ISSN XXXX XXXX © 2018 IJESC

Research Article Volume 8 Issue No.6

Review Paper Biodiesel Research Work

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Abstract:
Bio-diesel being renewable, biodegradable and green fuel can reduce our dependence on conventional/ nonrenewable fossil fuels and it also helps to keep pure quality of air by reducing obnoxious automotive/vehicular emissions. Possible solution of this problem is to replace or find renewable and economically feasible fuel as an alternative source. Already a lot of work for source which fulfill the criteria of sustainability and economical carried out. But the waste is critical issues. So characterization and formation of biodiesel with zero waste is prime objective.

1. INTRODUCTION

The global energy crisis in recent years is due to significant bottleneck in the supply of energy resources to an economy. Numerous nations all-inclusive are yet reliant on petroleum derivatives as fundamental source of national power matrices and vehicles, and its expanding costs, for the most part considering limited resources accessibility and availability. Along these lines, the main conceivable answer for this emergency is to discover practical and monetarily plausible sources of alternative energy. There are numerous elective sources satisfy the maintainability model. However, few of this can fulfill the second criterion (economic feasibility). The best option, fulfilling both criteria - the biofuel - that extracted from abundantly available biomass resources. Biodiesel is a non-toxic, Sulphur-free, biodegradable, oxygenated and environment friendly alternate diesel source. Biodiesel (unsaturated fat alkyl esters) is an elective diesel fuel got from the response of vegetable oils or lipids and liquor with or without the nearness of an impetus. Biodiesel is its biodegradability and being more ecological neighborly than of the petroleum products, making less natural effect upon unplanned discharge the earth. Biodiesel fuel is made through - transesterification. This procedure includes expelling the glycerin from the vegetable oil or fat. Amid the procedure, byproducts are methyl esters and glycerin. So, to reduce and form zero waste in process is objective. In most recent few decades, critical endeavors have been made by scientists to utilize distinctive sources demonstrated the utilization of straight vegetable oils is confined by some troublesome physical properties, especially their thickness. Because of higher thickness, the straight vegetable oil causes poor fuel atomization, fragmented ignition and carbon statement on the injector and valve seats bringing about genuine motor fouling. One possible method to overcome the problem of higher viscosity is blending of vegetable oil with diesel in proper proportion, and the other method is transesterification of oils to produce biodiesel. Transesterification - This process involves removing the glycerin from the vegetable oil or fat. In which byproducts left behind includes methyl esters and glycerin. So, to reduce and form zero effluent in process is objective.

2. LITERATURE REVIEW

In the recent years, serious efforts have been made by several researchers to use different sources

Ma F, Hanna MA [1999]: Showed the use of straight vegetable oils is restricted by some unfavorable physical properties, particularly their viscosity. Due to higher viscosity, the straight vegetable oil causes poor fuel atomization, incomplete combustion and carbon deposition on the injector and valve seats resulting in serious engine fouling. One possible method to overcome the problem of higher viscosity is blending of vegetable oil with diesel in proper proportion, and the other method is transesterification of oils to produce biodiesel. [2]

Peterson CL et.al [1992-1999]: It was reported that the transesterification process has been proven worldwide as an effective means of biodiesel production and viscosity reduction of vegetable oil. Temperatures, catalyst type, concentration ratio of alcohol to fuel and stirring speed rate have been observed to influence transesterification process to a greater extent.[3]

Masjuki HH et.al [2000]: A brief study was conducted on the use of biodiesel from coconut oil (50/50 blend), ‘‘B50” in motor coaches. This study revealed that it is a viable and a practical alternative fuel for older in-service engines. Particulate matter was almost negligible with the use of this fuel. Operators reported that the test vehicles had no noticeable drivability downsides. On the other hand, it was observed that thevehicles had some improved power performanc e while operating under city traffic conditions. [4]

Ramadhas AS et.al. [2005]: It found that no significant engine problems were reported in tests with urban bus fleets running on B20. Fuel economy was comparable with diesel fuel and the fuel consumption of biodiesel blend being merely 2–5% higher than that of conventional diesel. Ester blends have been distinguished as stable, and did not separate at room temperature over a period of three months. One limitation to the use of biodiesel is its tendency to crystallize at low temperatures below 0^0C. [5]

Wagner et al. [1984]: Conducted 200 h engine tests with soybean oil ester fuel on John Deere (4239T Model) engine. It was reported that the engine performance with methyl, ethyl and butyl esters was nearly the same as that with diesel fuel. Emissions of oxides of nitrogen were significantly higher for the esters. It concluded that the esters could be used on a short-term basis, and that further testing to be done for determining long-term ester fuel effects. [6]

