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## BIODIESEL - A RENEWABLE SOURCE OF ENERGY

*J.Devarenjan<sup>\*1</sup>, J.Billgates<sup>2</sup>, G.M.Joselin Herbert<sup>3</sup>*

*<sup>\*1,2</sup>Student, Department of Mechanical Engineering, St. Xavier's Catholic College of Engineering, Chunkankadai, Nagercoil, India.*

*<sup>3</sup>Professor, Department of Mechanical Engineering, Noorul Isalm Centre or Higher Education, Kumarakoil, India.*

### Abstract:

Energy is essential and vital for development and global economic growth. The use of fossil fuels for energy needs is highly discouraged due to its depleting nature and also for its contribution for greenhouse gases emission to the environment. So there is a need to find out an alternative fuel to fulfill the energy demand of the world. Biodiesel is one of the best available sources to fulfill the energy demand of the world. Renewable and carbon neutral biodiesel are necessary for environmental and economic sustainability. Biodiesel for agro products is one such fuel source, which is viable and expanding as an alternate source for fossil fuels. A vast majority of the scientists reported that short-term engine tests using vegetable oils as fuels were very promising but the long-term test results showed higher carbon built up and lubricating oil contamination is resulting in engine failure. They concluded that vegetable oils, either chemically altered or blended with diesel to prevent the engine failures. In 2001, a 6-megawatt backup power system that is entirely fuelled by biodiesel installed at the UC Riverside.

**Key words:** Biodiesel, trans-esterification, blended, oil, renewable source.

### I. INTRODUCTION

It is believed that global climate change is currently the foremost pressing global environmental problem. Many voluminous people could lose their lives and up to 1 million species could become extinct if the common global temperature increases by over 20C [1]. It's widely accepted that using fossil fuels has caused global warming; therefore fossil fuels as a source of energy should get replaced with renewable, clean energy sources to cut back CO<sub>2</sub> and greenhouse emission emissions [2]. Other detrimental effects of world warming include a possible increase in water level and subsequent submerging of lowlands, deltas and islands, further as changing of weather patterns [3]. Another issue is that the energy crisis, during which the planet suffers from lack of energy security because of depletion of the finite fuel resources. The continued use of fossil fuels as a primary source of energy is now well known to be unsustainable due to depleting resources and also the contribution of those fuels to environmental pollution [4]. The petroleum is that the one in all the important & necessary fuel within the development of business growth, transportation and agricultural sector and to satisfy many other basic human needs. However these fuels are the renewable fuels and its quantity is decreasing day to day thanks to the over usage of fuels. India is importing quite 80% of its fuel demand and spending an outsized amount of economy to import fuel from other countries. Nowadays Bio diesel is one in all the trendy and a horny fuel because of the depleting nature of fuel resources. The trans-esterification process which is employed while preparing the Bio diesel is reduce the viscosity of the fuel. But just in case of oil it's high viscosity and low volatility, which causes poor combustion in diesel engines. The method of removing the glycerides and mixing oil esters of edible fat with alcohol is termed as trans-esterification. The Trans-esterification process is employed to scale back the viscosity to a worth admire that of diesel and hence improves combustion. Compared to Diesel, the Biodiesel will reduce the emission of fewer pollutants over the entire air mixture [5].

### II. PRODUCTION OF BIODIESEL

Consistent with the Researchers and scientists, there are different methods for biodiesel production from different bio fuels. a quick review of those methods has presented here. Most of the researchers/ scientists reported that the assembly of biodiesel was more when the method was used a catalyst. Ahn etal followed only a two-step reaction process for the assembly of biodiesel [6]. From these methods canola methyl ester (CME), rapeseed methyl ester (RME), linseed methyl ester (LME), tallow ester (BTE) and sunflower methyl ester (SME), which are synthesized during a batch reactor using caustic soda, hydrated oxide and by using the sodium meth oxide as catalysts. By using two-stages, Cvengro and Povaz described biodiesel production by the low-temperature trans esterification of cold pressed rape seed oil with methanol at the upper temperatures of about 708°C [7]. A replacement enzymatic method which is employed for synthesizing methyl esters from plant oil and methanol in a very solvent-free reaction system was developed by Masaru etal [8]. In the same year, Uosukainen etal presented statistical and experimental

