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A Review of Physical Properties, Emission and Performance Improvement Analysis of Biodiesel-Diesel Blends Obtained from Different Feedstocks

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Abstract - *In present scenario, the demand and consumption of fuel is increasing incessantly to fulfill the needs of the human beings. So humans have always worked towards finding and developing a fuel that overcomes the shortcomings that exists in current fuels. We focused our study to find a feedstock that will improve lubricity and decrease NOx. To study the same, we went through a deep study of more than fifteen feedstocks that can be blended with diesel so as to analyze the effect of these fuels on the engine. Our study brought us to the conclusion that Argemone has a better lubricating property than diesel, whereas Corn oil helps in reducing NOx. So the main motive of our study is to develop an oil that will help improve on both of these factors. This will help streamlining engine working.*

Key Words: **Biodiesel, Biodiesel-diesel blending, Performance, Emissions, Transesterification, Argemone.**

1.INTRODUCTION

Diesel engine has become a very essential part of today's generation. But it also contributes to the atmospheric pollution. A solution for reducing the environmental pollution and energy shortage can be achieved by a significant shift from the use of fossil fuel to renewable energy sources. Vegetable oils can be an important alternative to diesel oil, since they are inexhaustible, renewable and can be produced easily in rural areas. The inventor of diesel engine, Rudolf Diesel had predicted that the plant based oils would be used widely to operate diesel engines. This work was based on review and study of previous researches that have already been carried out to produce biodiesel using different feedstocks.

In this study we profoundly analysed and compared the feasibility of biodiesel produced from different feedstocks on the basis of their cost, availability, performance, combustion and emission parameters.

Numerous researches have been carried out already to enhance the performance and reducing the emission by using different approaches such as using neat biodiesel, mixing different biodiesels with diesel at various proportions, modifying some design features in fuel supply system and in combustion chamber, and adding some additives with diesel.

All diesel injection equipment do on a smaller extent rely on diesel as a lubricant, so it's vital to study what its lubricating properties are. In pumps of some of the fuel injection system the moving parts are self lubricated by the fuel it carries when the fuel moves through the pump. So if the fuel does not have a fair amount of lubricity or it has a tendency to lose its lubricating property over a short period of time, there might be an increase in the amount of wear and tear between metal parts that depend on fuel as lubricant. So the need arises to develop a fuel that overcomes this issue as low lubricity as low lubricity might increase the engine life.

So our in depth study on different feedstocks was based on to find a fuel that helps improve the above cause. Among them Argemone if blended with diesel gave best results based on the research papers we visited. So using this feedstock, we can reduce the problems caused by low lubricity of diesel.

Now results through various experiments show that concentration of NOx in an untreated diesel exhaust gases ranges from 50-1000 ppm. This can have a wide impact, ranging from our health to damaging our environment. So reducing these emissions are a matter of real concern. Hence we studied to find that based on the research work that we did, we concluded that Corn oil when blended with diesel shows good result i.e. emissions decreased by a fair amount.

So our motive now became clear to prepare a blend using Argemone and Corn oil in equal proportion. For this we went on to study mixing criteria that needed to be studied.

After a deep study on physicochemical properties and mixing criteria we concluded that the blend can be carried out without any difficulty.

2. LITERATURE REVIEW

- Biofuel development has got the attention of researchers in recent years solving the problem of depletion of fossil fuels [1].

- Vegetable oil is marked to be a potential source of energy that can substitute fossil fuels because of nearly comparable properties to that of diesel fuel. Moreover it is inexhaustible, renewable and it is readily available [2].
- There are many experimental investigations that has been conducted using vegetable oils as fuel in diesel engines. The challenges that are associated with biofuel production and how they relate to sustainable development goals and their targets were focused by Andre M.N. 2017 [3].
- The experimental investigations using different vegetable oils as fuel concluded that, there was a considerable reduction in thermal efficiency and NOx emission, and increase in CO and HC emissions. In some investigations, the use of diesel when blended with different vegetable oils resulted that there was a reduction in exhaust gas temperature and NOx emission with a slight increase in Carbon Monoxide emissions [4].
- The use of palm oil as fuel in compression ignition engines shows that the short term use of palm oil will improve the performance and emission levels considerably and the prolonged use will cause the carbon deposition and sticking of piston rings. The use of corn oil as fuel resulted in the reduction in filter clogging problem and also improved the engine performance and reduced the carbon deposits (Murayama T., 1984) [5].
- The use of cotton seed oil as fuel in CI engine without doing any modifications in the engine, concluded that the engine parameters needed some readjustments for getting maximum output power and highest thermal efficiency [6].
- The performance and emission investigations by using honge, neem and sesame oil methyl esters as fuel reported that the characteristics were almost similar to those of the engine using diesel as fuel [7].
- The higher viscosity of biodiesel caused a reduction in engine power and the lower calorific value of biodiesel increased the specific fuel consumption and decreased the combustion temperature [8].
- The use of biodiesel derived from rice bran oil reported the increase in NOx emission because of the existence of molecular oxygen in bio-diesel, and suggested that exhaust gas recirculation technique can be used for reducing NOx emission even though the exhaust gas recirculation increases the brake specific fuel consumption and the emissions of hydrocarbon, oxides of carbon and particulate matters [9].
- The experiment on diesel engine fueled with methyl esters of waste pork lard and diesel blends resulted in the reduction in NOx emission from the engine [10].
- The experimental study using linseed oil and mahua oil blended with diesel as fuel in CI engine, reported that the blending of 50% linseed oil with diesel increased the smoke density and decreased the brake specific energy consumption. The mixing of 30% mahua oil with diesel reduced the smoke density and increased the thermal efficiency [11].
- The use of argemone biodiesel-diesel blend in a 4-cylinder turbocharged intercooled, common rail direct ignition engine shows a significant reduction in exhaust emissions (excluding NOx) were observed at part load and high load up to 30% blending of argemone biodiesel in diesel. At low load, less NOx emissions, higher HC and CO emissions were observed for all biodiesel-diesel blends [12].
- Biodiesel was produced from corn oil and the performance, combustion and emission characteristics were evaluated in diesel engine using corn oil biodiesel blended with diesel at different proportions as fuel [13].

3. CONCLUSIONS

After the analysis of numerous past researches based on production of Biodiesel using different plant based feedstocks, we concluded that Argemone and Corn oil is the most feasible feedstock for Bio-diesel Production in India. Throughout the review and selection process, our study is concerned about various factors such as cost, availibility of feedstocks, physiochemical properties such as density, lubricity, cetane number, performance, combustion and emission characteristics. The major factors that contributed towards the feasibility of these feedstocks are -

- Corn and Argemone are easily available at low prices in India.
- Corn is very abundant in India, India is the 7th largest Producer of Corn in the world.
- It was observed that the physio-chemical properties of biodiesel produced from Argemone and Corn oil is much closer to diesel.
- Reduction in CO emissions in comparison to diesel fuel was observed in Argemone Oil Biodiesel-diesel blend.
- There was decrease in peak cylinder pressure for all blended fuels as compared with that of diesel.
- The amount of NOx present in the exhaust was less for all blended fuels when compared to that of diesel. Moreover, the NOx emission from the engine was decreased with the increase in blend ratio of corn oil biodiesel.

It is observed that if we follow all the steps of transesterification process sequentially, then production of biodiesel comprising of Argemone and Corn in equal proportion can be carried out. Since Argemone has a better lubricity than diesel and Corn oil emits less amount of NOx, so it is expected that the biodiesel so formed will

have both the properties i.e. high lubricity and less NOx emission, thus making it a feasible and a good alternative of diesel.

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