Ryan and Bagby [1993]: Found that the vegetable oils (peanut, sunflower, cottonseed and soybean oils) exhibit characteristics opposite to those expected in most other fossil fuels. For this purpose, an alternative liquid fuel that will blend

readily with diesel fuel is required Many researchers have studied performance and emission characteristics of Undi oil blended with diesel. Undi is a species of family Guttifereae (Clusiaceae), native to India, East Africa, Southest Asia, Australia and South Pacific. Commonly it is called as „Indian laurel", Alexandrian Laurel, Beach calophyllum, Beauty leaf, Pannay tree, Sweet Scented Calophyllum (in English), Undi, Pongnyet, Burmese, Hawaii, Kokani, Nagachampa, (in Marathi), Sultan ChampaSurpan (in Hindi), Nagam, Pinmai, Punnagam, Punnai, Pinnay, Namere (in Tamil). [8]

C. Srinidhi et al. [2014]: Performed 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 show that the performance and emission characteristics of the engine fueled with Honne oil methyl ester – diesel blends are comparable to diesel. [9]

Bawane et al. [2014]: Performed experimental work to obtain the operating and emission characteristics of Undi Oil Biodiesel on Variable 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 without any engine modification. [10]

Bawane et al. [2014]: Experimental Investigation of Performance Characteristics of Calophyllum Inophyllum Biodiesel in CI Engine by Varying Compression Ratio. An experiment was conducted to obtain the operating characteristics of the variable compression ratio (VCR) engine run on biodiesel made from calophyllum inophyllum oil, at various compression ratio, and the results are compared with diesel. From the comparison of results, it is inferred that the engine performance is improved with significant reduction in emissions for the chosen biodiesel without any engine modification. [11]

Anil .K. Rajvanshi et al. [2007]: Evaluated the prospect of biofuel in India for energy purposes, using agricultural material. A strategy isdeveloped so that from a given piece of land maximum bioenergy and remuneration to the farmer's results. Thus, the values of the product of bio-energy and net returns (BENR) were estimated for the different cropping systems evaluated. It is shown that with this strategy not only the country can become self-sufficient in edible oil but will also have the potential of taking care indigenously of a substantial proportion of its energy need. [12]

S.Sundarapandian and G.Devaradjane et al. [2007]: Assessed the execution attributes, ignition parameters and outflows of vegetable oil esters like Jatropha, Mahua and Neem Oil esters. From the outcomes, it has discovered that the warmth discharge and work done decreased by around 4% for Jatropha, 5% for Mahua and 8% for Neem oil esters when contrasted with diesel. From the examination, it has reasoned that the execution of vegetable oil esters is great. In this manner, the created show is exceptionally good for reenactment work with bio diesel as elective fuel [13]

Chavan S B et al. [2013]: Conducted an experiment, concluded that there is a best source as a raw material – Undi Oil for biodiesel production. Seed characterization - Fresh seeds contains moisture 12%, the available oil percentage in Undi seeds is 55-75%. As per practical trial, recorded 52% of oil. Physico- chemical Properties - The fresh extracted crude oil is greenish yellow and it get darkened during the storage. [16]

G Basavaraj et al. [2012]: In this work, the policy framework to promote the biofuel sector in India is very encouraging, experience has shown that the government's initiatives have not translated into results on the production and commercialization fronts to meet the country's energy demand. [17]

3. LITERATURE OUTCOMES

This review paper provides good techniques that can be applied the work. Reading the literature reviews helped to clarify understanding of transesterification. Literature review gives the best idea to formulate new methodology and techniques for proposed work and which will be best suitable for further research in current field. This scrutiny gives stimulation for research work to generate new methodology to find out bi1odiesel with zero effluent discharge.

4. PROBLEM STATEMENT

In current globalization era, there in exponential demand of fossil fuels, that's even getting worse with increasing population and urbanization. Apart from air pollution Fossil fuel usage also causes global-warming due to greenhouse gases emission. As such, the situation demands for an alternate source of energy that can be used to overcome the speculated energy crisis. If the energy source is clean and renewable, it will reduce the environmental trouble as well. In the quest an alternate and renewable energy resources, scientists have plead with a variety of options among which biodiesel-diesel blends as alternative fuels has become a popular option and is getting the attention of many researchers. This is because scientists have enlisted the properties of biodiesel prepared from vegetable oils are very close to commercial diesel and thus it has a promising future as an alternative fuel for diesel engine. Biodiesel being renewable, biodegradable and green fuel can reduce our dependence on conventional/ nonrenewable fossil fuels and it also helps to keep pure quality of air by reducing obnoxious automotive/vehicular emissions. Possible solution of this problem is to replace or find renewable and economically feasible fuel as an alternative source. Already a lot of work for source which fulfill the criteria of sustainability and economical carried out. But the waste is critical issues. So, characterization and formation of biodiesel with zero waste is prime objective.

