# Performance and Emission Analysis of Undi Biodiesel on IC Engine- A Review

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## Abstract

Biodiesel is best alternative fuel now a day. Calophyllum inophyllum Linn. [Guttifereae (Clusiaceae)], commonly known as 'Indian laurel' or 'Alexandrian laurel' is a broad leaved evergreen tree occurring as a littoral species along the beach crests, although sometimes occurring inland. Undi is common feedstock for production of biodiesel blend. Various optimisation techniques were used to optimise process parameters of biodiesel production.

**Keywords: Undi Biodiesel, Optimisation Techniques, Transesterification Process**

## I. INTRODUCTION

Undi / Nagchampa (Calophyllum Inophyllum Linn) trees are normally planted along the highways, roads to stop soil erosion. Millions of trees exist all over Coastal India. If the seeds fallen along road side are collected, and oil is extracted at village level, by hand operated expellers, thousands of tons of oil will be available for Lighting the Lamps in rural area. It is the best substitute for Kerosene. Since these are spread over a large area, collection of seeds for BioDiesel manufacture is not viable. (A compact plantation can support a BioDiesel plant).

## II. LITERATURE SURVEY

Sanjaykumar Dalvi [1] et al. studied biodiesel fraction from oil content of Undi (Calophyllum innophyllum L.) is found 60-70 %.The extraction of oil is a primary step in any biodiesel production system. To escape this step in-situ transesterification method is used in which the Undi seed crush is directly converted into biodiesel with in- situ transesterification which is fatty acid methyl & ethyl ester composition.

A.G. Mohod [2] et al. prepared methyl ester from Calophyllum Inophyllum L. oil by using base catalyzed transesterification process. Different properties of raw Calophyllum inophyllum L. oil and its methyl ester were determined by using the standard procedures. The specific gravity and kinematic viscosity, Gross calorific value, Flash point, Fire point, Acid value, Free fatty acid content and Saponification value for raw Undi oil were 0.908, 5.80 cS, 35.55 MJ/Kg, 2480C, 283 0C, 0.933 mg KOH/g, 1.2 %, 210, respectively, While for Undi methyl ester were 0.856, 3.58 CS, 39.21 MJ/Kg, 188 0C, 231 0C, 0.523 mg KOH/g, 0.66 %, 200.7, respectively.

Gaurav Dwivedi[3] et al. investigated renewable sustainable and alternative fuel for compression ignition engine, biodiesel instead of diesel has been increasingly fuelled to study its effects on engine performances and emissions in the recent 15 years. Their objective was to do a comprehensive review of engine performance and emissions using biodiesel from different feed-stocks and to compare that with the diesel.

Rahul Krishnaji Bawane[4] et al. conducted experiment to obtain the operating and emission characteristics of Undi Oil Biodiesel on Vari-able Compression Ratio (VCR) engine run on various blends of biodiesel, compression ratios and load conditions. From the comparison of results, it is inferred that the engine performance is improved with significant reduction in emissions for the chosen oils with-out any engine modification.

Harshad. T. Magar[5] et al. Studied Undi based biodiesel is a non-edible fuel suitable for petrol & diesel engines. Transesterification process is used for preparation of Undi biodiesel. The physical & chemical properties of Undi biodiesel is nearly same as diesel. Experimental investigation of Undi oil has been carried out to analyze emission, performance characteristics in diesel engine with blends in diesel (0%,20%, 40%, 60%) by changing compression ratio and engine load. The emissions from the diesel engine calculated with the help of smoke meter & gas analyzer. We can change compression ratio & engine load of diesel engine without any major modifications in variable compression ratio (VCR) diesel engine

Ashish. G. Bandewar[6] et al. Investigated that Diesel engines provide important fuel economy and durability advantages for heavy-duty trucks, buses, non-road equipment, passenger cars and heavy-duty applications. Inspite of the various advantages diesel engines possess, they also have disadvantages of emitting significant amounts of particulate matter (PM) and oxides of nitrogen (NOx) and to a lesser amount, hydrocarbon (HC), carbon monoxide (CO), and toxic air pollutants. [1, 2]Biodiesel is attractive since it can be used in diesel engines without modification, easy and effective blending with pure diesel and cleaner emission profile compared to diesel fuel.

Mr. A. V. Jagtap[7] et al. investigated that The performance of vegetable oils can be improved by modifying them through the transesterification process. In their work, the performance of single cylinder water-cooled diesel engine using blends of diesel blended with undi biodiesel as fuel was evaluated for its performance and exhaust emissions. The fuel properties of biodiesel such as kinematic viscosity, calorific value, flash point, carbon residue and specific gravity were found. Results indicated that H25 has closer performance to diesel and H75 has lower brake thermal efficiency, mainly due to its high viscosity compared to diesel.

Ravi.S.D [8] et al. worked to study the performance, emission and combustion characteristics of Calophyllum Inophyllum (Surahonne) oil. The results were compared with diesel fuel, and the selected Calophyllum Inophyllum (Surahonne) oil fuel blends (10%, 20%, and 100%). For this experiment a single cylinder, four stroke, water cooled diesel engine was used.

