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Potential and challenges for large scale application of biodiesel in automotive sector

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Abstract: This Biodiesel is getting important consideration internationally as a possible alternative fuel for substituting mineral diesel partly or completely. In this review paper, best noticeable technique of biodiesel manufacture commercially, life cycle study and economic issues related to biodiesel. As an alternative fuel for partial or complete replacement of mineral diesel, biodiesel receives worldwide significant publicity. In this review paper there are comparatively highlighted the most significant method of commercial biodiesel processing, lifecycle investigation and economic problems in relation to biodiesel, engine quality, combustion and emission characteristics including difficulties of particulate motor compatibility and biodiesel uses in the wear of motor parts and lubrication oil.

Keywords — Biodiesel, Economic analysis, Feed stock, oil reservoir.

I. INTRODUCTION

As the global population increases day by day, by 2050, it is predicted to exceed 9 billion. The higher quantity of fuel required to meet the need for energy for this population [1]. The numerical review presented that the world's total confirmed oil reserves in 2014 exceeded more than 1700 billion barrels T.

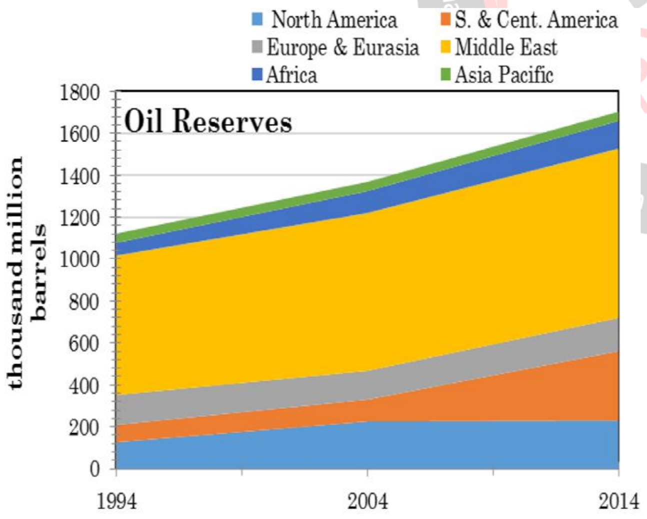

Fig.1. Distribution of global oil reserves (adopted from [2]

Emission characteristics. A variety of techniques and feedstock's used in biodiesel in automotive diesel engines are employed successfully so that high quality biodiesel can be generated at an appropriate rate.

Numerous studies are performed and published in the open-ended biodiesel journal. [9] Resumed research conducted between 2000 and 2011 by Xue et al. The focus of this analysis was on effects of biodiesel on power production(Fig. 1). these reserves are entirely in excess of 2050. As per previous experience, these estimates are only tentatively based and, as mentioned, not accurate. This will decrease in 2050 years if energy consumption rises in the future. These energy resources require better sources of alternatives and decreased pollution to reduce the temperature of the earth. The planet is gaining interest in some recent year's biofuel as an alternative fuel. Biofuel is a good choice since it is a fossil fuel substitute and also lowers overall emissions. It also has the possibility of generating new jobs [2].

It requires sustainable, reliable, economical, and less polluting alternative fuels than traditional. [3, 4]. In the biofuel industry from recent decades there have been a variety of innovations. Important production involves all biofuel forms of ethanol and biodiesel. These biofuels are generally accepted, since no significant modification necessary in the engine is necessary for the use of these biofuels and the production process of those biofuels are simple and large-scale [3, 5]. Some thermal characteristics are near normal mineral diesel, such as cetanium count, heat value, and biodiesel volume characteristics. Physical properties such as pour point, viscosity, density have some variations. Biodiesel also has 10-15% lower heat value than diesel density and viscosity [6-8]. Biodiesel can be manufactured from several feedstocks and the biodiesel characteristics depend on the feedstock types used. The characteristics of biodiesel affect motor performance and fuel consumption of engines. Further research by pinzi et al [10] has concentrated on low-cost biodiesel production of

