

Study of macro algae as marine biomass energy source

Abstract

Algae are organisms that grow in aquatic environments using the light and carbon dioxide (CO₂) to create biomass. Macro algae are larger algae that can grow in a variety of ways. Algae can be explored for a variety of other uses such as biofuels, fertilizer and pollution control. In addition, algae can also be used for reducing the emissions of CO₂ from power plants. CO₂ produced by the power plant could be utilized as a carbon source for algal growth, and the carbon emissions would be reduced by recycling waste CO₂ from power plants into clean-burning biodiesel.

Keywords: Algae, Energy Sources, Biodiesel

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Introduction

Biomass production from macro algae has been viewed as important mainly because of the need for pollution abatement and energy source. Environmental considerations will increasingly determine use of macro algae product and improve process acceptability that drive the next generation of economic opportunity. In context, biomass refers to any source of heat energy that is produced from non-fossils biological materials. Unlike fossil fuels, biomass is a renewable energy resource that is available where the climatic conditions are favorable for plant growth and production. Biomass is considered as an attractive alternative to fossil fuels as a source of energy. In addition to this, the biomass can also be used for carbon capture. The carbon capture is an approach to mitigate the global warming by capturing the carbon dioxide from the large point sources such as fossil fuel power plants and storing it instead of releasing it into atmosphere like technology for large scale capture of CO₂ is already commercially available and fairly well developed.¹ The different macro algae survive in different habitat. Thus, study focus on the types of macro algae which are suitable cultivation in Malaysia water. This approach would identify the oceanic parameters that are most suitable for the macro algae and conduct species matching.²

Need for Alternative Oil Source

There are several problems associated with the energy use in this country. First of all, there is requirement to overcome future possible oil shortage. The reservoirs are about 2000 billion tones whereas the daily is using about 71.7 million tons.³ Besides, there is need to reduce the impact of global warming and climate change. The increasing of greenhouse gas emission such as carbon dioxide caused bad impact to the country. Based on estimation in 2000, more than 20 metric tons of carbon dioxide was release to the atmosphere every year.⁴ The macro algae cultivation can reduce the released of greenhouse gas from the energy production. Through, application of macro algae as the marine biomass energy sources, the net emission of carbon into atmosphere from carbon capture may reduce.

Methodology

Water Sampling

The water samples were takes in Setiu Wetland, Bidong Island and Perhentian Island. The 200 meter depth is marks on the rope at the vandorn water sampler. The latitude and longitude at the location was identified using the Global Positioning System (GPS). The GPS was

set up assuming 500 meter distance from the shore. The water samples are transfer immediately into bottles after takes using vandorn water sampler to prevent the disruption of surrounding. The most suitable for macro algae survive is about 29-32oC.

Setiu Wetland: Two different times are taken which is at 11.00am and 3.00pm. So, four different of water samples are taken. The location of Setiu wetland are N 05o 40.540' E102o 43.080' and N 05o 40.313 E 102o 43.934'. Temperature of water samples was taken a moment after exchange the samples into the bottles. The water temperature is 32oC. This figure show the location of Setiu Wetland where the water samples are taken (Figure 1).

Bidong Island: Bidong Island is one square kilometer in area and accessible from the coastal town of Merang. It is located at 05o 36 N and 103o 03 E. At the Bidong island also takes two times samples, in 11.00am and 3.00 pm. Four collected of water samples taken and the temperature were identified. It is located 05o 36.828 N and 103o 03.262 E. The water temperature is 31oC. This figure show the location of Bidong Island where the water samples are taken (Figure 2).

Perhentian Island: Perhentian Island is divided by two which is Perhentian Kecil and Perhentian Besar. The sampling site is at Perhentian Kecil with located at 05o 51 N and 102o44 E. Two different times are taken which is at 3.00pm and 10.00 am on the next day.^{5,6} The location of Perhentian Island is 05o 21.26 N and 102o 44.2 E and the water temperature is 29oC. This figure show the location of Bidong Island where the water samples are taken (Figure 3).

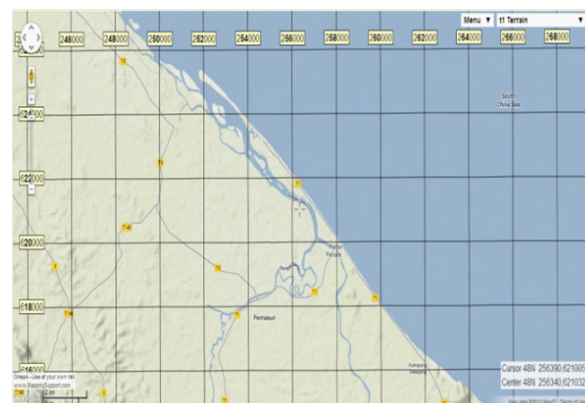


Figure 1 Setiu Wetland.

