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MICRO/MACRO ALGAE (SEAWEED)"- NEXT GENERATION FUEL SOURCE

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ABSTRACT
Energy plays an important role in the development of the economy & elevation of living standards. About 90% of the world crude oil supplies come from the Arab countries in the Middle East and due to the political situation there, the oil prices keeps fluctuating and supply lines are untrustworthy. This has lead to countries searching for an alternative fuels. This paper discusses the one of the major alternative fuel i.e.., ALGAL Fuel and also reviews about the current status of macro algae biofuel production and Harvesting. It attracts greater investment for sugar-based ethanol, advanced biofuels, drop-in fuels and biochemical's. Alternative fuel helps our country to grow economically, increasing employment and alleviation of poverty.

Keywords: Bio fuel, CO2, Macro algae, Harvesting.

I. INTRODUCTION
Based on the information world crude oil reserves amount of 1000 billion barrels and world natural gas reserves amount of about 5140 trillion cubic feet. India 6th largest consumer of crude oil in the world. India consumes nearly 2.7 million barrels a day, which costs about 890 crore rupees. Major consumption is in the field of industry & transport systems. The fast depleting fossil fuels are causing a great concern worldwide for a developing country like India where a major part of its fuel demands are met through imports and with the energy import bill rising all the time, and enormous energy needs still to be met, the government as well as private players are looking at bio fuels as an **alternative to traditional petroleum.**

There are many alternate fuels that can be used instead of traditional petroleum and they are CNG, Ethanol (E85), Liquefied Petroleum Gas (LPG), Methanol (M85) etc but very few alternative fuels have gained so much attention as quickly as biodiesel. Because of its Economical and Environmental advantages over other sources. India produces nearly 22% of its diesel requirement and 78% is imported at a huge cost in foreign currency and our expenditure and outlay for the import of Petroleum fuel is second to our Defense budget. The main commodity sources for biodiesel in India can be non-edible oils obtained from plant species such as Jatropha Curcas (Ratanjyot), Pongamia Pinnata (Karanj), Calophyllum inophyllum (Nagchampa), Hevca brasiliensis (Rubber) etc.

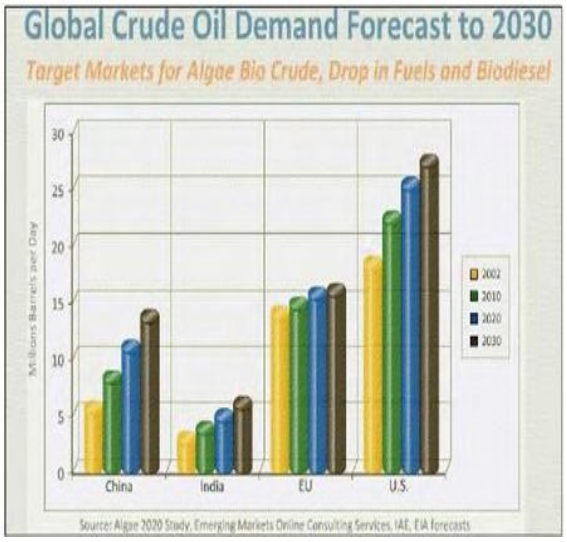

Figure 1.crude oil demand present and future

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II. MERITS OF BIOFUEL

Biofuel burns up to 75% cleaner than conventional diesel fuel made from fossil fuels. It reduces emissions of carbon monoxide (CO) by approximately 50% and carbon dioxide by 78.45% on a net lifecycle basis. It reduces by as much as 65% the emission of particulates. The ozone-forming potential of biodiesel emissions is nearly 50% less than conventional diesel fuel. Biodiesel fuel is a much better lubricant than conventional diesel fuel and extends engine life.

III. LIMITATIONS OF BIOFUEL

Biofuel can't be used in cold weather conditions without the addition of pour point reducers or without any engine modifications. It has a higher viscosity than conventional diesel and therefore becomes less useful at lower temperatures.

