

Effectiveness of Bio-Fuel Production

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ABSTRACT: *To meet the requirement of the desired energy for the upcoming future, biofuels can be a better source to tackle the drop rate of fossil fuels. Fossil fuel is the naturally occurring fuel that are limited in quantity in present scenario. The development of microbial biofuels are still under examination. Current study describe that biofuels can be used as a substitute for the conventional fossil fuels as they are more effective and can cause less pollution. Biofuels are mainly obtained from the cellulose, algal oil, corn, soy, sugarcane, etc. Major bio-fuel known are- woods, bio-ethanol, bio-butanol, bio-diesel and bio-gas. On the basis of biofuel generation there are four different types of generation to get better quality of biofuels types. Fossil fuels are the major contributor to greenhouse gases emission and various drawbacks like- increase pollution, decrease in resources. Biofuel helps generate energy that can be used for various purposes like cooking, electricity, heat, or in transport sector etc. Many researches are done for the commercialization of biofuel and also to know the other major by-products produced during biofuel generation. Major obstacles for the use of biofuel is that biofuel production cost is very high, produces less amount of energy and some of the biofuels use food matter to discover energy. In future, it can be used for a replacement to develop a pollution free environment and should develop a cost effective method of biofuel production so that it produces a desirable quantity of energy.*

KEYWORDS: *Biofuel, Biomass, Energy, Ethanol, Fossil, Generation, Microbial, Oil.*

1. INTRODUCTION

As per the demand for energy remain to grow internationally, fossil fuels consumption will likewise continue to rise. There is still an abundant resources of fossil fuel at rationally low cost, while this is possible to vary in the future, but more disapprovingly a rising usage of fossil fuel is not likely to be sustainable for longer period mainly due to the attributed upsurge in greenhouse gas (GHG) emission from using these fuels and the environmental impact of these emissions on global warming. Microbial biofuels are a sulphur-free, sustainable basis of energy that is also extremely biodegradable. As a result, there is a lot of curiosity in search for substitute renewable fuel sources that are carbon neutral[1].

High economic development around the world has bring about in increasing energy demand, which is likely to increase by approx. 1% every year by 2030, attainment about 105 million barrels of oil daily. Additional major features donating to increasing energy desire is the world's population, which is estimated to surpass 8.7 billion by 2035, meaning that an extra 1.6 billion people would utilize energy in upcoming future. On the basis of present estimation, the United States requires more than 13 million barrels of oil in a single day for transportation, accounting for approximately 76 percent of worldwide petroleum consumption. Biofuel generation is presently blowing up, having increased by greater than threefold from about 10 million tonnes of oil equivalent (Mtoe) in the year 2000 to 42 Mtoe in 2008. In spite of this exponential growth, biofuels still account for just about 2.5 percent of total shipping fuels in the global energy situation[2].

Several developed countries are supporting the generation of expanded or new biofuels industries for the transport area, and numerous emerging countries are becoming increasingly involved in “modernising” their biomass utilization and increase right to use of renewable liquid fuels. Numerous developing countries may be chiefly interested in biofuels for a multiplicity of reasons. Climates in numerous countries are well suitable for increase in biomass[3]. Petroleum as an energy source is becoming increasingly expensive. It also has a number of negative environmental significances. Biodiesel is a substitute of gasoline for better- environment. It can be generated with low-priced and more sustainable oil extracts from materials such as soybeans and corn.

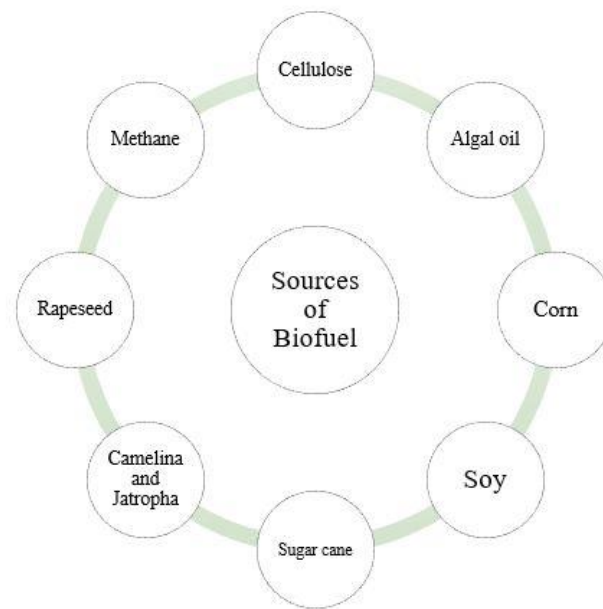


Figure 1: Different Types of Sources That Can Be Used For Biofuel Production

1.1. Some of the sources that are generally used for biofuel production are given in the Figure 1 and their description are listed below:

