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A LITERATURE SURVEY ON BIODIESEL

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***Abstract*— In this survey paper discuss on the different type bio-diesel. Bio-diesel is a part of bio-fuel. Biofuel are the fuel that produces by using agricultural crops and other biomass material within a short period of time. Common commercial used bio-fuel are bio-ethanol, bio-diesel, and bio methanol.Bio0ethanol made from sugarcane, sugar beet, and algae.Bio-diesel is made from vegetable oil, animal fats and algal lipid and from non-edible crops.Bio methanol made from organic waste agricultural waste. Heavy duty diesel vehicles are required large amount of diesel, bio-diesel tested using dynamometers and on-road techniques were significantly different. For HD vehicles, hydrocarbon (HC) emissions were significantly lower for B20 and B100 fuels from dynamometer and for B20 fuels from on-road emissions. In this survey paper discuss the different type of bio-diesel and it's different proprieties. Also discuss the experimental steps are used by different counties for bio-diesel quality checks. Discuss the technical specification of the test engine for bio-diesel.**

***Keywords*— Fish oil ethyl ester (FOEE), Fused Deposition Modeling (FDM), Polylactic acid (PLA) , Additive Manufacturing (AM) , Bioluminescence Detector (CLD etc.**

I. INTRODUCTION

Oil ultimate depletion and the production of harmful emissions from burning fossil fuels encourage the search for clean alternative fuels. Edible oils have higher prices than non-edible ones, so bio diesel was produced from non-edible vegetable oils. The oxygen content in ethyl ester is 10 to 12% more than in fossil diesel which results in better combustion and emissions reduction. Bio diesel calorific value is about 9% less than petroleum diesel oil and varies with different feedstock and the production process. The bio diesel viscosity is higher than diesel oil which results in poor atomization and improper fuel mixing. Bio diesel produces lower exhaust emissions and greenhouse gases except NO x. A continuous oil extraction process is favorable to produce higher bio diesel yield. Mechanical pressing of jatropha seeds can produce higher oil yield by up to 20% over that from chemical processes. The screw press is a continuous extraction technique .

Oil extraction can be produced by several methods: pressing the jatropha kernels mechanically, chemically, or enzymatic ally . The most known oil expeller types are Sundhara and Komet expellers. The seeds were pressed by means of a screw press . Lower calorific value and higher viscosity decreased the thermal efficiency of unheated oil due to value than diesel oil. Preheating of oil improved the thermal efficiency over that of the unheated oil due to reduced viscosity, better atomization, improved vaporization and improved combustion. Diesel-biodiesel blends have higher fuel consumption than petro-diesel to develop the same output power . Preheated vegetable oil exhibited a decrease in specific fuel consumption as compared to unheated oil due to lower viscosity which causes better atomization Specific fuel consumption was higher than diesel fuel for unheated and preheated biodiesel .

Higher specific fuel consumptions of biodiesel blends resulted in higher exhaust temperature than diesel oil. Lower thermal efficiency for bio diesel blends led to increase in the heat loss . Poor combustion characteristics and higher viscosity led to increase of exhaust gas temperature for preheated jatropha oil as compared with jatropha oil. Exhaust gas temperature is higher for jatropha oil than for diesel fuel due to jatropha oil higher viscosity .Jatropha biodiesel achieved lower air-fuel ratio as compared to diesel oil. tested diesel-biodiesel blends indicating that a richer mixture is required at higher engine loads.

A decrease in CO emission was obtained as the percentage of bio diesel increased. The reduction in CO emissions for biodiesel is due to the availability of extra oxygen which enhances the fuel combustion . Higher oil viscosity and poor fuel atomization lead to incomplete combustion. Preheating of fuel oil led to reduction in CO emissions compared to unheated oils and lower than for diesel fuel . CO emission levels are further reduced for preheated bio diesel due to reduced viscosity and density. The decrease in CO emission is more when the preheating temperature is increased from 75 to 90°C Bio diesel produced higher NO x emissions compared to crude diesel fuel for all output power due to higher cylinder temperatures in comparison to diesel fuel. The increase trend of NO x emission with engine load for jatropha biodiesel blends. The presence of higher oxygen content in biodiesel facilitates NOx formation. Unheated and preheated vegetable oil exhibited higher NOx emissions compared to hydrocarbon-based diesel oil. All preheated oils give higher NO x emissions at higher engine loads due to lower viscosity and increase in premixed rapid burning rate as the fuel inlet temperature increases.

