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STUDY ON FEEDSTOCKS OF BIOFUEL ENERGY AT FIRST-GENERATION IN INDIA - A REVIEW

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Abstract: The need for biofuel production is escalating as a consequence of rising oil prices, geopolitics, and worries about the effects of greenhouse gas emissions on environmental issues. The mainstream of the world's energy requirements is encountered by fossil fuels, and the amount of energy consumed is rising sharply. This will boost the number of greenhouse gases (GHGs) in the surrounding air and threaten the future security of the world's energy supply by depleting known non-renewable forms of energy. As of an economic, biological, and environmental argument of sight, fossil fuels are viewed as non-renewable. Due to severe restrictions for decreasing GHG emissions, greater biomass utilization can significantly contribute to substituting traditional fossil-based fuels and reducing emissions. Fuels made from the biomass can add to the diversity of energy sources used globally. The type of feedstock and the area where it was grown and generated have a significant impact on the economics of first-generation biofuel. The increased production of energy crops, which may conflict with food crops for land, will have an impact on food costs. This article has covered first-generation biofuel, the status of first-generation biofuels, first-generation feedstock biofuels, the nations and regions that produce first-generation biofuel globally, as well as the most pressing sustainability issues of the present.

***Index Terms* -:** Biofuel energy, Feedstock, First-Generation, fossil-fuels.

I.INTRODUCTION

Worldwide, bioenergy and biofuels are acknowledged as essential components of the future energy matrix, without which it will be impossible to achieve the reduction in greenhouse gas emissions required to slow the acceleration of global warming and climate change. Though less than 2% of the oil extracted from geological reserves in 2012 was generated in the form of biofuels. The majority of these biofuels were produced by two crops maize and sugarcane, respectively in two nations: the USA and Brazil. Compared to maize and other food crops, perennial lignocellulosic feedstocks offer a significant chance to fulfill future demand expansion in more sustainable methods. In a similar vein, less than 10% of the world's energy consumption for heat and power is derived from bioenergy, the majority of which is derived from wood, while other crop wastes and residues, particularly sugarcane bagasse, are also used. To ease the strain on already-existing natural forests, future supply will come more from managed (and planted) woodlands and quickly-growing energy trees. (Talukdar, 2013) Biofuel potential and taxonomic identity of the native B. braunii strain. Under laboratory circumstances, the strain GUBIOTJTBB1, which is well acclimated to the local climate, accumulated 57.14% total lipids and 52.6% hydrocarbons with an energy value of 54.69 kJ/g. The results are on par with those found when using previously identified B. braunii strains. It would need more growth and yield improvements to boost overall productivity to levels suitable for commercial uses. This is the first thorough examination of the indigenous B. braunii strain found in North-eastern India. Depending on the length of the culture, maximum levels of total lipid (57.14%) and hexane extractable crude hydrocarbon (52.6%) were found at 56 and 28 days, respectively. The sundried biomass of the strain has an energy value (54.69 kJ/g) about twice as high as other microalgae strains and higher than petroleum diesel fuel. In terms of total lipid and hydrocarbon contents, the strain GUBIOTJTBB1 was found to be superior to the Indian strains of B. braunii that had previously been reported.

Utilizing territory unsuitable for the development of food crops, high-productivity perennial feedstocks can make a significant contribution to the world's energy needs. This will necessitate a significant increase of trials on marginal land, combined agronomic research, and breeding on land unsuitable for the cultivation of food crops, as well as improved definitions of such land. (Kumar, 2011) The aim is to make an assessment of current energy scenario, potential of non-edible oil over edible oils, selected non-edible oil seeds as biodiesel feedstocks, impact of biofuel on environment and future direction. And conclude that though many food oils may be the least expensive source of feedstock for the manufacture of biofuels, the demand for biodiesel is anticipated to rise shortly. However, it might not be an adequate source to meet this rising need. This demonstrates the necessity of using non-edible oil seeds, which can serve as a dependable, sustainable feedstock for the manufacture of biofuels. Additionally, the majority of trees that bear non-edible seeds can reclaim abandoned ground and do not compete with food crops for the few available growing regions. Thus, identifying certain non-edible feedstocks and determining whether they are appropriate for the manufacture of biodiesel becomes crucial.