1.1.1. *Cellulose:*

It is that kind of fibre that are found in trees such as willow and hybrid poplar. Agricultural waste and corn stalks (after harvest) can be source for cellulose production.

1.1.2. *Algal Oil:*

Pond scum and Seaweed are specimens of algae that can be utilizes to create ethanol and biodiesel. Since they are mature in water, there is no dispute with land scarcity, which is a general problem with farming crops.

1.1.3. *Corn:*

Corn is only biofuel sources that are used in the United States. Although, it is a temporary solution. Changing corn to bio-ethanol is an economically high method with a greater energy utilization rate. This problem should be fixed with the application of well knowhow.

1.1.4. *Soy:*

One of the in demand biofuel, soy frequently goes by the method of trans-esterification to acquire transformed into biodiesel. The method is comparatively cheap and easy. Though, meanwhile soy is one of the dietary hub to many, researchers are frequently unwilling to depend on too much of such conventional food crops for the generation of fuels.

1.1.5. *Sugarcane:*

The second most widely used source for biofuel production in the today's world is sugarcane. On the other hand, when utilizes in vehicles, sugar cane ethanol can chock the engines, particularly if the cars are long-standing.

1.1.6. *Camelina and Jatropha:*

Flowering plants that can be grown-up in extremely dry regions are Camelina and Jatropha. They also have the capability to create the soil more fertile with time. While they deliver additional and better choices than other feeds their power is still to be understood.

1.1.7. *Rapeseed:*

Rapeseed or canola oil is obtained from a plants that are generally present in Canada and the United States. It is easy and low-priced to generate and ignite somewhat cleaner when equated to petroleum. On the other

hand, the plants would require acres and acres of farmland if there is a requirement to generate a significant quantity of biofuel.

1.1.8. Methane:

Methane can simply be generated from microbes that decay organic matter like food, various landfills materials, and compost. It can be generated in dumps. While a large amount of infrastructure for conversion is required.

Polyunsaturated fatty acids (PUFA), Carotenoids, proteins and carbohydrates are examples of intracellularly high value-added goods delivered by few microbial creators. These resources can be improved and utilized in actual bio-refinery procedures in a diversity of industries, like pharmaceuticals, food, cosmetics, chemicals, and nutraceuticals. Such a method will obtain the benefit of the numerous goods produced by the microbes and of the microbial biomass, so enhancing the value resulting from the entire procedure, with a demand of least environmental effect. By this way, the economics of the procedure may be significantly enhanced, as the high value-added goods (like polyunsaturated fatty acids and carotenoids) may withstand the microbial biofuel generation[4].

1.2. Types of biofuels:

All the four diverse kinds of biofuels are- 1st, 2nd, 3rd, and 4th generations' biofuel and is described in the Figure 2. Each of them is distinguished on the basis of the limitations as a resource of biomass, renewable resource of energy, and technical improvements. The major disadvantages associated with first generation biofuels are that they are obtained from the food source that is also used as biomass and also work as a source of problem when there is a condition of food scarcity. Since, second generation biofuel is obtained from non-food biomass but even so competes for land utilization which is also used for food generation. Third generation biofuel represents the better probability as a substitute for fuel by not competing with the food generation for land use and lastly the fourth generation biofuel is that type of biofuel which includes solar and electro fuels. Development of electro-fuels can be created by keeping electrical energy in the chemical bond of liquid and gas.