Producing the Bio fuel requires huge amount agricultural land to grow the Jatropha and some other plants. Using the agricultural land, will lead to the rise in cost of food crops. In ordered to these limitations know a day's scientists are on the lookout one more alternative fuel i.e. "Algal fuel"- micro algae & macro algae (Seaweed).

As the world's oil supply shrinks, it will be forced to find new ways of fuelling our cars and powering our homes- but the question will arises how? Scientists from a lab in California have developed a technology that turns seaweed into renewable fuel. Global warming has become one of the most serious environmental problems. It is necessary to substitute renewable energy for nonrenewable fossil fuel. Biomass, is one of renewable energies and also unique because it is the only organic matter among renewable energies. The fuels and chemicals can be produced from biomass in addition to heat and electricity. Marine biomass has attracted less attention than terrestrial biomass for energy utilization.

IV. MACRO ALGAE AND CONVERSION PROCESS

Seaweed is a potential carbon-dioxide (CO_2) neutral source of second generation biofuels. This type of algae, which can be used for everything from food to fertilizer. When seaweed grows it absorbs CO_2 from the atmosphere and this CO_2 is released back to the atmosphere during combustion. Seaweed, technically known as macro algae. It is one of the world's fastest growing plants. It does not require fresh water, irrigation or fertilizers, or take up land based farming- these ocean farms promise to be more sustainable than even the most environmentally sensitive traditional farms. Seaweed cultivation is an ancient practice traditionally carried out using long ropes and bamboo rafts. This can be produced at many locations across the world, with warm sea conditions and the possibility for several harvest cycles through the year make the waters around India particularly suitable.

Along with being a fantastic source of food, macro algae could be a substantial feedstock for biofuel production. While there are no seaweed based biofuels being produced at commercial scale. It is also one of fastest growing plants in the world, grows around 9-12 feet within three months. About 50 percent of seaweed's weight is oil, which can be used to make biodiesel for cars, trucks and airplanes.

Comparing the efficiency of algae as fuel source to other biofuel sources, there is a lot of difference i.e.; soya produces 40-50 gallons/acre; rapeseed produces 110-115 gallons/acre, palm oil 650 gallons/acre. On the other hand algae produce 10000-15000 gallons of biofuel per acre & it can absorb five times more Co_2 than land based plants. The oceans cover 73% of our planet's area. Half of the total photosynthesis occurs in the sea. Millions of hectares seaweed feedstock can be cultivated and extracted. Macro algae (seaweed) are not in competition with food or feed and do not increase deforestation. The seaweed based biofuels do not require land or fresh water. Biofuels have also forced global food prices up by 75 percent.

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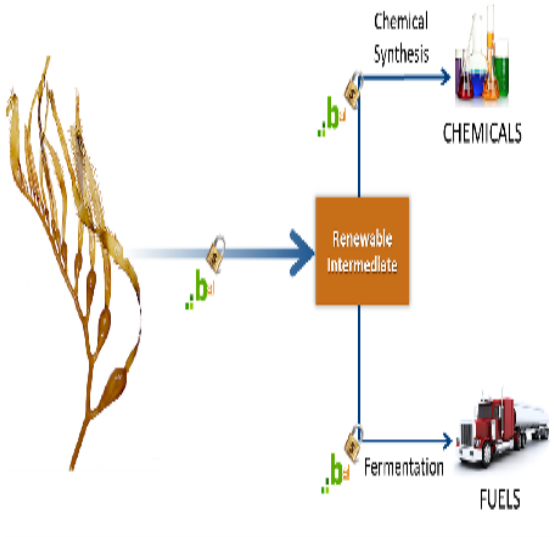

Figure2: Seaweed to Biofuel conversion

Conversion process

Alginate is a naturally found in long chains of repeating sugars-polymer. The first step is to get the bacterium to make an enzyme that cuts up the polymer into small pieces. The long polymer of alginate could now be broken up, but the small pieces would still need to get into bacterial cell then converted into type of sugar than E.coli can use to make ethanol. About 60 percent of dry biomass of seaweed is sugars, and more than half of those are locked in a single sugar- alginate.