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non-edible oil seeds. Knothe and Razon[11] demonstrate the experimental studies in biodiesel production techniques on the effect of the FFA profile and feedstock. The cold flow effect on biodiesel and engine system was reviewed by Monirul et al [12]. Examine the effect of cold flow on biodiesel and engine systems. Imdadul et al. [13] study biodiesel combustion and its diesel engine blend. Moster [14] investigated different forms of biodiesel processing techniques. Sharma et al [15] are studying biodiesel processing kinetics and biodiesel stability aspects. Another shameful researcher [16] is reviewed by multiple engines using different feedstock to analyze working conditions for engine emissions.

Most of these reviews are on a very small biodiesel canvas and do not get a full image. Biodiesel usage, engine efficiency, burning parameters, emissions characteristics, the injection of fuel, wear and lubrication of oil degradation are required to this degree.

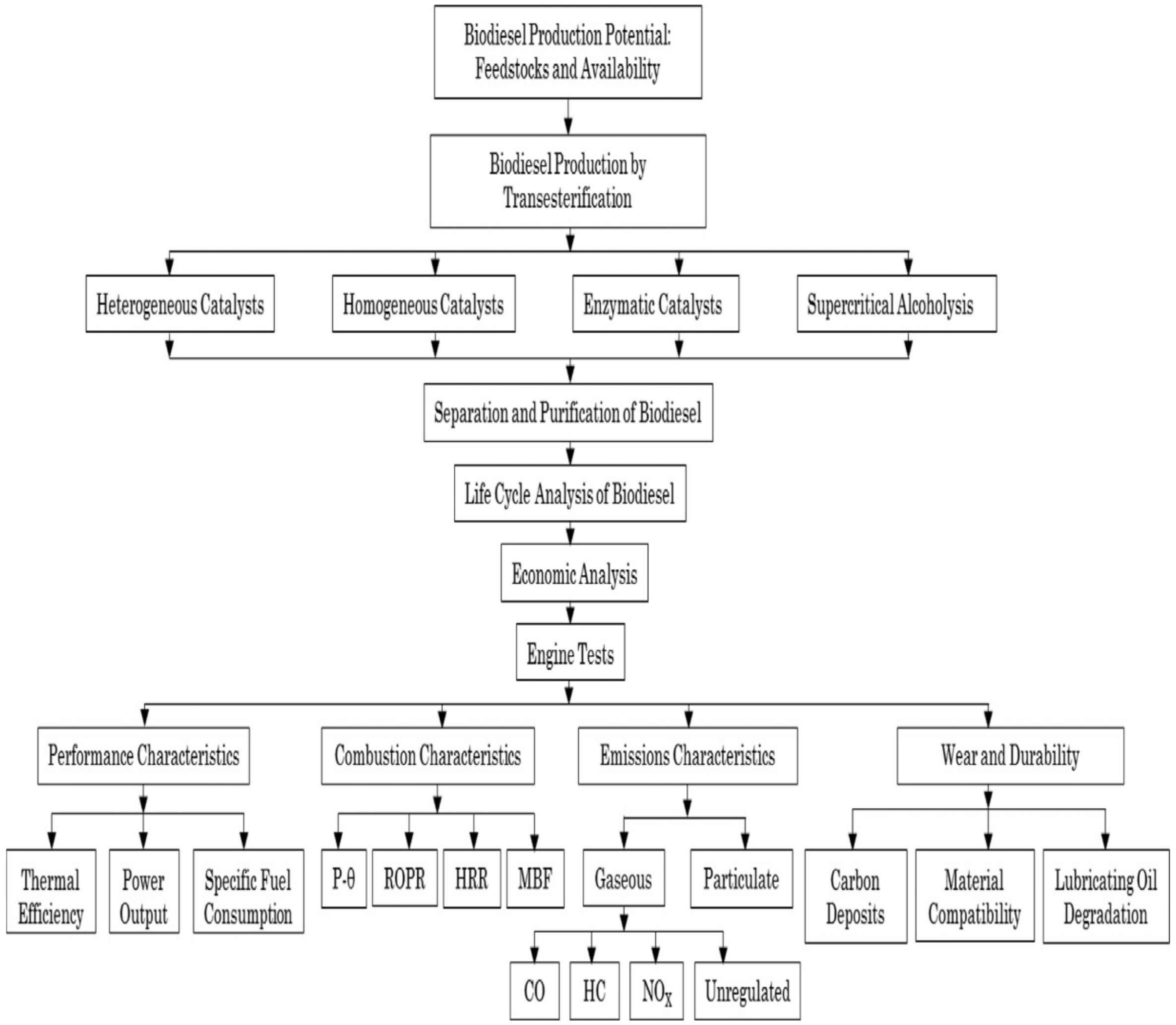

Fig. 2. Biodiesel landscape enclosed in this review paper

II. MANUFACTURE POTENTIAL FOR BIODIESEL: FEEDSTOCK AND AVAILABILITY

The biodiesel obtained from straw vegetable oil, such as sunflower, soybean, pongamy, jojoba, flax, palm, coconut, jatropha, waste vegetable oil, mustard etc.

Different countries use different biodiesel varieties depending on available feedstock type. Table 1[17] offers a country-specific list of feedstocks used in biodiesel.

Biodiesel is a widely used biofuel in the European Union and rape oil is the dominant biodiesel feedstock material which accounts for further than 49% of total fuel used in 2015. The top five EU countries for biodiesel production are Germany, France, the Netherlands, Spain and Poland. From 3.2 billion liters in 2010 to 3.8 billion liters in 2014, early biodiesel output capacity in Germany grows. Germany is thus considered the EU's largest biodiesel producer [18]. Table 2 shows the global distribution of biodiesel output between 2010 and 2014. Brazil is the global