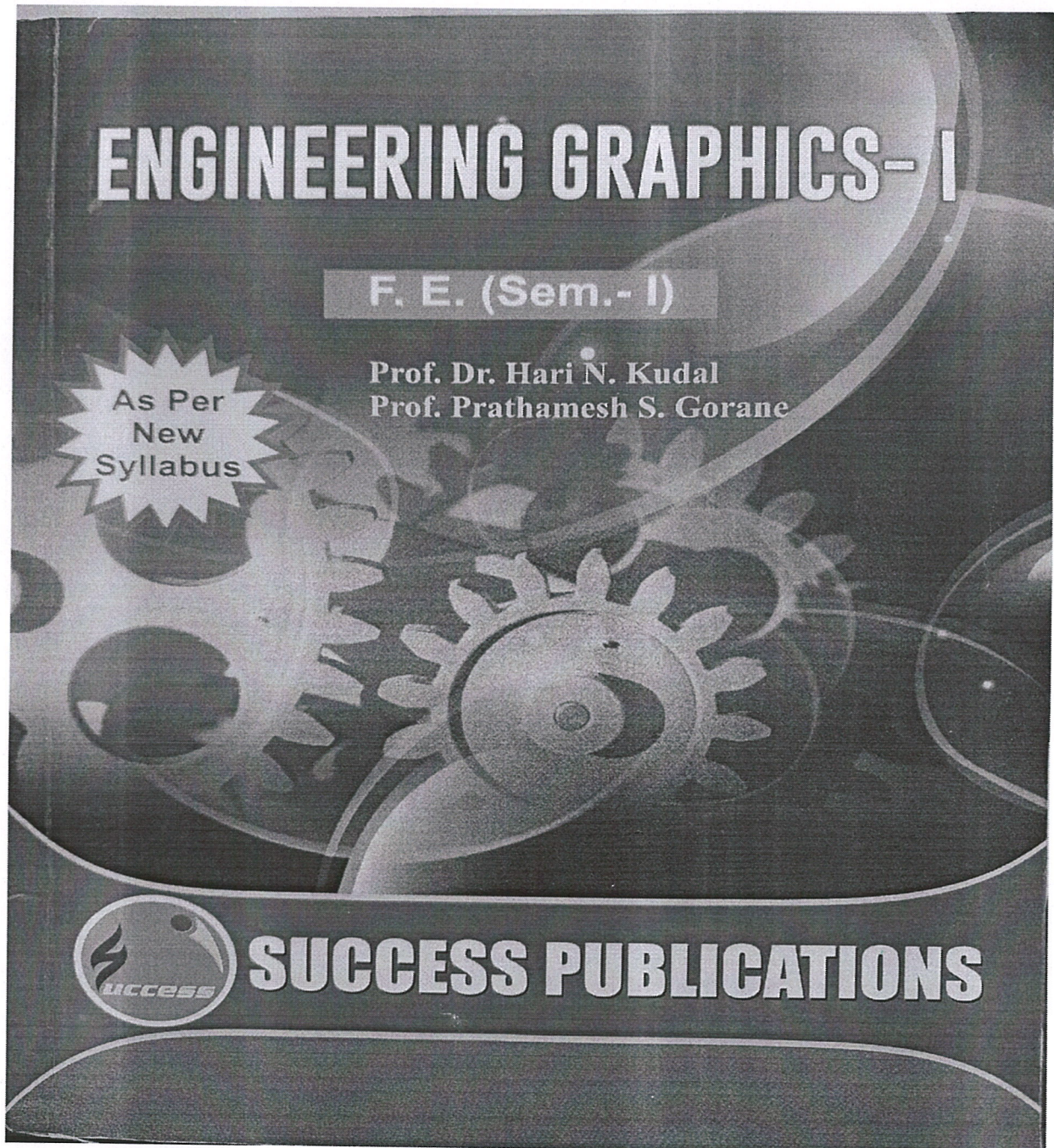



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F.E. (Sem. - II) (102013)

- Prin. Dr. Hari N. Kudal
- Prof. Dr. Abhijeet L. Dandvate

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New Syllabus  
and  
With All Solved  
Question  
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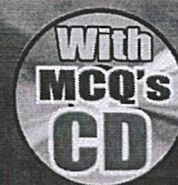
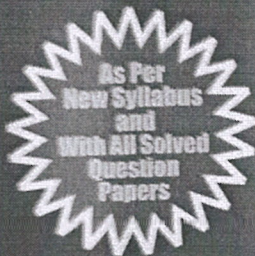
# APPLIED THERMODYNAMICS

