Protista-The Superhero

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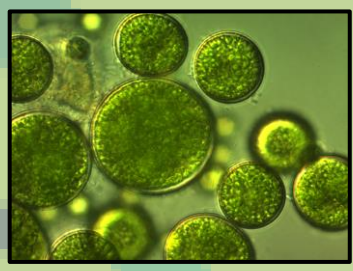
INTRODUCTION:



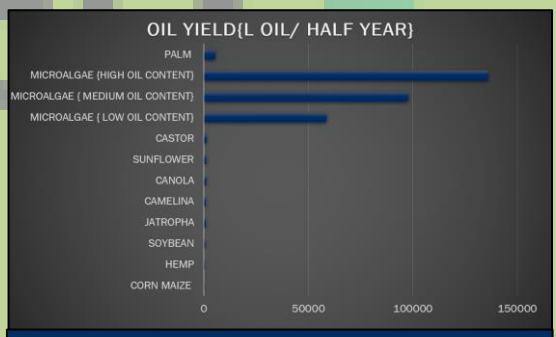
The energy demand is growing worldwide. The total energy consumption has increased from 196 EJ (10^{18} Joule) in 1973 to more than 350 EJ in 2009 and the tendency is rising. About 80% of this energy demand is delivered from fossil fuels with the consequence of serious environmental issues as almost 98% of carbon emissions result from fossil fuel combustion. Hence, finding a sustainable alternative to fossil fuels is vital to our planets survival.

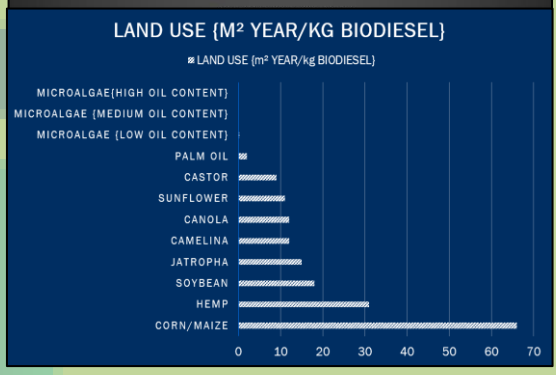
THESIS:

What is the next sustainable fuel? Biofuels, produced from biomass, are promising alternatives to fossil fuels. As biodiesel from oil crops, waste cooking oil and animal fat can fulfill only a small fraction of the existing demand for fuels, microalgae appear to be the only source of renewable biodiesel that is capable of meeting the global demand for fuels. Biomass yields of up to 100 to 150 tons dry matter per ha and year with lipid contents of around 40%, biodiesel yields of 40 to 50 tons per ha and year by far exceed the most promising yields from land crops.
The residual biomass obtained can be used for feed production.

AIM:

- To create a renewable source of fuel using abundantly available materials.
- To create an app to facilitate the collection and utilization of Algae.
- To utilize algae for the production of animal feed.





BODY:

a. ALGAE FUEL:

Oil present in Algae is converted into biodiesel through a transesterification process. Oil extracted from the algae is mixed with alcohol and an acid or a base to produce the fatty acid methylesters that makes up the biodiesel.

- It would work with our current system of fuels as a direct and immediate replacement and is non-toxic.
- It can also produce numerous useful byproducts and is extremely productive.
- It offers a nearly complete carbon neutral combustion.
- The annual productivity and oil content of algae is far greater than seed crops. Soybean can only produce about 450 l of oil per hectare. Canola can produce 1200 l per hectare, and palm can produce 6000 l. Algae, on the other hand, can yield 90,000 l per hectare. Algae contain anywhere between 2% and 40% of lipids/oils by weight.
- According to a study published by Water Resources Research, algae-derived oils have the potential to replace 17 percent of the nation's imported oil for transportation.

b. ANIMAL FEED:

Algae have been part of the human diet for thousands of years, based on archaeological evidence from 14,000 yBP in Chile and early written accounts. Thus, why not animals too?

- Algae are a high protein, nutritious, natural and a low cost food option for animals. Some health benefits include improved immune response, improved fertility, better weight control, healthier skin and a lustrous coat where 0.7 kg of microalgae feed supplement leads to a healthy weight increase of 0.5 kg a day.
- They also provide important marine minerals such as iodine-omega-3 fatty acids in the form of eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA).
- Adding algae to the diet of cows resulted in a lower natural breakdown of unsaturated fatty acids

and a higher concentration of these beneficial compounds in meat and milk thus improving the product for subsequent human consumption of meat and milk. Feeding of poultry with algae rich in omega-3 fatty acids places this cholesterol-lowering compound in eggs.

- The filamentous cyanobacterium Arthrospira platensis ("spirulina") and various commercial species of the unicellular green alga Chlorella contain up to 70 % dry wt. protein.
- Edible macroalgae contain unusually high amounts of dietary fiber, ranging from 23.5 % to 64.0 % of dry weight in Gracilaria spp., values that frequently exceed those for wheat bran.

c. ALGAE CULTURE:

Along with collection of algae through our web app, algae will be grown through Algae culture to meet the requirements of our project. Although it needs high investments, under good conditions, green algae can double its biomass in less than 24 hours.

Up to 50% of algae's weight is comprised of oil, compared with, for example, oil palm that yields just about 20% of its weight in oil. In terms of yield, around 60,200.336 kg of algae is required for the production of 1,000 l of fuel.

- Algae can be grown on non-arable land unlike other oil crops.
- They have the ability to produce much biomass per area than any other source of biomass.
- Algae species grow rapidly in different climatic conditions.
- Cultivation of Algae takes up significantly less field area as compared to Soya Bean plants, used for animal feed.
- If biomass is grown in a sustained way, its combustion has no impact on the CO_2 balance in the atmosphere, because the CO_2 emitted by the burning of biomass is offset by the CO_2 fixed by photosynthesis. Therefore, producing 100 tons of algal biomass fixes roughly 183 tons of carbon dioxide.
- Algae can be cultivated on land, fresh water, or seawater. Algae can be harvested batch-wise nearly all-year-round, providing a reliable and continuous supply of oil.
- Algae have the potential of growing in places away from the farmlands and forests, thus minimizing the damages to the ecosystem and food chain supply. Algae can also be grown in sewage and next to power-plant smokestacks, where they can digest the pollutants and deliver the oil.

SUCCESSES AND FAILURES:

Our experiment proved to be a success as we extracted oil from algae. However, we were unable to do a quantitative-based experiment.

Our web app proved to be successful but we failed to partner up with an organization. We have succeeded in spreading a lot of awareness on our project through explanations in classes, a documentary, videos, surveys, brochures, etc. We received a positive response from the community through surveys.

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We were able to popularize our idea by making a prototype of it and exhibited it in the ''Children's Science Congress'' screening programme conducted in UAE by the science India forum.

SKILLS GAINED:

We have improved our researching capabilities and have become independent learners.

This project has enabled us to improve our problem solving and critical thinking. Our determination and persistence have definitely increased with the inclusion of time management too.

Additionally, we have developed good communication skills as a team and have employed them to spread awareness. Moreover, we have enhanced our technological and presentational skills. Likewise, we have expanded our creativity and innovation as a team and hope to overcome any obstacle we may face.

Finally, we aim to revolutionize algae and keep learning as we grow.

CONCLUSION:

Biodiesel derived from oil crops is a potential renewable and carbon neutral alternative to petroleum fuels. However, the high cost and limited supply of renewable oils prevent it from becoming a top competitor for petroleum fuels. As petroleum fuels cost rise and supplies decrease, biodiesel will become more attractive to both investors and consumers.

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