Numerous energy crops, many of which are currently farmed in modest quantities, will play a significant role in the mix of feedstocks used in the future. However, to maximize yields and adapt types to a wider range of conditions, including future climates, exploitation of these developing feedstock crops would necessitate investment in breeding and agronomy. Particularly concerning biofuels, the manufacturing of feedstock is a major source of worry. However, these issues can be resolved with a better understanding of the various crops, the best locations to produce them, as well as better varieties and management techniques. The challenge of growing feedstock supply in sustainable ways can be handled by exploiting and developing the whole variety of available feedstocks, but only with safe, dependable, and rational regulations that will accomplish both environmental and economic sustainability. (Findlater, 2011) To collect the data this study included the Initial interviews were conducted with experts at universities, NGOs and private companies, followed by in-depth interviews with local stakeholders. And defined that in India, jatropha may have some potential as a biofuel crop, but significant issues remain. Before it can be a dependable biodiesel source, the planting materials and management strategies need to be greatly improved. Given that the effects of low production and land-use change will be felt for the duration of the plants' lives, commercial Jatropha planting should be done with prudence. The extent to which widespread planting will affect socioeconomic resilience to drought and other stressors should be determined by further research, which should quantify the local and regional impacts of the Jatropha plantation projects. While other Indian states considering the cultivation of jatropha can learn from this analysis. (Bhatt, 2014) Even though wastewater-grown microalgae are promising as a feedstock for renewable energy due to their high biomass, lipid productivity, and nutrient removal efficiency, the current technologies do not allow for economical and sustainable biofuel production at today's energy costs. Additionally, it is necessary to analyze the nutrient consumption rates of wastewater-derived algal biofuels and conduct bioprospecting in various wastewater environments to discover native microalgal strains that may produce oil. Additionally, efforts should be made by concentrating study on the creation of expansive, economical cultivation methods. The prospect of phytoremediation, CO2 sequestration, and low-cost nutrient supply for the algal biomass usage may be provided by coupling microalgae growing with wastewater, which will improve the economic outlook of microalgae-based biofuel production systems. The main aim of this study is to (a). To know the status of generation feedstock and (b). To evaluate the kinds of First-generation feedstock used in Biofuel Energy.

II. LITERATURE REVIEW

From the first artificial fire through the use of lyophilized timber as a fuel for power stations, bioenergy has always been a dependable form of energy. Although the idea of using lignocellulosic feedstock as a solid biofuel is not new, turning biomass into liquid fuel is a significant difficulty. The more sophisticated the biomass, the more difficult and generally costlier the conversion process involves. (V Seecharan, 2009) Biofuels are divided into four groups based on their feedstocks and manufacturing techniques: first, second, third, and fourth-generation biofuel. Researchers have focused on biofuels manufacturing using first-generation feedstocks as diesel substitute engines. Vegan's oil, Tallow, and leftover cooking oil are the feedstocks used in biodiesel in the first generations of biofuels. The biodiesel contributes less to global warming and contains less contaminant in its emission owing to the renewable nature. The industrialized nations produce enormous amounts of used cooking oil waste (TJ, 2003). Recycled waste cooking oil is harmful to human health, if consumed. The possible solution is to convert it into biodiesel. Esterification and transesterification are common progressions for creation of biodiesel from leftover cooking oil. Although most biodiesels are from vegetable oil in the first generations, which is lead to the price of biodiesel will be higher than that of traditional fossil diesel. Esterification and transesterification process is same for first, second and third generation biofuels. Secondary products like glycerol or value-added products like bio lubricants, greases and polyurethane also have great market potential.

The rate of biofuel is significantly affected by feedstock costs, while the prices of waste are impacted subsequently. (Carriquiry, 2011) Feedstock expenses account for up to 40–80% of the entire cost of producing first-generation biofuels. The amount of RH presented globally was shown to be an extremely appealing feedstock for ethanol biofuel conversion. (Abbas, 2010) Using a novel methodology, it was determined that the annual global production of bioethanol from RH ranges from 20.9 to 24.3 billion liters. For E5 gasoline, this bioethanol supply equates to about 374% of the world's demand, for E10 gasoline, to 19%, and for E25 gasoline, to 71%. The RH-to-ethanol sector was demonstrated to have the most potential in the Asian and Southeast Asian regions, with India having the greatest potential due to its existing very positive supply-demand balance for bioethanol. (Ratnavathi, 2011)The objective of the present review is to consolidate the research findings of using the whole sweet sorghum plant (lignocellulosic biomass, stalk juice and grain) as feedstock for biofuel production It is the only crop that produces grain and stem that may be used for chewing, paper, roofing, fencing, syrup, alcohol, jaggery, feed, fuel, and bedding. Typically, sweet sorghum juices contain 16–18% fermentable sugar, which yeast can use to immediately ferment into ethanol. Fast sugar decay during storage and a short harvest window for the highest sugar content are two technical obstacles to using sweet sorghum for biofuels.