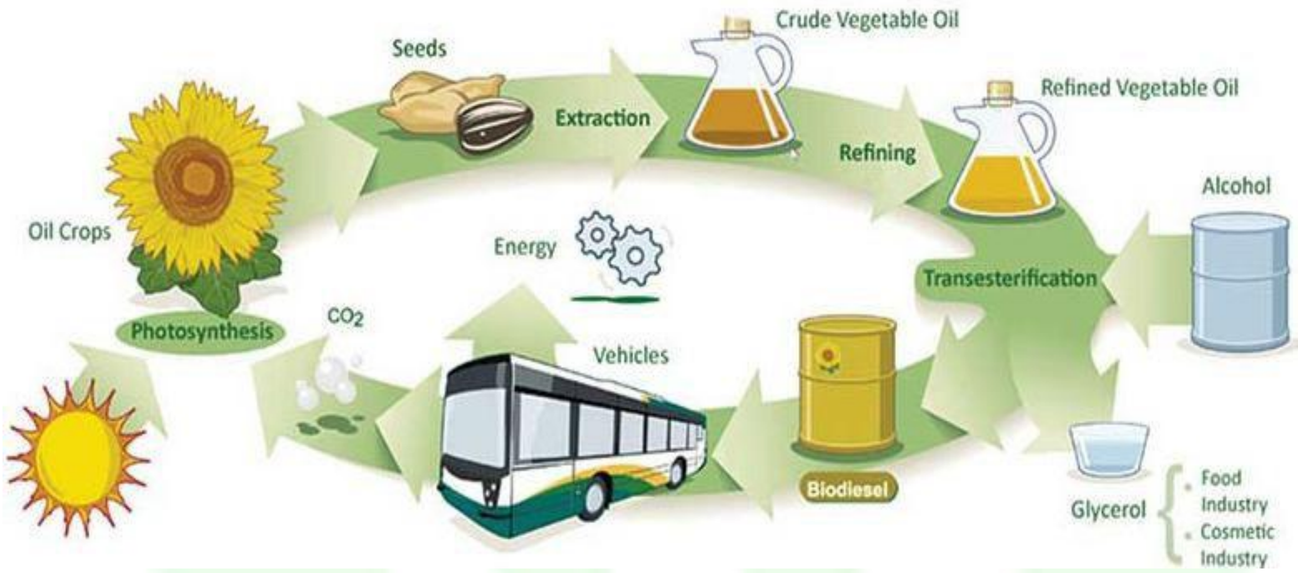

Fig. 1 Process of Bio-Fuel Manufacturing[31],

II. LITERATURE SURVEY

Viswanathan, et.al., [2021] "Experimental investigation on the application of preheated fish oil ethyl ester as a fuel in diesel engine." In the present study, waste fish oil was converted into fish oil ethyl ester (FOEE) sample using two-stage transesterification process. The entire chemical compositions of FOEE were examined by exploring GC–MS technique. The important properties in terms of physical and chemical condition of FOEE and its blends were examined based on standard ASTM biodiesel procedures. In the present work, direct injection single cylinder compression ignition engine with water cooled eddy current dynamometer coupled with DAQ was employed for experimentation. Diesel was used as a reference fuel and tests were conducted based on ISO 8178 D2 testing procedure to accomplish gen-set emissions norms prevailing in India. Further, the investigation was progressed with the use of engine exhaust heat for preheating the FOEE at three different temperatures namely 60 ◦C, 70 ◦C and 80 ◦C. The present research investigation was progressed to endorse a suitable approach to enhance the engine operational features with superior application of available energy in the renewable fuel. Therefore, practice of using alternative fuel (Fish oil Ethyl Ester) along with Fuel Preheating technique may be deliberate as the prominent method to attain improved engine operational features. As per ISO 8178 D2 standard for gen-sets, preheating temperature of 80 ◦C with FOEE was said to be more beneficial than other temperatures on account of its engine characteristics**[01].**