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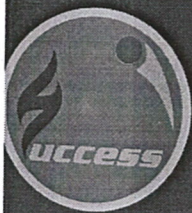
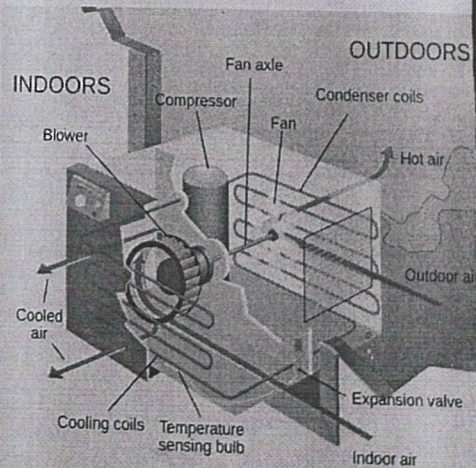
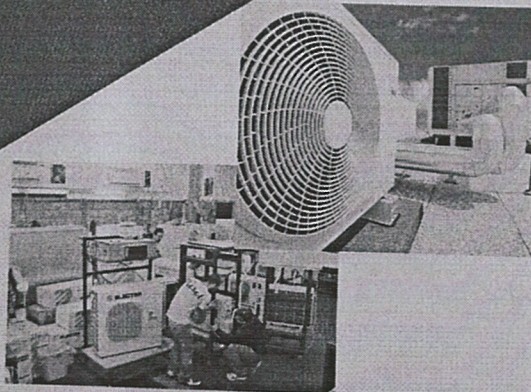
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# Refrigeration and Air Conditioning

As Per  
New  
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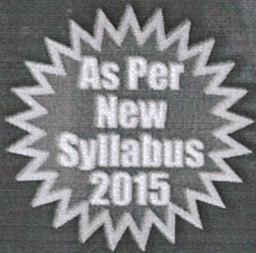
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# Thermodynamics

S.E (Mechanical Sandwich & Automobile)  
(Sem. - I)

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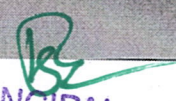


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Prof. Dr. Rupesh J. Patil

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# ENERGY AUDIT AND MANAGEMENT

**B.E. Mechanical Engineering (Sem.-I)  
(Elective -I)**

• Prin. Dr. Hari N. Kudal • Prof. Santosh Chavan



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June 2015



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### Biodiesel In India- A Review

Sanjay Mohite<sup>1</sup> and P.K. Rohitagi<sup>2</sup>

<sup>1</sup>Brahma Valley College of Engineering & Research Institute, Nashik, India

<sup>2</sup>Amity University, Noida, India

smohite001@yahoo.com

**Abstract.** This article provides the information of biodiesel development in India. It reviews the advantages and limitations of biodiesel, comparative analysis of diesel and biodiesel, economic analysis and the comparative analysis of the findings and results of various authors. Standard energy audit methods and bio-fuel performance certification methods are found as future challenge and scope for biodiesel.

**Keywords:** Fossil fuels, Biodiesel, Diesel engines, Energy audit, Biofuel performance certification.


#### 1 Introduction

Biodiesel is simply an alkyl esters of lengthy chain fatty acids obtained from renewable sources. It is an oxygen added fuel obtained from natural biological sources. It could be used in diesel engines with no engine modifications [1]. Biodiesel is highly biodegradable and has reduced levels of toxicity. It can be used in diesel engines instead of diesel fuel without any major modification of engines. Biodiesel emits a very less amount of harmful emissions like carbon monoxide, particulate matters, smoke, hydrocarbon emission. Biodiesel does not emit sulphur and net carbon dioxide [2-3]. Harmful emissions are reduced by biodiesel. Biodiesel is produced with an ease. Biodiesel is found to have superior lubricating properties, superior cetane number, higher density and lower sulphur emissions. In the world, biodiesel production has found to reach about 2.2 billion gallons. Biodiesel is being manufactured with the help of more than 350 numbers of oil bearing crops [4-5]. Biodiesel has a viscosity as compared to that of diesel. These vegetable oil esters are found to have 10% more oxygen by weight causing better combustion. Biodiesel is found to have higher flash point and cetane number. The value of biodiesel's cetane number is 50. It has about 10% low calorific value as compared to that of diesel [6].