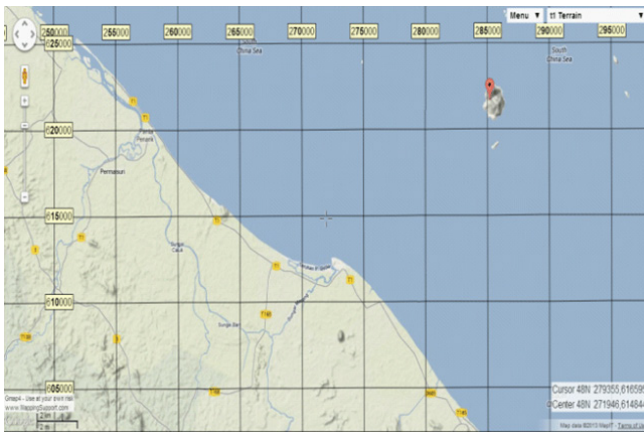


Figure 2 Bidong Island.

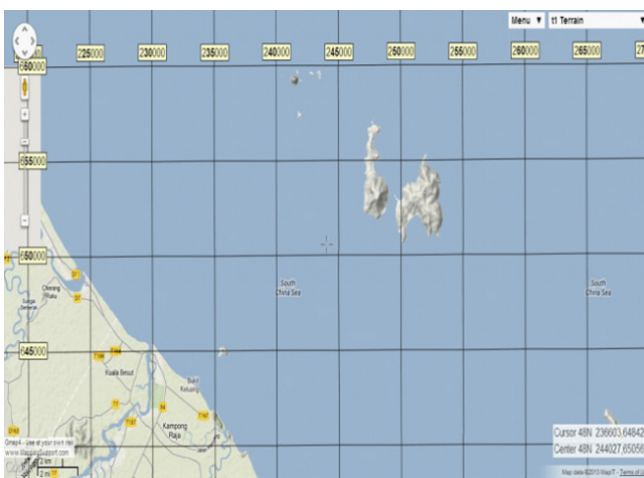


Figure 3 Perhentian Island.

Samples Preservation

Water sample are collect using vandorn water sampler and transferred to the bottle samples. Generally, at least one liter of water sample is needed. Sample volume is depending on the sampling location. The water samples are kept from heat and light to avoid pigment decomposition and bacteria infect. The location of each sampling sites are marks using GPS and the temperature of sea water is taken immediately to prevent surrounding disturbance.⁷ Hence, the water samples are place in an ice chest at temperature 1-4oC.

Calorific Value and Power Efficiency

Specific heat is the measure of kcals required to raise the temperature of 1 kg of oil by 10oC. The unit of specific heat is kcal/kg. It fluctuates from 0.22 to 0.28 relying upon the oil specific gravity. The specific high temperature confirms what amount of steam or electrical vigor it takes to high temperature oil to a wanted temperature.^{8,9} Light oils have a low specific heat, in as much as heavier oils have a higher particular high temperature. Calorific value was evaluated using the following relations.

Results

Physical Parameter Records

The Figure 4 shows the latitude against temperature of sampling

site whereas the latitude is decrease inversely proportional to the temperature at first point. Basically, the temperature is depending on the latitude because of water circulation patterns modify the direct effect of the amount of energy received from the sun.

The graph shows that not all of the temperature caused by latitude where at Setiu Wetland has highest temperature while their latitude is lower than Bidong Island. This is happening because the Setiu Wetland water has low salinity which is there are mixed of sea water and river.

The Table 1 & 2 showed the results from water analysis that conducted to analyze the nutrients of sea water in each sampling site which is Setiu Wetland, Bidong Island and Perhentian Island.

The values of total nitrogen at all sites are highest compare to others because there is more than 65 % of nitrogen in sea water. Setiu Wetland has the highest values of nutrients caused the higher population of macro algae that need more nutrients to survive such as *Ulva* species.