H. Suresh Babu Rao[9] et al. considered biodiesel as a promising option as they are clean renewable fuels and best substitute for diesel fuel in any compression ignition engine. The important advantages of using biodiesel are its renewability and better quality of exhaust gas emissions. Therefore, the attention is shifted towards non-edible oils like Jatrophacurcas, Kanaja, Mahau, Calophyllum inophyllum etc.

Avinash. K. Hegde[10] et al. Studied biodiesel is mono alkyl esters of long chain fatty acids derived from renewable feed stock like vegetable oils and animal fats. It is produced by transesterification in which, oil or fat is reacted with a monohydric alcohol in presence of a catalyst. The process of transesterification is affected by the mode of reaction condition, molar ratio of alcohol to oil, type of alcohol, type and amount of catalysts, reaction time and temperature and purity of reactants.

D. Subramaniam[11] et al. investigated experimental study, performance, emission, and combustion characteristics of methyl esters of Punnai, Neem, Waste Cooking Oil and their diesel blends in a C.I. engine was experimentally examined. For the study, Punnai oil methyl esters (POME), neem oil methyl esters (NOME), and Waste Cooking Oil Methyl Esters (WCOME) were prepared by tranesterification process. The Bio diesel-diesel blends were prepared by mixing 10%, 30%, 50%, and 70% of bio diesel with diesel.

Chavan.S.B. [12] et al. focused on the collection of seeds and oil extraction then proceed for biodiesel production with molar ratio 8:1, KOH were 1.2wt%, tempreture 65oc, reaction time 90minutes were used and testing of parameters as per ASTM 6751 standards. The physical properties like acid value, density, Calorific value, Flash point, Fire point and Moisture, Viscosity shows of calophyllum methyl esters were0.702,892gm/cc, 37.18MJ/Kg, 1760c, 1820c and 0.01% . The physico-chemical parameters showed that Calophyllum may works as a sustainable feedstock for biodiesel production that is equivalent to fissile fuel as per ASTM 6751.

C. Srinidhi.[13] et al. studied The biodiesel derived from Honne oil is considered as one of the promising alternative fuel derived from non-edible sources. The aim of this paper is to evaluate the utilization of this fuel in diesel engine in maximum possible effective way. To find this, an experiment analysis of performance parameter (such as brake power, break specific fuel consumption, brake thermal efficiency and Exhaust Gas temperature) and emission characteristics (NOx, HC, CO. etc.) is obtained for various bio diesel and diesel blends and compared with ordinary diesel at various loads on a modified variable compression ratio CI engine. The results of the investigation shows that the performance and emission characteristics of the engine fuelled with Honne oil methyl ester – diesel blends is comparable to the ordinary diesel.

Dattatray A. Chavan [14] et al. studied The rapid depletion of petroleum in the world, increasing fuel prices and the environmental problems has triggered the need of alternatives and renewable energy sources. Combustion of fuel results in the emission of carbon dioxide (CO2) and other harmful pollutants. This results in increasing the global CO2 level and global warming. The harmful pollutants not only affect on the environment but also on human being. This situation leads to seek turmeric leaf oil as an alternative fuel for diesel.

R. Bhaskar Reddy [15] et al. investigated the important factors which influence the performance and emission characteristics of D.I diesel engine is fuel injection pressure. honne oil has to be investigated in a constant speed, on D.I diesel engine with different fuel injection pressures. The scope of the project is to investigate the effect of injection pressures on a blend of 50% honne oil with 50% diesel and compare with pure diesel on performance and emission characteristics of the diesel engine. Two tested fuels were used during experiments like 100 % diesel and a blend of 50% honne oil mixing in the diesel. The performance tests were conducted at constant speed with variable loads. From experiment results it was found that with honne oil- diesel blend the performance of the engine is better compared with diesel.

B. K. Venkanna [16] et al. investigated experimentally the performance, exhaust emission and combustion characteristics of a direct injection (DI) diesel engine, typically used in agricultural sector, over the entire load range, when fuelled with neat diesel (ND) and blends of diesel fuel (D)/DMC/H/ kerosene (K). DMC/D/H/K blends have a potential to improve the performance and emissions and to be an alternative to ND. Experiments have been conducted when fuelled with H20 (20%H + 80%D), HK (20%H + 40%K + 40%D) and HKD5 (20%H + 40%K + 35D + 5%DMC) to HKD15 in steps of 5% DMC keeping H and K percentages constant. The emissions (CO, HC and smoke density (SD)) of fuel blend HKD15 are found to be lowest, with SD dropping significantly. The NOx level is slightly higher with HKD5 to HKD15 as compared to ND.

G. Deepankumar [17] et al. studied that Biodiesel can be extracted from vegetable oils and waste fats. The present work examined the use of Tamanu oil, a new possible source of alternative fuel for direct injection diesel engine. The biodiesel has been prepared from Tamanu oil by Trans-Esterification method.

## III. CONCLUSION

1) Wide study conducted on Undi Biodiesel.
2) Tranesterification and Trans-Esterification are common method of biodiesel production.
3) Researchers are used various optimization technique to optimize process parameters, in which Taguchi and SRM technique are mostly used.
4) Hence future scope is for new invented optimization techniques viz. Genetic algorithm and Ant colony optimization.

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