#### 2 Advantages and Limitations of Biodiesel

Biodiesel has certain advantages over diesel as follows:-



  
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2nd International Conference on Materials Manufacturing and Design Engineering

### A Taguchi Approach on Influence of Graphite as an Anti-Wear Additive on the Performance of Lithium Grease

Prashant Nagare<sup>a,\*</sup>, Hari Kudal<sup>b</sup>

<sup>a</sup>Department of Mechanical Engineering, Amrutvahini College of Engineering, Sangamner-422608, India  
<sup>b</sup>Department of Mechanical Engineering, SND College of Engineering and Research Centre, Yvela-423 401, India

#### Abstract

An Influence of graphite powder as an extreme anti-wear additive on the tribological performance of lithium grease was identified by conducting tests as per ASTM 2266 standard. Signal to noise ratio analysis was done to identify the levels for optimum wear scar diameter. Analysis of variance was done to identify significant factor which affects wear scar diameter. For optimum levels, wear scar diameter was predicted.

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Peer-review under responsibility of the scientific committee of the 2nd International Conference on Materials Manufacturing and Design Engineering.

**Keywords:** Antiwear additive; ASTM D 2266; Signal to noise ratio; Analysis of variance

#### 1. Introduction

Greases are semi-solid substances composed of lubricating oils and soaps or thickeners. Soaps of lithium, calcium, sodium, aluminum are commonly used thickeners. Greases are popularly used as lubricant; however without additives greases cannot fulfill particular application lubrication requirements. For heavily loaded applications graphite can be effectively used as an extreme pressure and anti-wear additive in greases. The grease should have consistency to carry load during bearing operation and should not thin during entire operation cycle [3]. The lithium soap grease is resistant to water and oxidation. The lithium soap grease shows good shear stability at high temperature.

\* Corresponding author. Tel.: +91 95118 32351; fax: +91 2425 259016  
E-mail address: [prn\\_2175@yahoo.co.in](mailto:prn_2175@yahoo.co.in)



  
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### Biodiesel In India- A Review

Sanjay Mohite<sup>1</sup>(7000-0001-190-001) and P.K. Rohtagi<sup>2</sup>

<sup>1</sup>Brahma Valley College of Engineering & Research Institute, Nashik, India

<sup>2</sup>Anity University, Noida, India  
smohite001@yahoo.com

**Abstract.** This article provides the information of biodiesel development in India. It reviews the advantages and limitations of biodiesel, comparative analysis of diesel and biodiesel, economic analysis and the comparative analysis of the findings and results of various authors. Standard energy audit methods and bio-fuel performance certification methods are found as future challenge and scope for biodiesel.

**Keywords:** Fossil fuels, Biodiesel, Diesel engines, Energy audit, Biofuel performance certification.

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#### 2 Advantages and Limitations of Biodiesel

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### Performance Characteristics of Karanja Biodiesel Blends Using Energy Audit Technique

Sanjay Mohite<sup>1</sup> and Sagar Maji<sup>2</sup> and  
Amit Pal<sup>3</sup>

<sup>1</sup>Brahma Valley College of Engineering & Research Institute, Nashik, India  
<sup>2</sup>Delhi Technological University, Delhi, India,  
smohite001@yahoo.com

**Abstract.** A new methodology is used to evaluate performance and emission characteristics with the use of energy audit. This is a method to check biodiesel feasibility as blends in diesel engine. This is one of the simple and fast method to save time and energy. In this method, heat flow analysis comprises of utilization in brake power, cooling water heat loss, heat loss in exhaust gas and heat loss in radiation have been calculated and compared. Brake specific energy consumption, losses in friction power and smoke have also been chosen as important characteristics of performance and emission in energy audit. These parameters of energy audit have been calculated and compared. These parameters of energy audit have been found with 10%, 20% and 30% blend of biodiesel at varying brake power of 0.5 to 3.5 kW at 1500 rpm speed. These parameters have been found satisfactory. Higher limit of conversion of fuel's heat energy into useful work output for B20 is found to be 29.04 %, 29% for diesel, 28.3% for B10 and 27.92% for B30 at brake power of 3.5 kW with lesser smoke. Karanja B-20 blend test fuel has been found to be more suitable in preliminary energy audit method and it would be tested further for other parameters.

**Keywords:** Performance Characteristics, Engine Emissions, Karanja Biodiesel Blends, Energy Audit Technique, Biofuel Performance Certification.