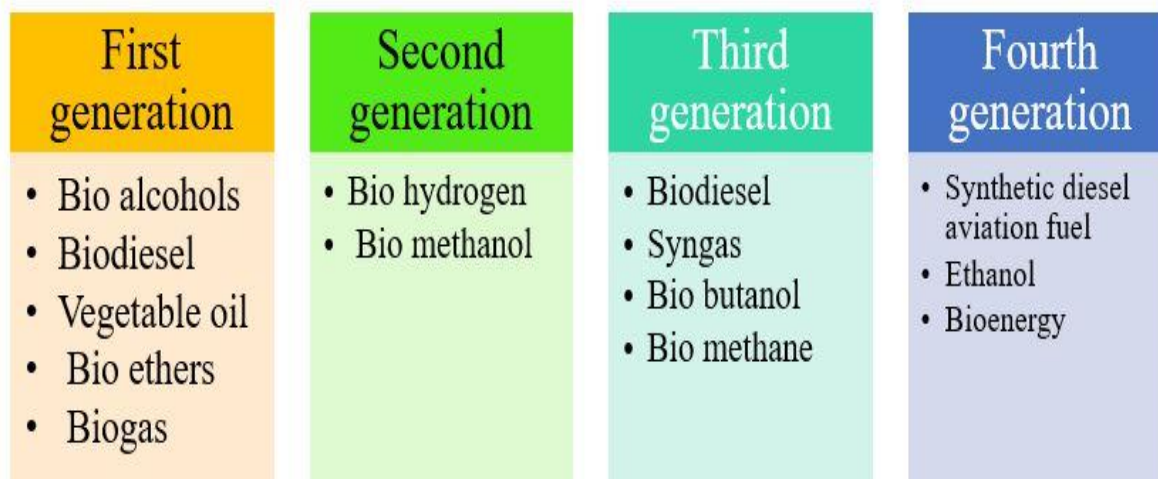


Figure 2: Types of Biofuel On The Basis Of Generation

1.2.1. First-generation:

First generation biofuels are prepared by food crop mature on farmland. The crops' oil, sugar, or starch content is transformed into ethanol or bio-diesel by the help of yeast fermentation or trans-esterification.

1.2.2. Second-generation:

Second-generation biofuels are prepared by woody biomass or ligno-cellulose, or by farming wastes. The raw material utilized to create the fuel is any raise on arable land however are by-product of the chief crop, or they are mature on peripheral land.

1.2.3. Third-generation:

Third generation biofuels' utilizes particularly genetically-engineered products like resource of energy from algae. Extraction of oil is obtained from matured and harvested algae. The oil obtained can be further utilizes as a bio-diesel by the similar method as first generation biofuel or can be refined to other fuels.

1.2.4. Fourth-generation:

This class of biofuels includes electro fuels and solar fuels. Electro fuels are made by storing electrical energy in the chemical bond of liquid and gas. The main objectives are biodiesels, hydrogen, or butanol but then contain other alcohol and carbon comprising gases like butane and methane[5].

From the previous few years, various domestic research laboratory, central organizations and private corporations too are in work to rise a feasible and sustainable algal bio-fuel method that are economically efficient than petroleum- found fossil fuel. Finances of manufacturing micro-algal biofuels rely chiefly on the budget of generating algal biomass[2].

1.3. Major Biofuel known till now:

Some of the major biofuels products that are still known are given in the Figure 3,