leader in the manufacturing and use of biofuels. Ethanol as biofuel is processed in Brazil. Brazil's energy matrix indicates the 47.3% of energy is used by renewables. Brazil has achieved the target of a biodiesel mixing of 5% with mineral oil within just two years [19]. For 2005, the EU set its targets for biodiesel as 2%, 2010 as 5.75% and 2020 as 10%. There are several non-edible species in South

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Asia – edible oil is present and also in excess of quantity available. The potential of vegetable oil in India it is only 1 million tons per year. [20]. Extensive extra oil sal (180,000 tons), mahu-petroleum (180, 000 tonnes), neem-petroleum-(10.000 tonnes), and neem-petroleum (100, 000 tons) per year. Karanja seeds and jatropha oil seeds are used for feedstock in India's biodiesel policy [21-22]. Jatropha is estimated to have a capacity of seed production of 0.4 to 12 tons annually[23]. Jatropha could be cultivated in low precipitation (200 mm year), low soil waste lands. In other cases, nitrogen fasteners are pongamia. The plant's seeds contain between 30 and40% oil. Pongamy pinnata is estimated to have an average annual seed yield of 4-9 tons.

Some studies indicate that the social and economic impacts of biofuels manufactured from organic foods. Such biofuels create conflicts between food and fuel. Certain studies reveal that such conflicts can occur [24]. Green seed canola is preferred to prevent such biofuels from non-eatable oils like pongamia pinnata (jatropha) [25]. Approximately 95 percent of the world's biodiesel is made from vegetable seeds of oil [26]. With the use of edible oil for biofuel production, fuel costs rise and a lack of edible oil increases the price of consumable oil. The use of non-eating seed for the production of biofuels thus decreases inflation in food prices. The plants in waste land could be unedible oil seed crops. The rate of deforestation will decrease and food crops will avoid their competition. Oil seeds that are not edible are also more effective and more ecological [26].