#### 1 Introduction

Biodiesel is a mono-alkyl ester consisting of long chain fatty acids, which is derived from renewable sources. It is an oxygenate fuel obtained from natural biological process [1]. Utilization of inexhaustible energy technology is at a slow speed. But, biodiesel is more popular as compared to other sources because it can be used as an alternative with diesel [2]. The estimation of energy demand was 13.1473 billion tonnes of oil equivalent in 2015 in the world. This demand has been increasing at a fast pace to 17.7156 billion tonnes of oil equivalent in 2040. Now, there is 239.4 billion tonnes stock of estimated oil reserves, which is being consumed in a fast manner. Therefore, it is very essential to replace this oil fuel with an alternative sources of energy. Diesel fuel is popular in the world and it is better to replace this diesel fuel with an alternative. According to US Legislation, biodiesel production was 30.1



  
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THIS CERTIFICATE ACKNOWLEDGES AND HONOURS  
DR./PROF./MR./MS. Chandrashekhar Patil

FOR PARTICIPATING/PRESENTING PAPER ENTITLED  
"Design and Optimization of Robot Supporting Structure"

IN THE 'INTERNATIONAL CONFERENCE ON RESEARCH CHALLENGES TO  
MULTI-DISCIPLINARY INNOVATION' HELD DURING  
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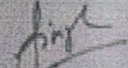
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"Linseed Biodiesel - A Review"

IN THE 'INTERNATIONAL CONFERENCE ON RESEARCH CHALLENGES TO  
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ON  
**Research Challenges to Multi-Disciplinary Innovation**  
(30<sup>th</sup> March - 01<sup>st</sup> April, 2021)

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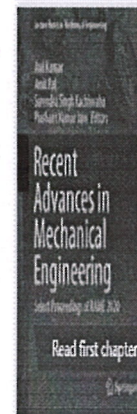
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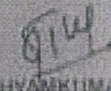
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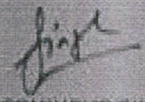
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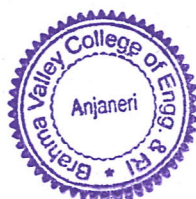
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
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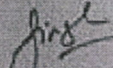
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INTERNATIONAL CONFERENCE ON RECENT ADVANCES IN MECHANICAL ENGINEERING  
Sanjay Mohite et al.

### Biodiesel Feedstock in India: A Review

Sanjay Mohite<sup>1,†</sup>, Sudhir Kumar<sup>1</sup>, Sagar Maji<sup>2</sup>, Amit Pal<sup>2</sup>,

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**ABSTRACT-** The demand for petroleum products are rising day by day due to rapid industrialization in the world. But the petroleum resources are limited and these will be depleted in the near future due to excess exploitation of these resources. Researchers are working to find out alternative feedstock which may have economic viability as well. Non-edible vegetable oils are one of the best alternatives as compared to edible vegetable oils. India has scope for the cultivation of non-edible plants and hence, the production of biodiesel. In this paper, Thumba, Linseed, Wild Apricot, Algae, Cottonseed and Mahua are chosen to find out its viability as potential resources for biodiesel in India.

**Keywords-** Biodiesel Feedstock; Thumba; Mahua; Algae; Wild Apricot; Cottonseed.

#### 1. INTRODUCTION

It is reported that there are 100 billion barrels reserves of petroleum in the world and are presumed to be exhausted in around 40 years [1]. In comparison to gasoline, the consumption of diesel is more than five times in India [2]. India will become the third biggest consumer of fuel in the transport sector after USA and China in 2020 with annual fuel consumption growth rate of 6.8% [3-4]. Fossil fuel reserves are limited in earth and its depletion is a major concern because of its extensive use in the world. Its use also deteriorates the atmosphere, giving harmful emissions. Serious efforts are required to prevent further deterioration of the environment. Considering these factors, there should be search for renewable source of energy which can replace fossil fuels. Therefore, renewable energy technologies from solar, wind and biomass are being explored and its popularity is also increasing. Utilization of renewable energy technologies

is at a slow pace because of lack of availability and its technical know-how with economic constraints. But, biofuel is becoming more popular as a renewable energy source because it can be used as a substitute for fossil fuel directly in internal combustion engine without any engine modification or little engine modification. Biofuels are obtained from various plant seeds [7]. In comparison to other petroleum fuels, diesel fuel is widely used to generate power in various sectors like transport, agriculture, commercial and industrial. Various researchers considered biodiesel as the best alternative fuel to substitute diesel [8].

Biodiesel is a fatty acid alkyl ester derived from a chemical reaction between vegetable oils and alcohol with or without the presence of a catalyst. Biodiesel acts as a renewable energy sources to reduce greenhouse gas emissions (GHG). It can also replace the fossil fuels in case of depletion of its reserves [9]. Biodiesel is generally renewable fuel and



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