Gowtham, R., et.al, [2021] "An Experimental Investigation on Performance and Emission Characteristics of PCCI Engine Using Biodiesel Ethanol Blends in Dual Fuel Mode." The cylinder pressure was found to be higher in full load for B70+E30 (75.8 bar at 6o a TDC). The B100 has lower cylinder pressure (71.25 bar at 9°aTDC). Whereas in the case of part load, the cylinder pressure was found to be higher for neat diesel (64.95 bar at 5° a TDC) and lower for B70+E30 (61.46 bar at 8° a TDC). The brake thermal efficiency was found to be higher for neat diesel (33.75%) at full load. And lower brake thermal efficiency was found to be B90+E10 (21.95%) at full load. However, the B70+E30 (30.22%) blend produced brake thermal efficiency which is closer to neat biodiesel at full load. The specific energy consumption was found to be higher for B90+E10 (16513.75 kJ/hr) at full load. And lower specific fuel consumptions were found to be neat diesel (10893 kJ/hr) at full load. The B70+E30 blend (12028.22 kJ/hr) produced lower specific fuel consumption compared to other biodiesel-ethanol blends. This may be due to improvement in fuel vaporization characteristics leading to better combustion efficiency. The HC emissions were found to be higher for B70+E30 (158 PPM) at full load. And lower was to be found for neat biodiesel (52 PPM) at full load. The cooling effect of ethanol can lead to flame quenching which is the most significant reason for higher HC emissions. The CO emissions were found to be higher for neat diesel (0.156 %) at full load. And lower was found to be for B80+E20 (0.099 %) at full load. The main reason for higher CO emission is because of fuel-rich zones and insufficient oxygen availability inside the combustion chamber. The NOX emissions were found to be higher for neat diesel (1745 PPM) at full load. And lower emissions were found to be B70+E30 (1225 PPM) at full load. The cooling effect of higher ethanol content in the B70+E30 blend combined with a reduction in cetane number led to an increase in ignition delay and reduction in in-cylinder temperature. The smoke emissions were found to be higher for neat diesel (90 %) at full load. And lower emissions was found to be B70+E30 (65 %) at full load. Due to maximum heat release and peak pressure for the B70+E30 blend enhanced the oxidation of carbonaceous soot produced during the mixing controlled combustion which led to lower smoke emission compared to other blends at higher engine load **[02].**

Uslu, Samet,et.al., [2020] "Effect of operating parameters on performance and emissions of a diesel engine fueled with ternary blends of palm oil biodiesel/diethyl ether/diesel by Taguchi method." In the current study, the influence of DEE ratio, palm oil ratio, injection advance and engine load to diesel engine performance and emission outcomes were assessed. Taguchi design technique and ANOVA were applied to achieve the best combination of operating factors. Furthermore, the percentage of contribution of tested parameters for the particular output performance were shown. Tests were tabulated based on Taguchi L27 OA that considered DEE ratio (0, 5 & 10%), palm oil ratio (0, 15 & 20%), injection advance (25°, 30° & 35° bTDC) and engine load (500, 750 & 1000-W) as factors and their corresponding levels. Analyzing the obtained data, it has been decided that DEE ratio, palm oil ratio, injection advance and engine load are influential on performance and emission outcomes of engine. The results obtained from this study are as follows;

1) The low DEE ratio increased BTE while BSFC and CO emissions decreased. On the other hand, high DEE percentage improved N Ox and smoke emissions. The average percentage of DEE provided ideal results for EGT and HC emissions.
2) A reduction in CO and smoke emissions levels was observed with high amounts of palm oil. Conversely, the low palm oil ratio increased BTE, decreased BSFC and EGT, and improved NO x and HC emissions.
3) The combination of conventional test study and Taguchi design technique could supply rounded and rapid assessment of the impacts of operating parameters on a diesel engine**[03].**

Vălean, et.al., [2020], "Effect of manufacturing parameters on tensile properties of FDM printed specimens." This paper investigates the tensile behavior of 3D printed specimens. Among the Additive Manufacturing (AM) technologies, the Fused Deposition Modeling (FDM) process was considered, while Polylactic acid (PLA) was used as the filament material. The experimental tests were performed on standardized dog-bone specimens and the main process parameters (printing orientation-PO and layer thickness/size effect) were analyzed. The following conclusions can be drawn: ▪ The main geometric parameters (thickness-t and width-W) of the specimens have relative errors below 4%; however, the W errors are approximately double that of the t ones. ▪ The Young's Modulus (E) changes by only 1.8% depending on the PO, while tensile strength (m) shows differences of over 8%, between the extreme values. Regardless of the PO, E and m have errors below 1.5%. ▪ Both E and m decrease significantly and polynomial with increasing sample sizes (30% for E and over 7% for m). Therefore, due to the presence of the inherent defects, a strong size effect is identified, especially for E. ▪ The determined values of tensile strength for PLA obtained through AM are in good agreement with those from injection molded, except of 450 orientation which are a little bit lower**[04].**

Rajak, et.al., [2020] , "Performance and emission analysis of a diesel engine using hydrogen enriched n-butanol, diethyl ester and Spirulina microalgae biodiesel." The aim of this investigation was to study the effects of addition of 5, 10, 15 and 20% of hydrogen energy share to diesel, Spirulina microalgae, n-butanol, and diethyl ether in a single cylinder diesel engine.

The following conclusions were drawn from this study:

BTE of the four-stroke engine was increased forSpirulina, n-butanol and diethyl ether with the usage of 5, 10, and 15% hydrogen energy. BTE increased with the addition of hydrogen energy.

SFC decreased for diesel-hydrogen by 19.84%, Spirulina-hydrogen by 18.3%, and n-butanol- hydrogen by 10.7%, whereas increased fordiethyl ether-hydrogen by 6.4% as compared to the diesel fuel at 15% hydrogen energy.