Jatropha was the main focus of the Indian biodiesel mission because of its many benefits, including its capacity to grow in a variety of conditions, its minimal fertilizer and irrigation needs, and its resistance to pests. (Karmakar, 2012) However, some of these perceptions have been proven false in practice. For a sustainable and long-term supply of biodiesel, it is now imperative to diversify the feedstock mix. Neem, among other non-edible oils, attracts attention as a sustainable biodiesel feedstock due to its many beneficial uses. Better pest and nutrient management, reforestation, medical uses, environmental cleansing, etc. are all possible with neem. Although the existence of non-edible oil in our country had long been acknowledged, there had never been a thorough investigation that could demonstrate these were the best prospects for the creation of biodiesel. Neem exhibits excellent promise as a non-edible biodiesel feedstock that may be employed in a comprehensive strategy due to its variety of uses. Biodiesel will probably initially cost more than diesel during the debut period. The Oil Marketing Companies would need to receive subsidies or concessions to make up the difference between Petro-diesel and bio-diesel. (Puri, 2012) study indicates the aim to the current state of ethanol production in Australia, the key technological challenges involved in the production of second-generation biofuel and the availability of various kinds of lignocellulosic biomass for biofuel production. Although Australia uses several alternative energy sources and has a large supply of fossil fuels like coal, natural gas, and oil, the technology to manufacture and use biofuels there is still in its infancy. Australia now relies primarily on first-generation feedstock for the production of biofuel, although it is gradually expanding to second-generation biofuel production technology. Australia has a huge supply of biomass in the form of bagasse, feedstock, forestry, and agricultural waste that isn't currently being used to make biofuels. Further study is necessary to optimize the yield of the lignocellulosic biomass conversion technology to the point of industrial viability.

Regarding the sustainability issues associated with first-generation biofuels, other viewpoints contend that separating food and fuel can lead to a distorted simplification of sustainability issues, omitting the interdependence of food and fuel even though the fuel is necessary for the production of food (Karp, 2011). The cost of biofuels made from biomasses with a lipid composition heavily influences whether they are economically viable. Since the price of food-grade oil plants has increased due to economic rivalry, it is obvious that they are not suitable feedstocks for producing affordable biofuel. Particularly for the wastes that were previously landfilled, the price of the used cooking oils, industrial wastes, and by-products is lower than that of the first-generation feedstocks. (Sawangkeaw, 2013) However, the complexity and number of downstream processes, such as collecting, drying, handling, and pre-treatment stages, gradually raise the cost of the biofuel produced from these wastes. Insect and microbial lipids, on the other hand, have the benefit of high productivity and a quick pace of expansion. The independence of climate offers a notable advantage for the production of insects and microorganisms in a closed environment as compared to edible and non-edible oil plant farming. However, because they are currently not fully developed or mature technologies, lipids generated from insects and microorganisms are currently more expensive than plant oils. In last session, research to reduce the cost of processing, particularly downstream processing, and the price of second-generation feedstocks is fundamentally necessary to obtain sustainable lipid-based biomass resources.