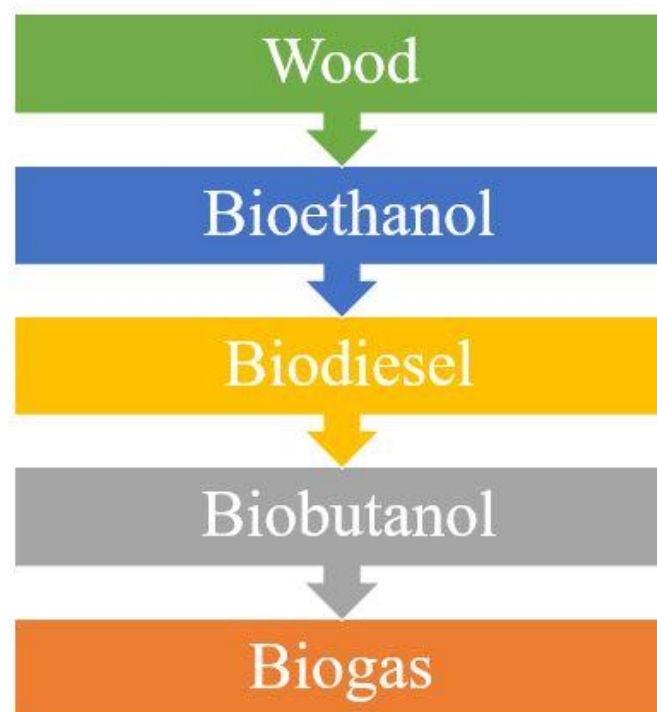


Figure 3: Major Types of Biofuel On The Basis Of Their End Product

1.3.1. Woods:

It is the greatest traditional and earliest biofuel known. Till now, it is utilizes in several regions around the globe for both purpose of domestic and industrial use. It is utilized in industrial boilers and in thermal power plant. It is utilizes for heating homes, or cooking etc.

1.3.2. Bio-ethanol:

It is the greatest known biofuel (liquid) that are used all over the world. It can also be known as ethanol or bio alcohol. It is produced by the process called fermentation of chiefly starch and sugar such as wheat, corn, molasses, or sugarcane that are present in plants. Ethanol is utilized as an alternative for gasoline in petrol-engine. Gasohol, a mixture of ethanol in a specific proportion approximately 15% with the gasoline.

1.3.3. Bio-diesel:

It holds second position in the top most known liquid biofuel. The highest biodiesel production is done by Europe and is utilizes for diesel engine. It is obtained from animal or vegetable oils and found mostly from plant such as sunflower, animal fat, soybean, or palm. Although utilized cooking oil that are obtained from

restaurant can be utilizes for fabricating bio-diesel. Bio-diesel is an unpolluted biofuel variety, as the quantity of polluting gases discharge for ignition is very small.

1.3.4. Bio-butanol:

Bio-butanol is the utmost hopeful biofuel with extreme power. An alteration for gasoline is bio-butanol which can be used directly. It generates low greenhouse gases emission on burning when compared with gasoline. Bio-butanol is obtained from algae and bacteria. To make use of bio-butanol feasible, many researches are being carried out.

1.3.5. Bio-gas:

Bio-gas is obtained by organic matter fermentation in deficiency of oxygen and the process of converting organic matter to other useful products are known as anaerobic digestion. For fermentation, organic matters such as wood, dried foliage, municipal waste, paper, several plastics and manure etc. can be used. Bio-gas ignites quickly, without generating considerable pollution. Thus as a fuel it can be utilizes. It can be flatten and then can be applied for power vehicles also[6].