design to judge interdependence of process variables in enzymatic trans-esterification [9]. The authors also studied the alcoholysis of colza oil methyl ester (biodiesel) [10]. The biodiesel production was reviewed by Fangrui and Hanna Samukawa et al investigated the consequences of the pretreatment of immobilized *Candida antarctica* lipase enzyme (Novozym 435) on methanolysis for biodiesel fuel production from soybean [11]. Waste frying oils transesterification was studied by Felizardo et al. with the aim of achieving the most effective conditions for Bio diesel production [12]. Within the same year, an integrated method for the assembly of biodiesel from micro algal oil was introduced by Miao and Wu [13]. Zhu et al employing a heterogeneous solid super base catalyst (calcium oxide) produced biodiesel from *Jatropha curcas* oil [14]. Al-Zuhair et al discussed the effect of carboxylic acid concentration and water content on the assembly of biodiesel [15].

### III.COMBUSTION

The equipment on the fashionable ICE isn't designed to use Bio-diesel as fuel. But just in case of the many of the heavy duty engines are designed to run with the Bio-diesel blends B20 [16]. Traditional direct injection fuel systems of the engines were operated roughly at 3,000 psi at the injector tip but just in case of contemporary common rail equipment operates upwards of 30,000 PSI at the injector tip. The Components of the engines are designed to work at a better temperature range, from below freezing to over 1,000 °F (560 °C). Diesel oil is predicted to burn efficiently and produces as few emissions as possible. The common emission standards are being introduced to internal-combustion engines; we've the requirement to manage harmful emissions that are being designed into the parameters of diesel engine fuel systems. The normal inline injection system is more forgiving to poorer quality fuels as critical the common rail equipment. The upper pressures and tighter tolerances of the common rail system allows for greater control over atomization and injection timing. This control of atomization still as combustion allows for greater efficiency of contemporary diesel engines yet as greater control over emissions. Components within a diesel oil system interact with the fuel in an exceedingly thanks to ensure efficient operation of the equipment then the engine. If an out-of-specification fuel is introduced to a system that has specific parameters of operation, then the integrity of the equipment is also compromised. A number of these parameters like spray pattern and atomization are directly associated with injection timing [17]. One study found that biodiesel and its blends produced droplets were greater within the diameter than the droplets produced by traditional petro diesel during atomization. The smaller droplets were attributed to the lower viscosity and physical phenomenon of traditional petrol. The droplets which are found at the periphery of the spray pattern were larger in diameter than the droplets at the middle this was attributed to the faster pressure drop at the sting of the spray pattern; there was a proportional relationship between the droplet size and also the distance from the injector tip. The best spray penetration was found that B100, this was attributed to the greater density of B100 [18]. If the droplets size is larger than it may be ends up in inefficiencies during the combustion, increased emissions, and also the horse power is decreased. In another study it had been found when injecting biodiesel that there's a brief injection delay. This injection delay was attributed to the greater viscosity of Biodiesel. it had been noted that over traditional petro diesel, the Bio diesel has higher viscosity and therefore the greater cetane rating cause poor atomization, likewise as mixture penetration with air during the ignition delay period. Another study noted that this ignition delay may aid in a very decrease of NOx emission [19].

### IV.PROPERTIES

Biodiesel has promising lubricating properties and cetane ratings compared to low sulfur diesel fuels [20]. counting on the engine, this clarification needed might include high injection pumps; pump injectors (also called unit injectors) and fuel injectors. Older diesel Mercedes are popular for running on biodiesel is about 37.27 MJ/kg [21]. The calorific value of biodiesel which is 9% below regular petrol and diesel. A variation in biodiesel energy density is more hooked in to the feedstock used than the assembly process. Still, these variations are but for petro diesel [22]. It's been claimed biodiesel gives better lubricity and more complete combustion thus increasing the engine energy output and partially compensating for the upper energy density of petro diesel [23].