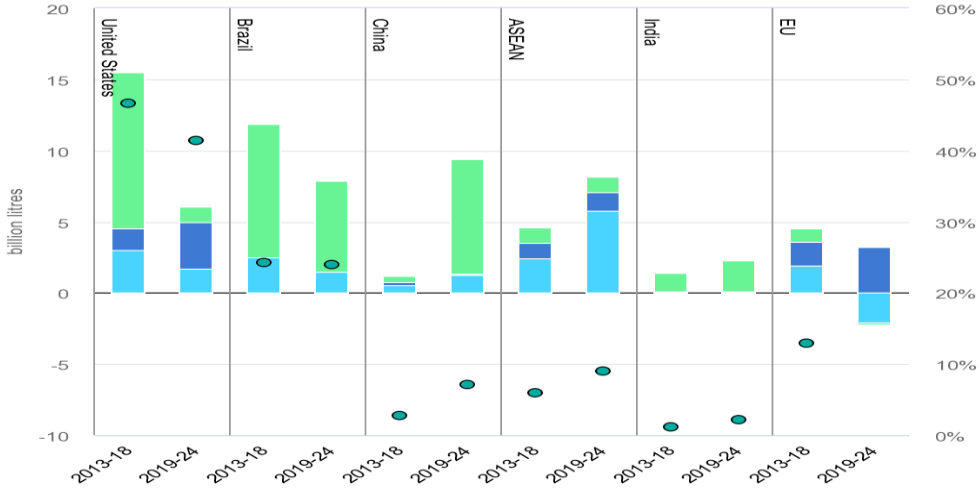
It is significant to note that the extraction of first-generation biofuel is restricted to specific geographic areas because both the kind of biofuel and the output of localized fossil-based fuel rely on the availability of feedstock. (Ahmad Dar, 2018) sweet sorghum is the best crop to grow in hot, dry climates because it can be harvested 3–4 months after planting, is planted 1–2 times per year, and produces more energy than sugarcane, and sugar beet, corn, wheat, and other crops. It also has a high tolerance to drought, saline, alkaline, and water logging conditions. As sweet sorghum satisfies the many needs for food, fuel, and fodder, the potential food vs fuel conflict from the diversion of cropland for its cultivation is mitigated. This conflict results from the diversion of agricultural land for the development of energy crops. Sweet sorghum outperforms other feedstocks in terms of ethanol yield (1.26-1.80 t acre-1) and net energy output (2,23,928 MJ ha-1) in terms of hydrogen and methane. Therefore, the biorefinery idea with minimal wastage is essential if we are to maximize the yield of sweet sorghum. Future bioenergy demand will be met simultaneously by better ethanol production technologies, the use of genetic engineering or biotechnology in sorghum to generate efficient cultivars, and the establishment of yeast and bacterial strains that are tolerant to ethanol. (Maheshwari Packiam, 2018) stated that the pearl millet crop has been used to produce biofuel in comparison to other crops that produce sugar, such as sorghum, bamboo, rice husk, cotton stem, areca nut sheath, maize dric, and shank, and rice husk and straw. When it comes to carbohydrates, pearl millet ranks well, with cellulose and hemicellulose accounting for 41.6% and 22.32%, respectively. There are numerous technologies available for producing biofuels from cellulosic ethanol. The cellulose can be converted to glucose by several enzymes. Microorganisms can further ferment these fermentable carbohydrates into ethanol. Due to its low cost, pearl millet biomass might be utilized to commercially scale up ethanol production within a few years.

III. STATUS OF FIRST-GENERATION BIOFUEL

The first-generation biofuel industry is characterized by established commercial markets and quite well mechanisms, as shown in the generation of sugarcane ethanol in Brazil, corn ethanol in the US, oilseed rape biodiesel in Germany, and palm oil biodiesel in Malaysia. The demand for non-petroleum alternatives has been emphasized by the recent fluctuations in oil prices and upcoming supply concerns. (Laursen, 2006) The conflict between food and fuel is seen as one of the key issues surrounding the commercial feasibility of first-generation biofuels since it contributes to rising global food costs as a result of increased biofuel production from crops. To support their economic development, several non-OECD nations have established their biofuel industries to manufacture fuels for both domestic consumption and export. To make ethanol or biodiesel, first-generation feedstock from agricultural sources such as sugarcane, animal fats, wheat, corn, starch, and vegetable oil is used. Crops and other recycled waste items can be used to make biofuel bioethanol and biodiesel. The development of first-generation biofuels heavily depends on crops such as corn, sugarcane, sugar beets, soybeans, and canola. As a result, the community has debated the inherent competition between foods and fuels over the past few years. The synthesis of next-generation biofuels from various feedstocks, including agricultural waste, crop leftovers, and cellulosic biomass from high-yielding grass species, is now possible because of recent technological developments in research and development. Utilizing sugarcane, sugar beets, potatoes, corn, and other grains, bioethanol is created by a fermentation process. By esterifying plant oil or animal fat with primary alcohol, biodiesel is primarily generated from these sources. Furthermore, first-generation biofuels typically take the forms of bio-alcohol, bio-diesel, vegetable oil, bio-ethers, and biogas. (Hirani, 2018) First-generation biofuels are commonly produced using feedstocks like starch, sucrose, or vegetable oil. Simple biochemical processes are used to convert these materials into motor fuel, such as turning starch and sucrose into ethanol or vegetable oil into biodiesel. These technologies have previously been created by the food industry, hence the need for additional study and development before producing transportation fuels is no longer necessary. However, compared to perennial grasses, such crops demand a lot of agricultural input (fertilizer).