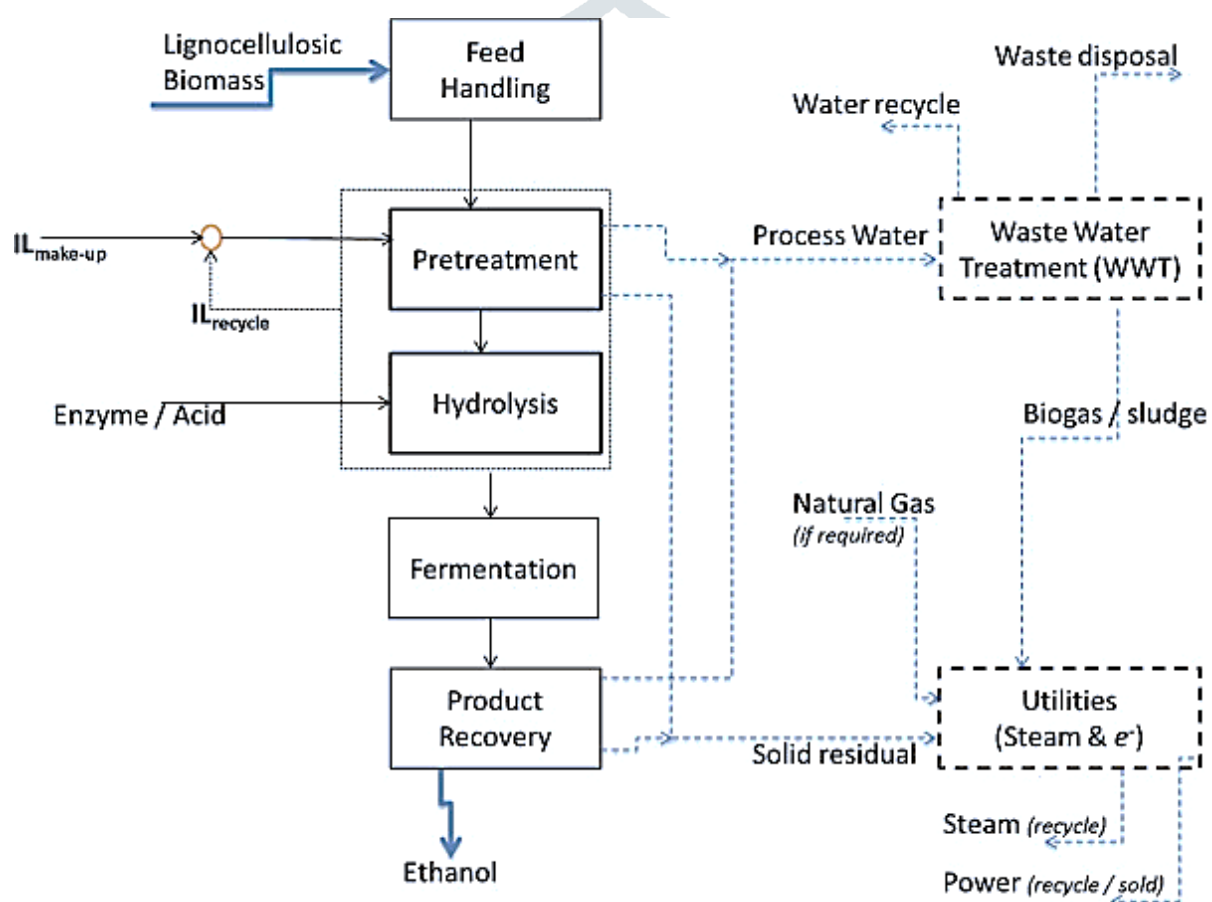


Figure 4: Conversion of Ligno-Cellulosic Biomass to End Product; Ethanol

From the Figure 4, diagrammatic representation of the conversion process of ligno-cellulosic biomass to one of the biofuel i.e. Ethanol. The method used to convert ligno-cellulosic biomass to ethanol is done by fermentation by the use of various enzymes or acids.

Biofuel	Fossil fuel
<ul style="list-style-type: none"> • Produced from living matter • Renewable energy source • Biofuels releases net zero carbon dioxide in the environment. • Provides low amount of energy per unit biomass • Cause less pollution than fossil fuel • Requires more investment for their production and are costly 	<ul style="list-style-type: none"> • Naturally present in the environment and are formed by geographical process • Non-renewable energy source • Increase the concentration of carbon dioxide in the environment • Produces high amount of energy per unit biomass • Play a major role in environmental pollution • Comparatively less investment and less cost of fuel

Figure 5: Difference between the Biofuel and Traditional fossil fuel

From the Figure 5, some of the difference among biofuel and fossil fuels are discussed. Till now, the major problems associated with marketing of biofuel that are derived from microorganisms is remain the great cost for production. For that reason, it is important to discover methods to decrease the costs of biofuels production method that is derived from microbes, via utilization of cost effective feedstock and/or by-product production of high-value added goods. Though, almost all of the available works are concentrating on microbial biofuels, label the generation of single microbial bio-fuel which states that the works for other existing and valuable microbial goods or constituents from the microbial biomass are still in the case of undervalue or lost[4]. Recent application of nano additive at diverse phase for microalgae culture to end product uses, discover to have a strong mercantile ability, and a positive impact on the environment and the production of valuable by-products in the upcoming future.

2. LITERATURE REVIEW

Teresa Lopes da Silva et al.[4] explained that the generation of biofuels originated microbes were now under examination because they are substitute for fossil fuel that are decreasing day by day and also create a negative effect on the environment. Although biofuels that were obtained from microbes were not financially compatible. Very known single mode to overwhelm this restriction in the utilization of microbes to get biofuels and other high value products that were obtained from transformation of substrate, and side by side grabbing advantage of diverse microbial biomass constituents to create other fascinating goods, as per an integrated method. By that way, it could be feasible to increase the economic value of the overall method, with the required decline of waste flow generated. It was estimated that the integrated method makes economic sustainable biofuel production and competitive for the upcoming future. It was described that the examination on integrated microbial method that are based on yeast, bacteria, and algal cultivation that were developed analytically, and by giving more importance of this method as a mode to get an optimum result for microbial biofuel generation method.

