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A Study Diesel Engine - A Review Paper

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Abstract: *This study offers comprehensive details on the use of bio-fuel as a viable and alternative source of energy. The present study indicates the factors which need to be prioritized for appropriate combustion and the fuel characteristics on which the engine's efficiency depends. A fuel-testing laboratory determined the properties of the pure mustard oil fuel and its blends, i.e., density, viscosity, dynamic viscosity, carbon residue, flash point, fire point and calorific value. The application of diesel engine has been rising dramatically since it's invention and the usages have speared in the field of transportation, agriculture, constructions and what not..The bio-fuel was prepared from vegetable oil, i.e., mustard oil and tested in a diesel engine in both pure form and as a diesel blend Finally, an analysis and comparison was made of the effects of the various fuels on the different engine properties..*

Keywords: Diesel engine, Combustion, transportation, comprehensive

I. INTRODUCTION

Diesel engine uses the fuel energy for producing thermal energy which further converted into mechanical energy and the process occurred in the combustion chamber. The operation based on burning of fuel-air mixture inside a confined cylinder, which results in high pressure that is responsible for moving the piston. As the connecting rod attached to the crankshaft, a rotary power is achieved to accelerate the vehicle.

During this whole process of combustion, the fuel burns and produces heat energy which divided into kinetic energy that makes the work done and other portion losses in terms of exhaust and cooling system. The number of the cylinder may vary according to the demand and engine size. The four-stroke diesel engine completes 2 cycle for 1 revolution whereas two stroke completes one revolution for each cycle. However, several conditions are required for carrying out perfect combustion for instance- adequate air supply, fuel-air ratio, fuel properties, atomization ,injection time ,cooling system and the condition of the machineries. Hence ensuring aforementioned criteria can lead a engine to operate in an effective and long-lasting way.

The study of Yosimoto et al. (2001) reflects the Japanese experience using different vegetable oil blends with kerosene to improve the performance of a small high-speed diesel engine under high load conditions. They worked with a single cylinder/direct injection, 4-stroke, air-cooled diesel engine, applying four blends (20, 40, 60 and 80 % by volume) of soybean oil with kerosene, as well as rapeseed oil with kerosene and compared the results with that of pure diesel fuel. They also studied the spray distribution of each blend in the atmosphere using 4-hole nozzle injector engines. The results show that a blend of 20% vegetable oil with 80% kerosene by volume, improves the thermal efficiency of the test engine under high load. Therefore, vegetable oil blends of 20% to 40% are recommended as successful alternatives to diesel.

II. RESEARCH METHODOLOGY

Data has been collected by experimenting the Sulzerseven-cylinder diesel engine while working onboard. The experimenting data was cross checked with available data. Importance of different parameters is ascertained from various deviation of running engine and their remedy. Fuel characteristics are mentioned which are found essential during the voyage. Adequate air-fuel ration is measured from the engine control room. Finally, the structure of engine is observed during the engine overhauling.

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Advantages of Diesel Engine

1. Fuel Efficiency

Diesel engines are generally known for their superior fuel efficiency compared to gasoline engines.

The fuel efficiency of a diesel engine can vary depending on several factors, including the specific engine design, vehicle type, driving conditions, and load.

On average, diesel engines tend to be about 20-30% more fuel-efficient than gasoline engines. In terms of measuring fuel efficiency, diesel engines are commonly assessed using two metrics:

– Miles per Gallon (MPG)

Diesel engines typically achieve higher MPG figures than gasoline engines. It is not uncommon for diesel-powered vehicles to achieve 30 MPG or more on highways.

– Liters per 100 Kilometers (L/100 km)

This metric is commonly used in countries that follow the metric system.

Diesel engines generally consume fewer liters of fuel per 100 kilometers traveled compared to gasoline engines. For instance, a diesel vehicle might consume around 6-8 liters per 100 kilometers, depending on the factors mentioned earlier.

It's important to note that these figures are averages and can vary significantly based on the specific vehicle, driving habits, and other variables.

Additionally, advancements in engine technology, such as hybrid systems or improved efficiency measures, can further enhance the fuel efficiency of diesel engines in modern vehicles.