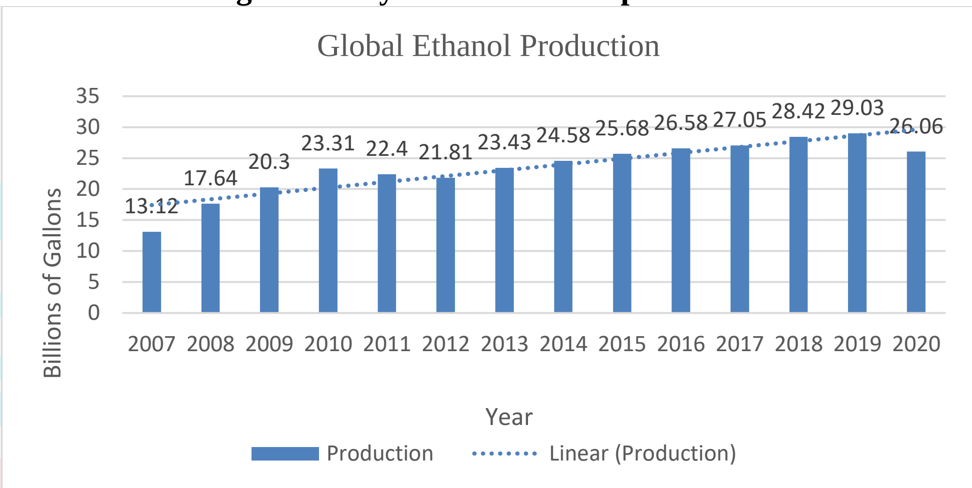
While the majority of evaluations still demonstrate that first-generation biofuels reduce GHG emissions and improve energy balance, they also have several disadvantages. Many first-generation biofuels, but not all of them, are currently under scrutiny because they: With the possible exception of sugarcane ethanol, which offers limited GHG reduction benefits at relatively high costs in terms of $/tons of carbon dioxide ($/t CO2) avoided, biofuels do not always provide the claimed environmental benefits because the biomass feedstock may not always be producible. Biofuels are also an expensive solution for energy supplies when total production expenses, excluding government grants and subsidies, are considered. (Umakanth, 2019) Using first- and second-generation ethanol production technology, sweet sorghum has the potential to provide a good source of fermentable sugars from stalks and grain. This is because sweet sorghum has a demonstrated ability to grow in a variety of settings. Sweet sorghum beats other crops when it comes to climate change as a desirable climate-resilient crop to manufacture ethanol, generate power, and reduce carbon emissions caused by the use of fossil fuels. The fact that sugarcane has gained dominance over the production chain for sugar and ethanol and is receiving the majority of investments is one of the barriers to this crop's growth as a biofuel feedstock.

Fig. 1: Biofuel's production growth by country/region



Source: (Biofuels production growth by country/region, 2019)

Fig. 2: Yearly Global Ethanol production



Source: (Renewable Fuels Association, 2021)

The above fig. presents the global level Ethanol Production by countries on yearly basis from 2007 through 2020. Although overall global output is rising, the COVID-19 epidemic caused a worldwide decline in production in 2020. In 2020, the United States produced more than 13.9 billion gallons of ethanol, making it the world's greatest producer. 84% of the world's ethanol is produced by the US and Brazil together. Brazil predominantly employs sugarcane, whereas the great bulk of ethanol produced in the United States comes from corn. (C. De Fraiture, 2008)Water is essential for maximizing the production of biomass-producing crops and the leftovers left behind. According to a study on the land and water impacts of worldwide 1G biofuel production in 2030, there would be a significant strain on local and territorial groundwater sources in places where conventional agricultural output already faces serious water restrictions (like in India and China, two of the world's largest agrarian farmers and consumers). As a result, policymakers would be reluctant to pursue biofuel options based on conventional food and oil crops.