5. METHODOLOGY

Biodiesel creation is the way toward delivering biofuel, biodiesel, through compound responses transesterification and esterification. This includes vegetable or creature fats and oils being responded with short-chain alcohols (regularly methanol or ethanol). The alcohols utilized ought to be of low atomic weight, ethanol being a standout amongst the most utilized for its ease. In any case, moreprominent transformations into biodiesel can be obtained utilizing methanol. Although either acids or bases can catalyze the transesterification reaction, the most common means of production is base-catalyzed transesterification. This way has bring down response times and impetus cost than those postured by corrosive catalysis. In any case, antacid catalysis has the impediment of its high affectability to both water and free unsaturated fats exhibit in the oils. The major steps required to synthesize biodiesel are as follows: **Feedstock pretreatment** - Normal feedstock utilized as a part of biodiesel generation incorporate yellow oil (reused

vegetable oil), "virgin" vegetable oil, and fat. Reused oil is prepared to expel polluting influences from cooking, stockpiling, and dealing with, for example, soil, burned nourishment, and water. Virgin oils are refined, however not to a sustenance review level. Degumming to expel phospholipids and other plant matter is normal, however refinement forms shift.[2][3] Regardless of the feedstock, water extracted, as its presence during base-catalyzed transesterification causes the triglycerides to hydrolyze, giving salts of the fatty acids (soaps) instead of producing biodiesel.

Determination and treatment of free fatty acids - A sample of the cleaned feedstock oil is titrated with a standardized base solution in order to determine the concentration of free fatty acids (carboxylic acids) present in the vegetable oil sample. These acids are then either esterified into biodiesel, esterified into glycerides, or removed, typically through neutralization.

Reactions - Base-catalyzed transesterification responds lipids (fats and oils) with liquor (regularly methanol or ethanol) to deliver biodiesel and a tainted coproduct, glycerol. In the event that the feedstock oil is utilized or has a high corrosive substance, corrosive catalyzed esterification can be utilized to respond unsaturated fats with liquor to create biodiesel. Different strategies, for example, settled bed reactors, supercritical reactors, and ultrasonic reactors, do without or diminish the utilization of concoction impetuses.

Product purification - Products of the reaction include not only biodiesel, but also byproducts, soap, glycerol, excess alcohol, and trace amounts of water. All of these byproducts must be removed to meet the standards, but the order of removal is process-dependent. The thickness of glycerol is more prominent than that of biodiesel, and this property contrast is misused to isolate the greater part of the glycerol coproduct. Residual methanol is typically recovered by distillation and reused. Soaps can be removed or converted into acids. Residual water is also removed from the fuel.

Transesterification - In natural science, transesterification is the way toward trading the natural gathering R″ of an ester with the natural gathering R′ of a liquor. These responses are frequently catalyzed by the expansion of a corrosive or base impetus. [18] The response can likewise be expert with the assistance of proteins (biocatalysts) especially lipases.

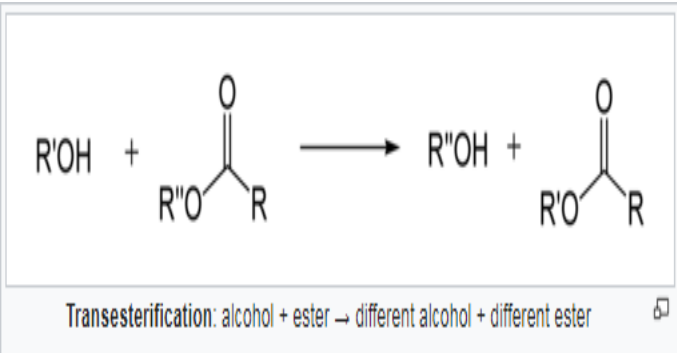

Figure .1. Transesterification[21]

Strong acids catalyze the reaction by donating a proton to the carbonyl group, thus making it a more potent electrophile, whereas bases catalyze the reaction by removing a proton from the alcohol, thus making it more nucleophilic. Esters with larger alkoxy groups can be made from methyl or ethyl esters in high purity by heating the mixture of ester, acid/base, and large alcohol and evaporating the small alcohol to drive equilibrium. Transesterification process can be applied in fields such as Polyester production[19], High pressure transesterification [20] and most importantly in Methanolysis and Biodiesel production.[21]

6. EXPERIMENT VISUALIZATION

The transesterification is the response amongst oil and fat, with a short chain liquor (methanol, ethanol, and propanol) within the sight of reasonable impetuses in the transesterification response, as they give high generation yield. Few researchers have worked feedstock having higher FFA levels using alternative processes. But there are certain exceptional cases wherein direct trans-esterification cannot be performed. Such cases appear in raw vegetables oils (non-edible oils) like Karanja, Jatropha, Mahua, Castor, Neem, Cotton seed, and Thumba i.e. Citrulluscolocynthisschard. Because these non-edible oils possess high free fatty acids (FFA). For deciding if the crude vegetable oils can be transesterified straight forwardly, the corrosive esteem is the most vital property that must be known. Oils of high free unsaturated fats substance can be changed over into biodiesel by means of double step transesterification process. In the initial step, the oil is dealt with by a corrosive broke down in methanol to lessen FFA content, while in the second step the preheated oil is transesterified with methanol within the sight of base impetus calcium oxide (framed from calcinations) to shape biodiesel with zero waste.

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