Depending on the assembly method, the colour of biodiesel ranges from golden to dark brown. It slightly miscible with water contains a high boiling point and low pressure. The flash point of biodiesel (>130 °C, >266 °F) is significantly above that of petroleum diesel (64 °C, 147 °F) or gasoline (-45 °C, -52 °F). The density of the Bio-diesel is ~ 0.88 g/cm<sup>3</sup>, beyond petro diesel (~ 0.85 g/cm<sup>3</sup>) [24]. Biodiesel contains virtually no sulfur, and also the Bio-diesel is commonly used as an additive to Ultra-Low Sulfur Diesel (ULSD) fuel to supply an aid with lubrication, because the sulfur compounds which are present within the petro diesel provide much of the lubricity [25].

## V. ADVANTAGES

### Micro algal oils

- The constituent that's present within the fatty acids is analogous thereto of vegetable oils.
- Under some condition, the constituent present in them is also as high as 85% of the dry weight.
- Short-time growth cycle currently
- The composition of micro algae present in them are going to be relatively single

### Bacteria oils

- The growth occurs at the faster rate.

### Oleaginous yeasts

- Resources which are present are abundant within the nature.
- In some species high oil content is required.
- The growth cycle is incredibly short time.
- Strong capability of growth is required in several cultivation on conditions
- The scrap fibers are converted and utilized to yield useful oils and also the others currently

### Waste oils

- The waste oils are the lowest when put next to the crop oils [26].

## VI. DISADVANTAGE

- The fuel value of most of the algae lipids are below that of diesel
- When compared to common crop oils, the price of cultivation is extremely higher.

### Bacteria oils

- Most of bacteria cannot yield lipids but complicated lipoid

### Oleaginous yeasts

- Filtration and cultivation of yeasts and mildews will occurs with high-content oils
- The oil which is extracted from oleaginous yeasts and mildew may be a complex process.
- When compared to the common crop oil, the value of cultivation is incredibly high

### Waste oils

- When a substance containing lot of saturated fatty acids then it's hard to be converted to biodiesel by catalyst [26].

## VII. APPLICATIONS

- In most of the injection pump in diesel, Bio diesel will be utilized in the pure form or it's going to be blended with petrol.
- Depending on the manufacturer, the new extreme high-pressure (29,000 psi) common rail engines have strict factory limits of B5 or B20.
- The solvent properties of Bio diesel is differ from that of petro diesel, it'll degrade the rubber gaskets and also the hoses within the vehicles and it'll tend to wear out normally. But now it's replaced by FKM, which is non-reactive to the Bio diesel.
- Biodiesel has been accustomed break down deposits of residue within the fuel lines where petro diesel has been used [27]. As a result, fuel filters may become clogged with particulates if a fast transition to pure biodiesel is formed. Therefore, it's recommended to alter the fuel filters on engines and heaters shortly after first switching to a biodiesel blend.
- Biodiesel is additionally employed in rental generators.

## VIII. VEHICULAR USE AND MANUFACTURER ACCEPTANCE

In 2005, with 5% biodiesel blends, indicating a minimum of partial acceptance of biodiesel as an acceptable diesel fuel additive was released by the Chrysler (then part of DaimlerChrysler) the Jeep Liberty CRD diesels from the factory into the eu market [28]. In 2007, DaimlerChrysler indicated its intention to increase warranty coverage to twenty biodiesel blends if biofuel quality within the U. S. could also be standardized [29]. The Volkswagen Group has released a release indicating that several of its vehicles are compatible with B5 and B100 made of rape seed oil and compatible with the EN 14214 standard. The use of the desired biodiesel type in of Biodiesel its cars won't avoid any warranty [30].

Mercedes Benz doesn't allow diesel fuels containing greater than 5% biodiesel (B5) due to concerns about production shortcomings [31]. Any damages caused by the use of such non-approved fuels won't be covered by the Mercedes-Benz Limited Warranty [32].

Starting in 2004, the town of Halifax, Nova Scotia decided to update its bus system to allow the fleet of city buses to run entirely on a fish-oil based biodiesel [33]. This caused town some initial mechanical issues, but after several years of refining, the full fleet had successfully been converted [34].

In 2007, McDonald's of UK announced it'd start producing biodiesel from the waste oil byproduct of its restaurants. This fuel which is produced from the oil byproducts of the restaurants are accustomed run its fleet [35]. The 2014 Chevy Cruze Clean Turbo Diesel, direct from the factory, are rated for up to B20 (blend of 20% biodiesel / 80% regular diesel) biodiesel compatibility [36].