Nation	Feedstock
Sweden	Rapeseed
Spain	Sunflower
Italy	Rapeseed
Russia	Rapeseed, Soybean, Sunflower
France	Rapeseed, Sunflower
Mexico	Animal fat, waste cooking oil
UK	Rapeseed, waste cooking oil
Germany	Rapeseed
USA	Soybean, waste cooking oil
Brazil	Soybean, Palm, Castor
Canada	Canola, Animal fat
India	Jatropha, karanja
Australia	Waste cooking oil, Animal fat
Japan	Waste cooking oil
Indonesia	Palm, jatropha
China	Jatropha, Waste cooking oil
Korea	Waste cooking oil
Malaysia	Palm

Fig. 3. List of Main Biodiesel Feedstock Use In Different Nations [17]

	2010	2011	2012	2013	2014
EU	132.1	203.6	188.8	202.3	203.1
Central and south America	44.6	76.8	103.8	100.5	120.4
Asia and Oceania	28.3	68.5	72.3	87.0	111.7
Eurasia	2.96	2.2	4.6	4.4	4.9
Africa	0.14	0.14	0.04	0.0	0.0
Middle East	0.1	0.1	0.1	0.0	0.0
North America	23.2	66.3	66.1	91.9	88.5
World	213.3	417.8	435.8	486.1	528.6

Fig. 4. Biodiesel Manufacturer (000 Barrel Per Day) [27]

As in other markets, vegetable oil prices fluctuate on the international market. e. g. Soybean oil prices in August 2012 are US$1230/ton; palm oil prices are also US$931/ton [28]. Feedstock costs are a crucial parameter for the cost of biodiesel. Using low costs in feedstock materials (priced at $ 331 per ton) and non - vegetable food oil such as jatropha is becoming increment vigorous (priced at $ 350 per ton to $ 550 per ton)[28]. More study needs to be done on the use of waste cooking oil and non-editable vegetable oil with a global goal of achieving 10 percent of use of bio-diesel by 2021.

Zhang et al. estimated that the costs of biodiesel are over 1.5 times that of mineral diesel, whereas the prices of waste pure vegetable oil were 2.53 to 3 times less [29]. The cost of purified vegetable oils represents 75% to 80% of the price of biodiesel production, compared to 50% of the cost of

biodiesel generated by waste cooking oils. Biodiesel is therefore cheaper from waste cooking [30]. If biodiesel from edible vegetable oil seeds is subject to international price fluctuations in cost. The price is not contingent on international market if it is made from non–edible oils such as jatropha and karanja, or from waste cooking oil [28]. The availability of land per capita is limited as the global population grows. More crops of unedible oil seeds must therefore be cultivated in non-fertile soil. The environment impact of fuel consumption will be reduced.

III. ECONOMIC ANALYSIS

In 2014 the prices were 4.22, 3.49, 3.34, and 2.09 US $ per gallon respectively of biological petrol, diesel, gasoline and natural gas [31]. If you see that biodiesel rates are higher than pure diesel fuel in the current situation without a levy. This makes this fuel unusable without subsidies in the free market.

The EU manufactured 23 million tons of biodiesel per year in 2014[32]. Total biodiesel production capacity was 0.56 million tons each year in Canada and the United

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States and 9.2 million tons per annum in 2015[33]. Biodiesel is only competitive with crude oil if the price of biodiesel feed is lower than the price of crude oil. Actually only US$ 1/gallon subsidies for biodiesel are economical in the USA. This is because the United States government committed to cutting carbon emissions and creating new jobs.

For governments around the world, biodiesel is a source of renewable fuels. The key concern is to substitute it with diesel for the manufacturing of biodiesel from vegetable oil. The emphasis is therefore on improvement and advances in the processing and production of feedstock materials in order to lessen fuel costs. The use of used cooking oil and animal waste is utilized to minimize costs as a feedstock material, but it is much lower than the industry as a whole.

IV. CONCLUSION

This review article gives comparative study and current situation in biodiesel research field. It covers number of aspects such as region wise manufacturing of biodiesel, feedstock used in different nation and economic aspects of biodiesel. Approximately 95% manufacturing of biodiesel in the world is from edible vegetable oil. Due to this price of biodiesel increases also price of food due to less availability. Economic point of view carry out research in biofuel manufacture from non- edible vegetable oil and waste cooking oil.

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