From the marine bacterium Pseudoalteromonas, scientists used genes for an enzyme that cuts alginate into molecular bits. The large structured these genes of a cellular transport system already found in E.coli, so the bacterium would secrete the alginate slicing enzyme into its environment. Another marine microbe Vibrio splendidus and heavy amount of the Vibrio DNA for use in the E.coli microbes pumped out ethanol. The system yields 80 percent of the theoretical maximum amount of ethanol for a given amount of biomass. E.coli consumes the broken down alginate the bacteria generate a lot of pyruvate, a chemical intermediate useful for making fuels such as butanol or biodiesel.

Researchers have monitored a bacterium that can breakdown and digest seaweed's gummy cell walls to yield ethanol and other useful compounds. If the process makes larger scale, macro algae could soon be a source of renewable fuel.

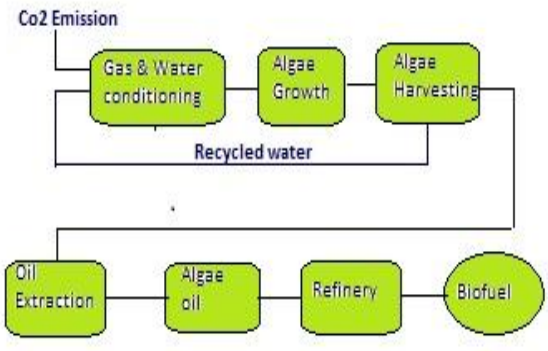

Figure3: Seaweed to fuel process conversion stages

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V. PRODUCTION OF BIOFUELS

In macro algae we can produce maximum number of Biofuels namely Bio-ethanol, Biodiesel and Biogas. These fuels are widely used in Transportation sector.

1. Bio-ethanol production process

Macro algae are chosen because it has two main high sugar content mannitol and laminaran. Both mannitol and laminaran are easy to extract. The macro algae is cut up and treated. It appears like a sledge and it is now called feedstock. The microorganisms called yeasts are added to feed stock mixture in big tank. The feedstock is changed by the yeast to ethanol and other components. This process is called Fermentation. The ethanol is separated from other component and filtered. The bioethanol can now be used with petrol.

2. Biogas Production process

Biogas is produced naturally from the breakdown of organic material. The main constituent in biogas is methane gas. Biogas can be made by using macro algae. Macro algae contain high sugar content, producing methane gas from seaweed by using anaerobic digestion (AD). It takes place in big tanks. Special microorganisms are added. These microorganisms are called anaerobes and breakdown the macro algae without oxygen. The mixture undergoes a series of reaction in the microorganisms. Methane gas is produced at the end of this process. Methane gas is the main ingredient of biogas which can be used as fuel.

3. Biodiesel production process

Biodiesel can be made from oils within algae. Macro algae contain oil within its cell. This oil can be used to make the biodiesel. There are different varieties of macro algae which contain oil. Algae are selected by scientists which contain more amounts of oil contents.

The macro algae cell are specially grown and selected for their oil content. They contain oil inside their cells. Then the oil is extract from macro algae by the use of chemicals. The oil may be also squeezed out of the macro algae cells by scientific equipment. The oil is then changed chemically so it can be used as biodiesel.

VI. ADVANTAGES OF MACRO ALGAE

No need to use crops such as palms to produce oil. Algae Oil Extracts can be used as livestock feed and even processed into ethanol. High levels of polyunsaturated in algae biodiesel are suitable for cold weather climates. Grows practically anywhere. It can reduce carbon emissions based on where it's grown.

VII. CONCLUSION

Few years back, the gap formed due to the exhaust consumption of fossil fuel lead to search for alternative source of fuel and lead to the field of 'Biofuel'. However the source of biofuel being land the growth of biofuel conserves the land of food crops. This leads to rise in prices of food commodities.

Micro algae fuel from seaweed appears to be an ideal alternative on the seaweed grow in ocean and also ecofriendly as it consumes Co_2 during its growth. Costs for seaweed cultivation need to reduce by at least 75% in order to make anaerobic digestion of cultivated seaweed of commercial interest.

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