The only other biofuel made on an industrial basis is biodiesel. This biofuel is produced differently from ethanol because it might be regarded as a chemical reaction. It does need biomass (oily plants and seeds), but the actual process involves separating the lipids and turning them into biodiesel by severing the bonds holding the lengthy fatty acids to glycerol and substituting them with methanol in a procedure known as transesterification.(Mandade, 2019) a multi-objective optimization-based systematic method for selecting the best feedstock is provided. To make sustainable judgments for biofuel policy in the context of India, designed scenarios offer extra insights. Land for crop-based biofuels will be difficult to redirect because they compete with food in the Indian context. Water sources will also be significantly impacted. Water availability and needs for ethanol production must be evaluated to ensure that ecological stress on the environment is kept to a minimum. The choice of the feedstock becomes crucial for making a sustainable choice to satisfy the need for blending. The goal of the Indian biofuel policy is to minimize emissions in the transportation industry. Future unforeseen repercussions can be prevented with the help of a thorough feedstock selection assessment. To evolve the Pareto curves for the reconciliation of the various objectives, a multi-objective optimization methodology has been utilized.

IV. FEEDSTOCK FOR FIRST-GENERATIONS OF BIOFUELS

Feedstock accounts for more than 80% of the total cost of producing bioethanol and biodiesel in the biofuel industry. To achieve low manufacturing costs that can provide fossil fuels a strategic advantage, the best feedstock must be chosen. Grain grains are the main feedstock for the first-generation biofuel that is currently being commercialized in many nations. A variety of conversion processes can be used to manufacture bioethanol, a liquid biofuel, from a range of feedstock biomasses. Bioethanol can be produced by fermenting biomass that contains significant quantities of sugar or substances that can be turned into sugar, such as starch, cellulose, and hemicelluloses. (Agarwal, 2021) Camelina is a biofuel crop that is underutilized because of its fast rate of reproduction, resistance to drought and frost, low input needs, and quick maturation. The usage of its oil as aviation fuel in European and American nations demonstrates its vast potential and economic relevance for industrial applications. In 2009–10, DIBER (DRDO) was a pioneer in bringing this crop to India. It also conducted camelina cultivation agrotechnology standardization in diverse agro-climatic conditions. Timely seeding is necessary for camelina cultivation under Indian circumstances to maximize yield. Depending on the surrounding conditions, the crop can be grown on fallow ground in hills. As a result, the unused land resources might be effectively used to grow camelina, a crop with a short winter growing season.

