A Review on Studies and Research for Biodiesel Production from Various Feed stocks

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Abstract— **Biodiesel production by using the cheap feedstock is the challenge faced by researchers. Various feedstocks such as waste animal fats, vegetable oil, waste cooking oil, animal tallow , algae. karanja, jatropa, polanga are being explored. Also processes for biodiesel are being studied with respect to optimization of cost and efficiency. The present review aims at summarizing the research carried out in order to explore the possibility of various feedstocks and technologies. Also the studies related to the impact of biodiesel production on economy are reported.**

Index Terms— **feedstock, emission, technology, economy**

I. INTRODUCTION

The present scenario of fuel requirement, growing demand for fuel and depleting petroleum reservoirs calls for sustainable technology to meet the energy problems. Various non conventional energy sources include solar energy, biofuels, fuel cells, tidal energy etc. These all sources have some advantages and disadvantages. The solar and tidal energy depend on nature and climate and also have high initial cost. The diesel is main fuel used in the world for vehicles. There is urgent need for exploring new methods for diesel production. The biodiesel is now a days very talked about fuel source. The use of easy, cheap technology and feed stocks are major factors associated with biodiesel production. The current review provides the summery of the studies and investigations carried out in order explore new techniques and feed stocks to render effectiveness and economy to biodiesel production.

II. METHODS FOR BIODIESEL PRODUCTION

Studies and review on development of new techniques for biodiesel synthesis from alternative sources was studied by Laosiripojana and Champreda [1]. The alternative fuels include hydrogen, gas-to-liquid (GTL), biomass-to-liquid (BTL), dimethyl-ether (DME), biodiesel, and bioethanol. They indicated that the production of biodiesel was accompanied by various byproducts such as glycerol, lignin, and undefined residues. Basumatary reviewed non-conventional seed oils as potential feedstocks for future biodiesel industries [2]. According to them the economy of biodiesel use largely depends on use of alternate feed stocks as the use of edible oil is non economical alternatives. Yellow oleander, Pongamia glabra, Jatropha curcas, Rubber (Hevea brasiliensis), Rocket (Eruca sativa Mill.), Terminalia belerica Robx, Zanthoxylum bung are few nonconventional feedstocks which have high potential of biodiesel production. They concluded that, in the energy intensive era, it is time to set up biorefineries with cost effective technology with alternate feed stocks. Adeyemo et.al. assessed the impacts of biodiesel feedstock production in the Eastern Cape Province of South Africa through the application of a Partial Equilibrium Model to the Eastern Cape Social Accounting Matrix[3]. According to their studies the biodiesel production aided the GDP to considerable extent and also helped creating employment opportunities. It also has impacts on low economy households. They concluded that every single small investment provided considerable benefit to the economy. In depth discussion on success, challenges and prospects of biodiesel production was provided by Sani et.al. [4]. They summarized the challenges for this technology such as feed stock, competition with other resources and acceptability. Biodiesel still remains promising alternative and need to be explored. The research and the technological development gives lot of hope and positive prospects in finding economical solution for application of low cost technology for biodiesel production. Microalgal triacylglycerols was studied as feed stock for biodiesel production by Hu et.al.[5]. They reviewed current knowledge on oleaginous algae and their fatty acid and triacylglycerols (TAG) biosynthesis, algal model systems and genomic approaches for better understanding of triacylglycerols (TAG) process. According to them isolation, Metabolic engineering through genetic manipulation and critical knowledge regarding both the regulatory and structural genes are few important aspects which need to be studies.

The model for estimation of biodiesel production cost was reported by Haas et.al.[6]. According to their studies the oil feed stock contributed to 88 percent of production cost. The sale of glycerol reduced the production cost by 6 percent. Their model, though preliminary in terms of details, provides with tool for prospective economy of the process. Datta and Mandal carried out review on biodiesel production and its emissions and performance[7].Their study indicated that it was possible to prepare biodiesel from different renewable feedstocks. Vegetable oil, waste cooking oil, animal tallow and algae. karanja, jatropa, polanga are few feed stocks that are being explored in india. Emissions are better for biodiesel fuel excluding NOx. Lubricating properties of biodiesel also were better. Jatropha oil as a feedstock was used by Vyas et.al.[8]. They used homogenous alkali catalyst for the purpose. They also reported the effect of biodiesel on vehicle emission. They reported 80 percent yield of biodiesel by this process. The emission of SO_2 and SPM decreased with use of

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biodiesel They concluded that Jatropha plantation, seeds collection and other policies need careful attention in developing this technology for commercial application. Izah and Ohimain evaluated the challenge of biodiesel production from oil palm feedstock in Nigeria[9]. According to them feedstock supply shortages, poor quality of the feedstock, technological challenges and poor policy framework were few challenges faced by the country in use and production of biodiesel. Upgrading the policy and used of non edible oils , according to them, played key role in adopting biodiesel as a fuel. They emphasized that enzymatic transesterification was good alternative because of reduced feed stock limitations. Enzyme immobilization added to the process with recovery of catalyst and enhanced product separation.

A review on use of microalgae for biodiesel production was carried out by Matta et.al.[10]. They studied the current prospects of microalgae technology with respect to cultivation, harvesting and use. Reduction in cost per unit area is key challenge for the researchers. It is very critical to control the microalgae growth conditions. According to them there is need of investment before algal biodiesel is economically viable and can become a reality. Savings in cost of nutrient and water requirements, using cheap sources of CO_2 for culture enrichment, cheaper design culture systems with automated process control and reduction in labour by various means are few measures needed to be explored from economy point of view.

A study was done by Sedjo and Brent Sohngen for assessing the effect of increasing use of wood for biofuel production[11]. Their study predicted 60 percent rise in wood demand and around 20 percent rise in cost by 2020-22. They suggested offshore wood production can help to meet this demand. Gude et al studied biodiesel production by waste cooking oils, non-edible and low-cost oils (Jatropha curcas and Camelina Sativa) and algae as feedstock[12]. They illustrated methods for sustainable biodiesel production from various feedstock. Utilization of locally available used cooking oils and by utilizing process by-products as raw materials in other chemical processes can render economy to the biodiesel production. Microwaves and ultrasonic techniques can incorporate to improve energy footprints from the biodiesel production. Baroi and Dalai carried out review on 12-Tungstophosphoric Acid (TPA) as a solid acid catalyst precursor for biodiesel production from various feedstocks[13].A case study on economic impacts of ethanol production by Switchgrass as a Feedstock was done by Burton et.al[14]. According to this research , the levels and types of economic impact of biorefinery was influenced by the least-cost configuration of the feedstock supply chain.

Gohel et.al. used yeast for maximum accumulation of lipids which was later converted into biodiesel by acid transesterification[15]. This made the process faster and easier.Gude et.al carried out studies on microwave energy potential for biodiesel production[16]. They reviewed microwave energy based synthesis of biodiesel. Potential design and operation challenges which need future attention of the researchers. .Ivana et all carried out study on use of waste animal fats as feedstocks for biodiesel production[17].They studied the possibility of use of waste animal fats in enzyme catalyzed and non catalyzed processes. According to them this animal waste fats were potential feedstocks for biodiesel production.

Conclusion

The review summarizes various feed stocks and methods used by investigators. It can be concluded that the biodiesel production and its use as alternative fuel calls for further research in order to economize the production and use of new , low cost feed stocks.

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