## IX. RAILWAY USAGE

The UK's first "biodiesel train" was operated by Brits train operating company Virgin Trains which was converted to run on 80% petrodiesel and 20% biodiesel [37]. On 15 September 2007 the Royal Train completed its ever journey to run on 100% biodiesel fuel which was supplied by Green Fuels Ltd. Prince Charles and James Hygate who is that the choice maker of Green Fuels were the first passengers on a train fueled which is entirely by biodiesel fuel.

Since 2007, the Royal Train has operated successfully on B100 which is principally uses Bio diesel because the most fuel [38]. Similarly, during the summer of 2008 a state-owned short-line railroad in eastern Washington ran a test of a 25% biodiesel / 75% petro diesel blend, purchasing fuel from a biodiesel producer which is sited along the railroad tracks [39]. The train is powered by biodiesel made partially from canola grown in agricultural regions through which the transportation runs.

In 2007, Disneyland began running the park trains on B98, which is principally operated on 98% of Bio diesel. In 2008, due to variety of the storage issues, the program was discontinued, but in 2009 January, it absolutely was announced that the park would then be running all trains on biodiesel manufactured from its own used cooking oils. This could be the one of the change from running the trains on soy-based biodiesel [40]. In 2007, the historic Mt. Washington railway line added the first biodiesel locomotive train to its all-steam locomotive fleet. The fleet has climbed up the western slopes of Mount Washington in New Hampshire since 1868 with a peak vertical climb of 37.4 degrees [41]. 5% biodiesel are visiting be utilized in Indian Railways' Diesel Engines which is announced by the Indian Railway Minister D.V. Sadananda Gowda on 8 July 2014 [42].

## X. AIRCRAFT USE

Czech jet aircraft has tested a flight that has been completely powered by the biodiesel [43]. Other recent jet flights also use Biofuel, however, some using other kinds of renewable fuels. The world's first commercial aviation flight on a microbially derived biofuel using Solajet was launched by United Airlines flew on November 7, 2011 Solazyme's algae-derived renewable jet fuel. The Eco-skies Boeing 737-800 plane was fueled with 40 percent Solajet and 60 percent petroleum-derived jet fuel [44].

In September 2016, the Dutch flag carrier KLM contracted Alt Air Fuels to produce all KLM flights departing la International Airport with biofuel. For the next three years the Paramount, California-based company will pump biofuel on to the airport from their nearby refinery [45].

## XI. BIODIESEL IN GENERATORS

In 2001, a 6-megawatt backup facility that's entirely fueled by biodiesel installed at the UC Riverside. So on avoid the damaging blackouts of critical operations at the expense of high pollution and emission rates the companies has to launch Backup diesel-fueled generators. By using these generators were ready to essentially eliminate the byproducts that result in smog, ozone, and sulfur emissions [46]. After we use these generators in residential areas around schools, hospitals, and also the final public it'll winds up in substantial reductions in poisonous CO gas and stuff. Several techniques are used for the conversion of biomass into bio fuel within the three states of solid, liquid and gas [48].

## XII. CONCLUSION

The worldwide energy crisis has necessitated the searched for alternative environmentally friendly energy sources. Within the last 20 years attention had shifted to research in developing and optimising technology in biofuels as a sustainable alternative although 350 oil-bearing crops are identified, only few are potential biodiesel like sunflower, rapeseed, palm and jatropha. It's observed that biodiesel has similar combustion characteristics as diesel and also found that the underside catalyst performs better than acid catalyst and enzymes [47]. it is also inferred that the engine performance was inferior when using vegetable oil/ diesel blend because the high viscous oil caused injector coking and contaminated the oil. The tests with refined oil blends indicated considerable improvement in performance. The emission of un- burnt hydrocarbon from the engine was found to be more on the all the fuel blends as compared to diesel. The emission of oxides of nitrogen from the engine found to be higher on the all fuel blends as compared to diesel.



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GuanHua Huang a, Feng Chen b,c, Dong Wei c, XueWu Zhang c, Gu Chen c a School of Chemical Engineering and Technology, China University of Mining and Technology, China b School of Biological Sciences, The University of Hong Kong, Pokfulam, Hong Kong, China c College of Light Industry and Food Sciences, South China University of Technology, Guangzhou, China
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