Jon K. Pittman et al.[1] explained that on basis of existing techniques algal culturing for biofuel generation alone is not likely to be economically feasible or gives a positive energy profit. It was proposed that microalgae could be used for in a couple form, one for waste water treatment and other for biofuel generation would be a fascinating option in terms of cost-cutting, GHG (greenhouse gas) emission, fertilizer and freshwater resource value of biofuel production from microalgae. The large biomass generation of waste water grown-up microalgae proposed that this culturing method provides an actual potential as a practical resource for biofuel production and is expected to be one of the major methods utilized for the generation of renewable and sustainable energy.

M.V. Rodionova et al.[7] described that biofuel could be a feasible basis of renewable energy with respect to limited nature, geo-political uncertainty, and harmful worldwide impacts of fossil fuel energy. In summarized way, biofuel contain any energy-intensify chemicals produced straight away by biological method or obtained from the chemical transformation of biomass of previous living organisms. Generally biofuels were produced from photosynthetic organisms like photosynthetic macro and micro algae, bacteria and vascular land plants. The primary goods of biofuel might be in the form of liquid, solid, or gases. These goods are further changed by physical, biochemical, and thermochemical process. Biofuels could be differentiated into two different types-primary: could be directly generated from burning of wood, cellulosic plant matter, and dried animal waste while secondary: it could be further differentiated into three generations that were indirectly produced from animal and plants matter. The first generation biofuel produces ethanol obtained from crops that have high starch amount. The second generation was bioethanol obtained from non-food cellulosic biomass. The third generation was the biofuel obtained from microalgae, cyanobacteria and other microorganisms was the highest encouraging method to encounter the worldwide energy demand. It was also suggested to future research should be on new biofuel production species, genetically modified species for biofuel production, full knowledge of biofuel generation process, and efficient tools for mass production of microbes.

Dong Liu et al. explained that by the use of constructed wetlands for immediate treatment of waste water and generates biofuels took benefits of the unnecessary waste of Nitrogen, did not require further Nitrogen fertilization, protect a significant energy input, when equated with other biofuel generation method. Constructed wetland could generate more renewable energy with respect to the energy required for its production, and offer an essential environmental profit. They comprised of the ability to be other resource of feedstock for biofuels. As constructed wetland biomass can be generated on marginal lands and Green land space, constructed wetland (CW) require neither participate for productive soils with nutritional generation nor inspire ecosystem demolition. The traditional WTP (Water Treatment Plant) as the starting point, the CW shows little GHG emission capacity. The methane, Nitrous oxide, and fossil fuel carbon dioxide emissions for CWs were far lesser than those of a WTP (Water Treatment Plant). Fear for its capability to be extensively accepted by individuals is that CWs are dispersed in space, particularly in rural zones in China, which make it hard to bring together CW plant biomass. Using CWs for biofuel development could be improved by the growth of a central rural sewage management system in rural regions in the upcoming future.

N. Misra et al.[2] described that biofuel production and used had grown significantly in the present time, governance to policies, aimed at enhancing energy safety and decreasing greenhouse gas emission. Microalgae were the most powerful biofuel feedstock that could offer drop-in fossil fuel alternative without motivating competition for agricultural sources, and were deliberated to be more environment friendly than first and second generation biofuel feedstocks because of its diverse benefits, that comprises of sustainable biomass development, effective land and water consumption, and high lipid content. On the other hand, there were numerous techniques and scientific barricades that had yet to be conquered. It was also overviewed that the microalgal species that are recognized to store high level of lipids, as well as the crucial aspects to reflect while opting appropriate algal strains for mass production. The advantages and disadvantages associated with raceway pond and photobioreactor cultivation method was also examined. The recent improvement in genetic engineering of microalgae to amplify lipid and biomass productivity with also discussion about the on-going biosafety problems related to utilization of genetically altered algae. Moreover, an extensive range of high-value goods that could be parallel developed from microalgae had been talk over. Complete summary of the main techno-economic restrictions to profit oriented algal-derived biofuels besides a promising approaches for overwhelming these problems in the direction to harvest environmentally sustainable and cost-competitive biofuel.