2. Power and Torque

Diesel engines produce superior power and torque compared to gasoline engines. This is one of the most recognized advantages of a diesel engine. Its allows for a more powerful and efficient engine as diesel engines are capable of generating more power at lower RPMs.

Furthermore, diesel engines typically have a higher torque-to-weight ratio than gasoline engines, allowing for faster acceleration and better handling.

3. Longevity and Durability

Generally, diesel engines can last up to three times longer than gasoline engines, making them a great option for those who want a reliable engine that will last a long time.

The materials used in diesel engines are also of a higher grade than those of gasoline engines, making them more durable.

Diesel engines have a higher compression ratio than gasoline engines, which reduces the wear and tear on the engine, as well as the use of lubricating oil.

This combination of higher-grade materials and better lubrication makes diesel engines less prone to wear and tear than gasoline engines.

4. Resale Value

The resale value of diesel engines is also higher than that of gasoline engines because diesel engines maintain their performance over a longer period.

This means that you will get more money for the vehicle when you sell it, as it will be seen as a better investment.

Used diesel engines are in high demand due to their reliability and performance, allowing the owner to get a higher resale value.

5. Lower Carbon Emissions

When it comes to reducing emissions, diesel engines are the way to go. Diesel engines produce fewer emissions than gasoline engines, making them a more environmentally-friendly choice. Not only that, but they also have higher fuel efficiency, meaning they use less fuel and produce fewer emissions.

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Diesel engines are also capable of burning a wider range of fuel types, including biodiesel and renewable diesel. These alternative fuels produce fewer emissions than regular diesel, making them even more eco-friendly.

On top of that, diesel engines tend to last longer than gasoline engines, meaning fewer emissions from replacing engines. Plus, diesel engines are more durable and require less maintenance than gasoline engines, which also reduces emissions.

Overall, diesel engines are a great choice for those looking to reduce their environmental impact. Not only do they produce fewer emissions, but they also tend to be more fuel efficient, last longer, and require less maintenance.

6. Fuel Availability

When it comes to choosing a fuel for your vehicle, diesel is often the preferred option.

Diesel fuel is readily available and usually less expensive than premium gasoline, making it a great choice for those looking to save money.

7. Fuel Stability

Diesel fuel has a longer shelf life compared to gasoline. It is less prone to degradation and evaporation, which means it can be stored for longer periods without significant deterioration.

There is also a reduced risk of ignition. Diesel fuel has a higher flash point than gasoline, which means it requires higher temperatures to ignite. This makes diesel fuel less volatile and safer to handle. The lower risk of accidental ignition enhances safety during the storage, transportation, and handling of the fuel.

Lastly, there is a lower risk of contamination. Diesel fuel is less prone to contamination by water and other impurities compared to gasoline. Water contamination can occur due to condensation in fuel storage tanks or during fueling processes. Diesel fuel is less soluble in water, which allows water to separate and settle at the bottom of the fuel tank, reducing the risk of engine damage caused by water ingestion.

Disadvantages of Diesel Engine

Diesel Cons:

- Abysmal horsepower, slower speed
- Expensive fuel, limited gas stations with diesel
- Noisier and more rugged ride than gasoline-powered engines
- Produce emissions that emit carcinogens, nitrous oxides, and soot into the atmosphere
- Costlier repairs and maintenance.
- Human health, our environment, global climate and environmental justice are all affected by diesel emissions. Human Health - Exposure to diesel exhaust can lead to serious health conditions like asthma and respiratory illnesses and can worsen existing heart and lung disease, especially in children and the elderly.
- Overheating is perhaps the biggest significant problem with diesel engines. Overheating often appears when you are pushing the engine excessively hard. It can also develop in other issues such as shattering or distorting of cylinder heads and damage to the bearings and crankshaft.
- Higher upfront cost Diesel engines are more expensive to produce than petrol engines, which means that diesel cars tend to be more expensive to buy. These are around Rs. 1 lakh more expensive compared to their petrol counterpart for a mass market vehicle.
- Since diesel fuel is very low in octane, depending on the amount of contamination, the engine may run rough or start knocking.

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