There are four species of major species of macro algae found at sampling site based on matching of their physical and chemical characteristic such as temperature, salinity and nutrients contents in macro algae. The species in Setiu Wetland are *Ulva lactuca* and *Enteromorpha intestinalis* while in Bidong Island is *Sargassum cristaefolium* and in Perhentian Island are *Sargassum cristaefolium* and *Glacilaria confervoides* (Figure 5).

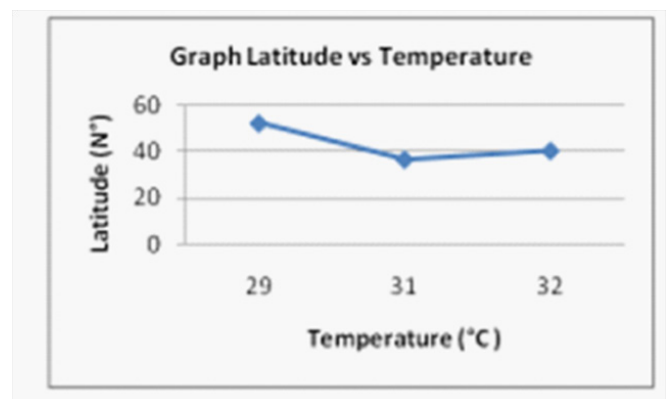


Figure 4 Graph Latitude against temperature.

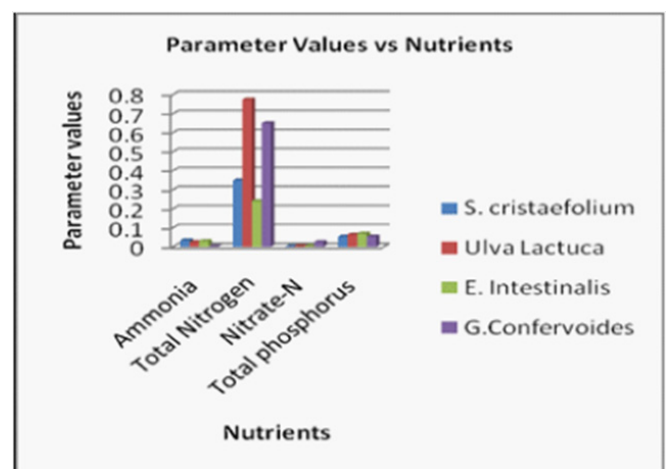


Figure 5 Graph parameter values against nutrients.

Table 1 Experimental results

Sampling Site			
Parameters	Bidong Island	Setiu Wetland	Perhentian Island
Temperature °C	31	32	29
Salinity (ppm)	32.34	24.1	35.13
pH	5.8	5	6
Ammonia	0.034	0.035	0.0665
Total Nitrogen	0.391	0.46	0.3265
Nitrate-N	0.002	0.002	0.003
Total phosphorus	0.045	0.045	0.031

Table 2 Macro algae species with their parameters values

Macro algae species				
Parameters	<i>S. cristaeifolium</i>	<i>Ulva Lactuca</i>	<i>E.Intestinalis</i>	<i>G.Confervoides</i>
Temperature °C	24-34	22- 34	20 – 33	31 – 34
Salinity (ppm)	30-33	19- 22	8.2-25	15-32
pH	4.0 - 6.0	7.1 -8.5	6.9-9	7.0-8.0
Ammonia	0.029 – 0.039	0.01 - 0.04	0.02 – 0.04	0.001 – 0.005
Total Nitrogen	0.2 – 0.5	0.65 – 0.9	0.10-0.38	0.5 – 0.8
Nitrate-N	0.001 – 0.003	0.002 – 0.008	0.001 – 0.009	0.001 – 0.004
Total phosphorus	0.03 – 0.08	0.04-0.09	0.04 – 0.10	0.02 – 0.09

Conclusion

Macro algae may found in many types of habitat in Malaysia such as Bidong Island, Redang Island, Perhentian Island and Setiu Wetland. The water analysis is used to identify the mineral contents in sea water in order to matching the species. In order to identify the market price, the costs of macro algae are calculated by drawing the cultivation system in 100000 meters for 10 blocks. The use of macro algae as the marine biomass energy sources has the potential to offset substantial use of fossil fuels. The net emission of carbon into the atmosphere can be reducing due to use the macro algae as biomass energy sources. This research estimates the carbon capture energy value from deployment aquaculture system for seaweed farming. Based on the market price of macro algae, the *Ulva Lactuca* and *Sargassum cristaeifolium* are the lowest price compare to other species.

Acknowledgments

None.

Conflicts of interest

None.

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