3. DISCUSSION

The chief marketable problems are anxious with mixing into present value chain and capitalization problems. To overwhelmed these problems, various stake-holders require to show a dynamic and essential part in encouraging combined method based on microbes, in direction to grow a bio oriented budget. The problems associated with sustainability must confirm that the application of combined microbial methods accomplish numerous social, economic, and environmental criteria, particularly no biodiversity loss; no damage to air, water or soil; no opposition with supply of food; adaptable communal situations like job development, area development; cost effective biomass to product chain. If all these problems are attained then the future of combined microbial methods looks like hopeful idea, as it estimated to donate to the rising desire for

sustainability, collected with foundation of new energy resources, alternative of fossil fuels, and generation of a broad range of bio-oriented goods such as materials and chemicals with marketable curiosity.

The widely present biofuel that are marketable is bioethanol, which is derived from the corn starch or sugar cane, while the next biofuel that are commercially used is biodiesel that is derived from the oil based crops such as oilseed rape or soybean. Since, biofuels have the ability to be beneficial for the environment as compared to fossil fuels, with the arguments that whether these crop oriented biofuels are economically good as compared to fossil fuels. Moreover, more fear about the influence that the usage of these crops for biofuels potency have on food accessibility.

Although there is plenty of consideration on biofuel utilization for the conveyance section, the utilization of biofuel for purpose of cooking, is a possible use of extensive significance universally, particularly in rural regions of emerging nations. In all circumstances, ignition of biofuel for cooking purpose will produce discharge of pollutants that are less than the discharge from cooking with known solid fuels. Around three billion individuals in emerging nations prepare with solid fossil fuels and undergo severe health harms from subsequent inside air effluence. Hence, biofuels might show an acute role in refining the wellbeing of billions of individuals. It is remarkable that the progression of biofuel generation desired to encounter the required energy for cooking is extremely lesser than that intended for attaining all transportation fuel requirements.

4. CONCLUSION

Expansion of the worldwide desire for energy is increasing day by day, in the same way fossil fuel consumption are also increases. Supply of fossil fuel is plenty in amount and are at lower cost, since this is expected to vary in the upfront future, but then more disapprovingly an increasing utilization of fossil fuel is not likely to be renewable for longer duration mainly due to the recognized rise in greenhouse gas discharge from by means of these fuels and the ecological effect of these discharges on global-warming. Progressive biofuels have numerous advantages, one is that they do not challenge the farming production for food marketplace, second is that they frequently attain a much lesser net greenhouse gases discharge stability than the conventionally used fuels they change or few of the biofuels belongs to first generation. And finally, each biofuels whether it is first generation or advance generation biofuel's type can be combined with conventional fuels, therefore assisting to directly decrease greenhouse gas discharges devoid of delay for exclusive modifications to existing energy storage, distribution, and transport methods and present engine. Biofuels are currently generated from raw materials crops that can be utilized as food. Outcome from this is that there is a coincidence of rivalry among fuel and food, which have an influence on food values. Alternative certain risk is the growth of bio-fuel raw material generation into environment that can tolerate greater biodiversity and another services dynamic to our financial prudence and survival. Similar to numerous different de-carbonisation instruments, bio-fuel and waste fuel are at this time corrected by price tag, which differs reliability on the techniques and its development. Nevertheless examination and growth, financial prudence of scales or a constriction of greenhouse gas discharge criteria might be in future get decrease and in few circumstances nearby the competitive breach with fossil fuel. Although, nearly each of the accessible mechanisms are intent on microbial biofuel, mark the generation of particular microbial biofuels which describe that the mechanism for additional present and valued microbial products or components obtained from the microbial biomasses are still in the situation of underrate or missing. So in future, use of biofuel will help to cope up with the challenges faced due to increase in pollution which is mainly due to utilization of fossil fuel and also to protect naturally occurring fuels for future generation and also try not use food a raw material for biofuel production that ultimately helps to feed the rising population in future.

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