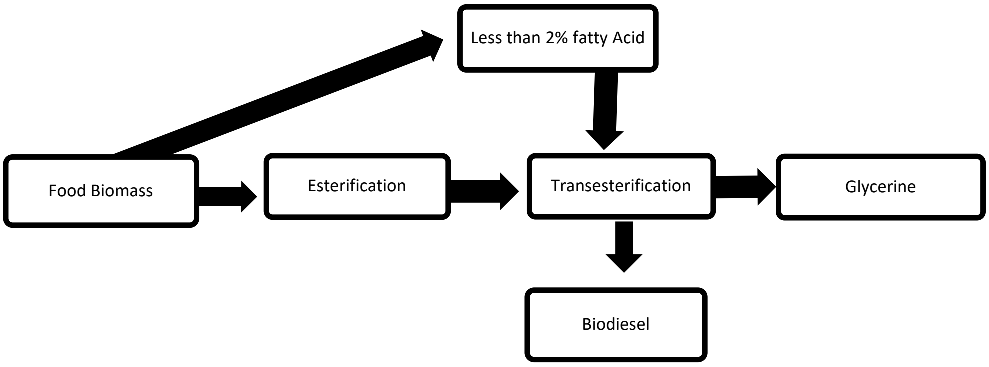
First-generation biofuels are widely used today, despite potential drawbacks such as high energy costs, limited use of arable land, and the question of whether they should be considered fuel or food. They continue to be a safe and practical strategy for sustainability and lowering the use of fossil fuels, nonetheless. (Lee, 2013)Due to intense competition between sugarcane-based ethanol production and the global sugar market, biofuel output has decreased in nations like Brazil, one of the world's largest ethanol/sugar producers. A similar conundrum with the rising cost of food on the global market limits the amount of ethanol that can be produced from corn. The cost of vegetable oils is the same reality that restricts the biodiesel market**.** (Satlewal, 2017) The majority of the globe has excess rice straw, but Asia has the greatest (>1000 million tonnes). However, more than 50% of it is currently inefficiently burned in the field, leading to severe respiratory illnesses and worrying pollution levels, due to its restricted usage and low nutritional value as fodder. To use it as a feedstock to create biofuels and biopower, new technologies must be developed. Along with current data on changes in chemical composition, physio-chemical structure, lignin-carbohydrate connections, and accessibility, the manner of various pre-treatment approaches in lowering the rice straw recalcitrance was reviewed. In order to produce biofuels in hot, arid climates, cultivate sweet sorghum issues including raising the octane of gasoline, cutting greenhouse gas emissions, and reducing gasoline imports (Almodares, 2009). It has also been explained how silica in rice straw affects enzymatic hydrolysis and biorefinery. In particular, the quality of rice straw (wall composition, polymer features), cost-effective pre-treatment, specific technology for silica extraction, and effective enzymatic hydrolysis with fewer inhibitors to yeast fermentation are suggested as the key factors responsible for improved enzymatic digestibility.

The effective and sustainable development of renewable energy sources is of global interest. The creation of technological solutions and activities is necessary for a sustainable transition from non-renewable to renewable resources. After coal, natural gas, and oil, biomass is a major resource, especially in developing nations. The consumption of biomass, which refers to the use of different feedstocks ranging from biofuel production, has significantly expanded.(Pazmiño-Hernandez, 2017) A waste product of banana packing operations is banana peduncle. The number of processed bananas in the peduncle is roughly 13%. Using commercial machinery and a commercial yeast strain, it is possible to extract the juice from a banana peduncle and ferment a 5£ concentration of the extract to create bioethanol without the need for additional nutrients. Higher concentrations seem to stop the yeast from growing. In an anaerobic digester, the bagasse left over after extraction and the stillage created after ethanol distillation is easily bio-gasified. There is enough biogas on hand to make a 3£ concentration. The concentrated syrup is planned to be made at the packing house, partially powered by biogas created from bagasse anaerobic digestion, and then transported to a central facility for ethanol fermentation. (Khan, 2009) Fatty acid and TAG synthesis routes in algae are still poorly understood biochemically. The connection between the cell cycle and TAG synthesis has to be critically examined. The most significant impact on enhancing the economics of microalgal diesel production is most likely to come from genetic and metabolic engineering. Therefore, metabolic engineering by genetic modification is required to increase the generation of TAG. Due to the low cell density, harvest is regarded as an expensive and challenging component of the industrial production of microalgal biomass. Microalgae can be harvested and their water content is decreased using a variety of techniques. The most frequent harvesting techniques used in current algae aquaculture include flocculation, micro screening, and centrifugation.

V. DIAGRAMMATIC REPRESENTATION OF CONVERSION PROCESSES AND METHODS

Fig. 3: Conversion process of first-generation biofuel (Owolabi, 2011)

Chemical Conversion: (A.B.M. S. Hossain, 2009)



A. Esterification step:

(RCOOH + CH3OH)→**H2SO4**→(RCOOH3 + H2O)

B. Transesterification step:

CH2OOCR1		R2COOH3 CH2OH
CHOOCR2	+ (3CH3OH)→ **KOH**→	R2COOH3 + CHOH
CH2OOCR3		R3COOH3 CH2OR
(Triglyceride)	(methanol)	(Methyl Ester) (Glycerol)

Table:1 Transesterification process (A.B.M. S. Hossain, 2009)