• Increased combustion cylinder pressure of diesel, Spirulina microalgae, n-butanol, and diethyl ether with the addition of hydrogen energy upto 19.9% (spirulina-hydrogen) as compared to diesel for 20% hydrogen energy share.

• BSN emission decreased by 22.89, 54.64, and 27.42% for Spirulina microalgae, n-butanol and diethyl ether, respectively as compared to diesel-hydrogen at high engine loads **[05].**

Ibrahim, et.al., [2020], "Experimental study on the effect of preheated Egyptian Jatropha oil and biodiesel on the performance and emissions of a diesel engine." The Emission concentrations of CO_2 and smoke

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were reduced for all tested fuels with respect to diesel oil. HC and CO increased for unheated tested fuels and were reduced for preheated tested fuels compared to diesel oil. NO x concentrations were decreased by up to 7 and 35% for preheated biodiesel and oil, respectively compared to the unheated fuel at 75% of engine load. Preheating of bio fuels is a good cheap tool for reducing NO x emissions. BSFC increases were noticed for all fuels compared related to diesel fuel but decreased for preheated jatropha oil at 90°C. Brake thermal efficiency was improved for preheated jatropha oil at 90°C.Exhaust temperatures for various blends gave an upward increase trend with jatropha biodiesel concentration increase in the blends. It increased **[06]**

Govindasamy, et.al., [2018], "Experimental investigation of the effect of compression ratio in a direct injection diesel engine fuelled with spirulina algae biodiesel." In this study, the effect of compression ratio on the diesel engine parameters while working with Spirulina as the fuel was evaluated. Experimental values taken for the three different compression ratios (15, 16, and 17.5) set by the manufacturer, has depicted that the increase in compression ratio improves the performance of the engine in terms of BSFC and BTE. The maximum performance is delivered by the engine while using a B20 blend of spirulina biodiesel at a compression ratio of 17.5, at which the BSFC improves by 15% and BTE improves by 10%. With respect to emission parameters, increase in compression ratio leads to increase in emission of HC, whereas, CO emission reduces. For all compression ratios, the emissions of HC, NO x and CO are lower with spirulina biodiesel versus that of standard **[07]**

III. Characterization Of Diesel And Jbd

The measurements of properties of the fuels were carried out according to ASTM D 6751-02 [20]. The specifications and manufacturers of the instruments were given in the following Table 1. The effects of the fuel properties on various operational aspects of the diesel engine were discussed as follows:

TABLE 1. Astm methods and instruments used to measure fuel properties

Property	**ASTM Method**	**Instrument**	**Make**
Density	D 1298	Hydrometer	Petroleum instruments, India
Flash Point	D 92	Cleveland open cup tester	Petroleum instruments, India
Calorific Value	D 240	Bomb calorimeter	Parr, UK
Kinematic Viscosity	D 445	Kinematic viscometer	Setavis, UK

IV. Experimental setup

Internal combustion liquid cooled which has vertically fixed engine type which rotates at 1500rpm. The addition of loads is done through an electrical dynamometer. In an unit time the fuel quantity can be measured by a burette which is linked to the tank. The exhaust gas was measured by AVL437C smoke meter. A test rig is connected with a data acquisition system for obtaining different curves and results during experimental investigation. A five gas analyzer aligned with a stationary engine to provide composition details of emission in exhaust gas are CO, CO2, UBHC, NOX, and other non-useful oxygen. In this method, the cable at one end is connected to the exhaust gas outlet while the other is at the end of the inlet of the analyzer. Figure 1 and 2 shows the experiment setup. Tabulation 1 and 2 shows Engine Specification and properties of fuel.

Fig.2. Experimental Setup Ta

Table No. 2 Technical specification of the test engine

1 Technical specification of the test engine	
Engine type	Kirloskar Oil Engine TV1
Bore	87.5 mm
Stroke	110 mm
Rated power output	5.20 kW
Rated speed	1500 rpm

No. of cylinder	1
Cooling system	Water-cooled
Injection pressure	200 bar
Injection timing	23 deg bTDC
Compression ratio	17.5 : 1

V. CONCLUSION

In this paper discuss on the emissions for HD diesel vehicles tested using dynamometers and on-road techniques were significantly different. For B20 blends, the HC emissions for both test procedures led to significant decreases in these emissions, but also a significant difference between the dynamometer and the on-road emissions. In the cases of NOx emissions studies, a statistically significant increase in NOx emissions was found for B20 blends from the dynamometer data, while the on-road studies resulted in a decrease that was not significant. For fuel economy, the dynamometer data for B20 showed a significant decrease in fuel economy, while the on-road data gave an increase that was not significant.

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