VI. CHALLENGES OF FIRST GENERATIONS OF BIOFUEL

Direct production of food crops results in first-generation biofuels. The carbohydrates, sugar, animal fats, and vegetable oils that these crops produce are inevitably used to create biofuel. It's vital to remember that while the source from which the fuel is obtained varies, the composition of the biofuel themselves doesn't really. The three most widely utilized first-generation biofuel feedstocks are corn, wheat, and sugar cane. The major Challenges of First-generation biofuel is discussed below

i. **Soil erosion:** Significant soil erosion has been associated with the production of several feedstocks. This is because, during the original land conversion (destruction of native vegetation) and the time between harvesting time and regeneration, large sections of soil surface are subjected to severe rain and winds. In general, annual feedstocks experience substantially more soil erosion than persistent feedstocks.

ii. **Biodiversity loss:** Production of large quantities of feedstock in vast farming practices can be very harmful to biodiversity. For instance, compared to rubber plantations, disturbed forests, and primary forests, oil palm plantations support lower organisms. By far, habitat devastation brought on by LUCC impacts is regarded as the most significant determinant of biodiversity loss brought on by biofuels. When contrasted to the transformation of agricultural land, the conversion of natural ecosystems like grasslands and forests is typically associated with higher levels of biodiversity loss (Fischer, 2009).

iii. **Food security:** Untangling the impact of the rise of biofuels on food security is quite challenging. Production of food and biofuels may compete directly or indirectly, and the effects of this competition may be felt at many scales ranging, including local, state, and federal levels. When a food crop, like maize, is used to produce biofuel, there is a direct rivalry. To prevent such competitive pressure, several emerging nations, including China and India, have banned the utilization of food crops for the development of biofuels (Zhou, 2009).

iv. **Social conflicts:** Particularly in areas of the developing world wherein biofuel development occurred without institutional arrangements in existence to govern it, biofuel development has been a catalyst for societal unrest. Social disputes around biofuels typically involve difficulties with customary land (Gasparatos, 2013).

v. **Rural development:** One of the main forces behind the growth; of biofuels, particularly in developing nations, has been rural development (Gasparatos A. a., 2012). biofuel plants are useful for providing employment opportunities for rural people; However, these opportunities are irregularly dispersed along the biofuel distribution network and greatly depend on the method of feedstock production as well as the local environment in terms of geography, socioeconomics, and politics (Gasparatos, 2013).

VII. POLICY IMPLICATION

Biofuels are pushed for in the name of environmental, economic, political, and energy security. Biofuels now have a limited impact on how energy is supplied, as well as how water and land are used. However, there are programs and regulations in place all over the world to enhance the production of biofuels. (Solomon, 2010) By using by-products, farmers and community groups can generate additional money, which can lead to regional socio-economic expansion and development in rural locations. In addition to economic governances like incentives, tax deductions, and the blend of biofuels with conventional fuels, local and national government initiatives have a significant impact on the economic viability of first-generation biofuels. From a societal standpoint, the increase in biofuel production caused social problems in emerging nations, mostly because it occurred without sufficient regulatory requirements. In nations with abundant biomass feedstock, the growth of the biofuel sector has the potential to significantly expand the number of employment available. (Yan, 2009)For instance, Malaysia's biodiesel business is expected to add about 1 million new jobs over the next several years.

VIII. CONCLUSION

The development of first-generation biofuels has a tremendous influence on the economy and ecology worldwide. However, the battle between agricultural products as a source of food or fuel will continue to be difficult until new technology advancements reveal the routes for producing next-generation biofuels from agricultural waste. In addition to producing biofuels with significant net energy balances to be deemed biofuels and renewable sources of energy, many other agricultural productions have been highly optimistic about resolving the food vs fuel dilemma in the society. Upcoming biofuels are the subject of extensive research and innovation; however, there are numerous obstacles to overcome before they can be implemented for production at a commercial level. Furthermore, the energy sector is one of the most significant sectors, particularly biofuel, which has partnered with agriculture to improve the globe by producing and using more produce effectively for nutrition and fuels. The most widely grown cereal crops, including wheat, rice, and maize, can be used to make food, and their leftovers, such as wheat straw, rice straw, and corn stover, can still be used to make bioethanol from biomass. When compared to the bio-ethanol now produced from the cereals of cereal crops, bioethanol created from biomass is eventually more ecological and affordable. However, several obstacles must be overcome to successfully produce first-generation biofuel in mass production using biomass as a fuel source. To meet the rising global demand brought on by the depletion of the world's oil reserves, the future of biofuels may not be dependent exclusively on one generation but rather on a combination of the three generations.

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