Growth Rate of Algae in Different Medium

Science Fair Project Report

Level : Middle Level

Category : Life Science

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(Grade 7)

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(Creating the community of Excellence)

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ABSTRACT

Algae are organisms commonly found in aquatic environments. There are two types; macroalgae and microalgae. The large multicellular macroalgae are often found in ponds and in the ocean. They tend to be measurable in inches, although giant kelp in the ocean can grow to more than 100 feet in length. Microalgae are tiny unicellular algae that grow as suspensions in water; they are measurable in micrometers. Common sources of microalgae are bogs, marshes, and swamps.

All algae require sunlight, water, nutrients, and carbon dioxide for growth. Through the process of photosynthesis, algae convert the carbon dioxide into glucose (a sugar). The glucose is then broken down into fatty acids, which under normal conditions, are used to produce membranes for new algal cells. If, however, the algae are starved of nutrients, the fatty acids produce fat molecules (oil). Because carbon dioxide is the only source of carbon for algae, having an adequate supply is essential if they are to be used for commercial purposes.

I collected algae from the nearby masjid, and selected dam water (Vaigai dam), falls water(Kutladampatti), sea water (Chennai), fish tank water, sterile water and soap water as the different growth medium and started my research on finding the good growth medium for the algae by providing suitable conditions. My research proved that algae grow well in the fish tank water.

INTRODUCTION

Algae fuel, algal biofuel, or algal oil is an alternative to liquid fossil fuels that uses algae as its source of energy-rich oils. Also, algae fuels are an alternative to commonly known biofuel sources, such as corn and sugarcane. Several companies and government agencies are funding efforts to reduce capital and operating costs and make algae fuel production commercially viable. Like fossil fuel, algae fuel releases CO2 when burnt, but unlike fossil fuel, algae fuel and other biofuels only release CO2 recently removed from the atmosphere via photosynthesis as the algae or plant grew. The energy crisis and the world food crisis have ignited interest in algaculture (farming algae) for making biodiesel and other biofuels using land unsuitable for agriculture. Among algal fuels' attractive characteristics are that they can be grown with minimal impact on fresh water resources, can be produced using saline and wastewater, have a high flash point, and are biodegradable and relatively harmless to the environment if spilled.

Reproduction in Algae

STATEMENT OF THE PROBLEM

- The world is now facing acute shortage of non-renewable resources. Dramatic increase of consumption of resources raised alarming signals to the existing resource base.
- Biodiesel is a diesel fuel derived from animal or plant lipids (oils and fats). Studies have shown that some species of algae can produce 60% or more of their dry weight in the form of oil. Because the cells grow in aqueous suspension, where they have more efficient access to water, CO2 and dissolved nutrients, microalgae are capable of producing large amounts of biomass and usable oil in either high rate algal ponds or photo-bioreactors. This oil can then be turned into biodiesel which could be sold for use in automobiles. Regional production of microalgae and processing into biofuels will provide economic benefits to rural communities.
- So I decided to do a research on finding the good growth medium for the algae.

HYPOTHESIS

The rate of growth of algae is high in dam water.

DESIGN OF STUDY

INDEPENDENT VARIABLE:

- Types of water(Sterile water, soap water, fish tank water, falls water, dam water and sea water)

DEPENDENT VARIALBE:

- Growth of algae

CONTROLLED VARIABLES:

- Amount of sample algae
- Quantity of different types of water
- Sunlight and air

MATERIALS:

- 6 clear and transparent bottles
- Sterile water, soap water, fish tank water, waterfalls water, dam water and sea water
- Labels and marker
- Measuring cup
- Aquarium airline

PROCEDURE:

- 6 water bottles are selected which are clear and transparent and so that they will allow sunlight to reach the algae.
- Boiled the tap water and then cooled it to prevent the bacterial growth. (Sterile water)

- Poured 500 ml of sterile water into each bottles.
- Then added 500ml of sterile water, soap water, fish tank water, waterfalls water, dam water and sea water separately in each of the 6 bottles. These waters act as different growth medium for the same sample algae and provide different nutrient to the algae.
- Three teaspoons of algae (collected from nearby masjid) are added equally to each of the bottles.
- Drilled a small hole in the bottle caps for aeration and then placed in the place having indirect sunlight.
- Since it is green algae, the temperature (weather report) and the colour changes in every growth medium are planned to observe day by day for nearly one month.

COLLECTION OF DATA

Photographs


Day 30

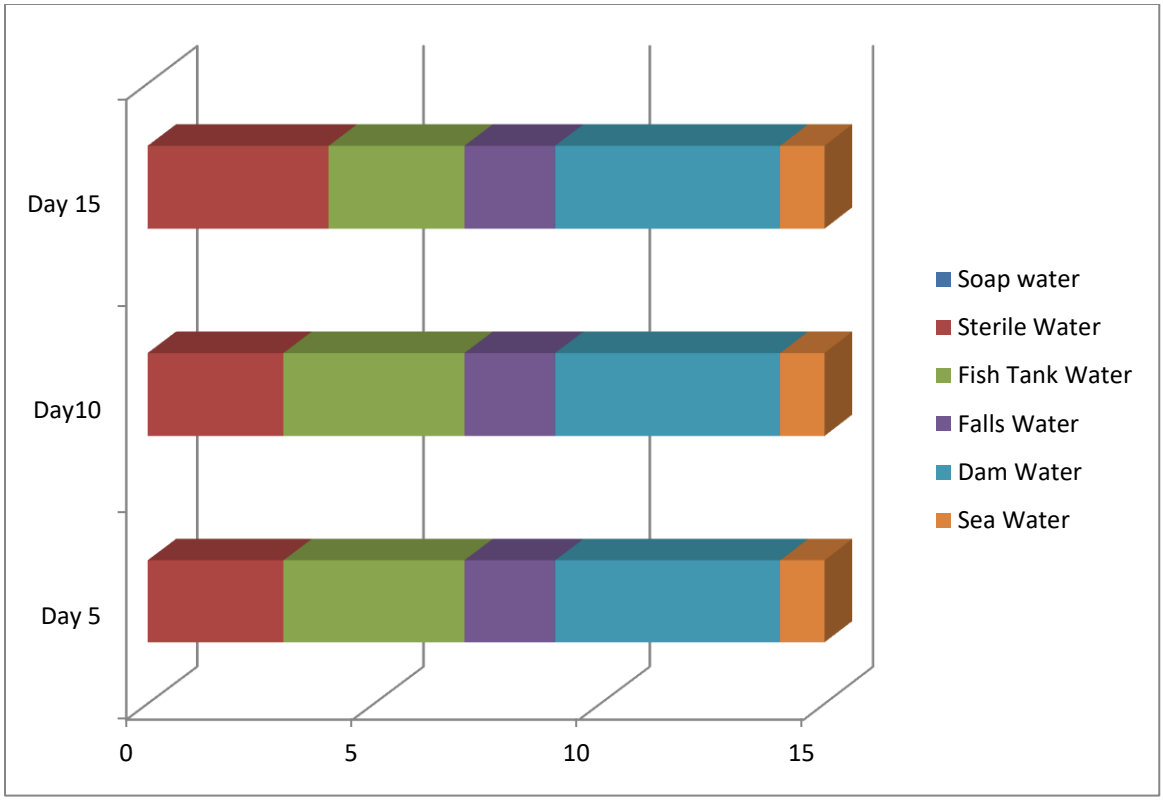

Day 1
Day 30

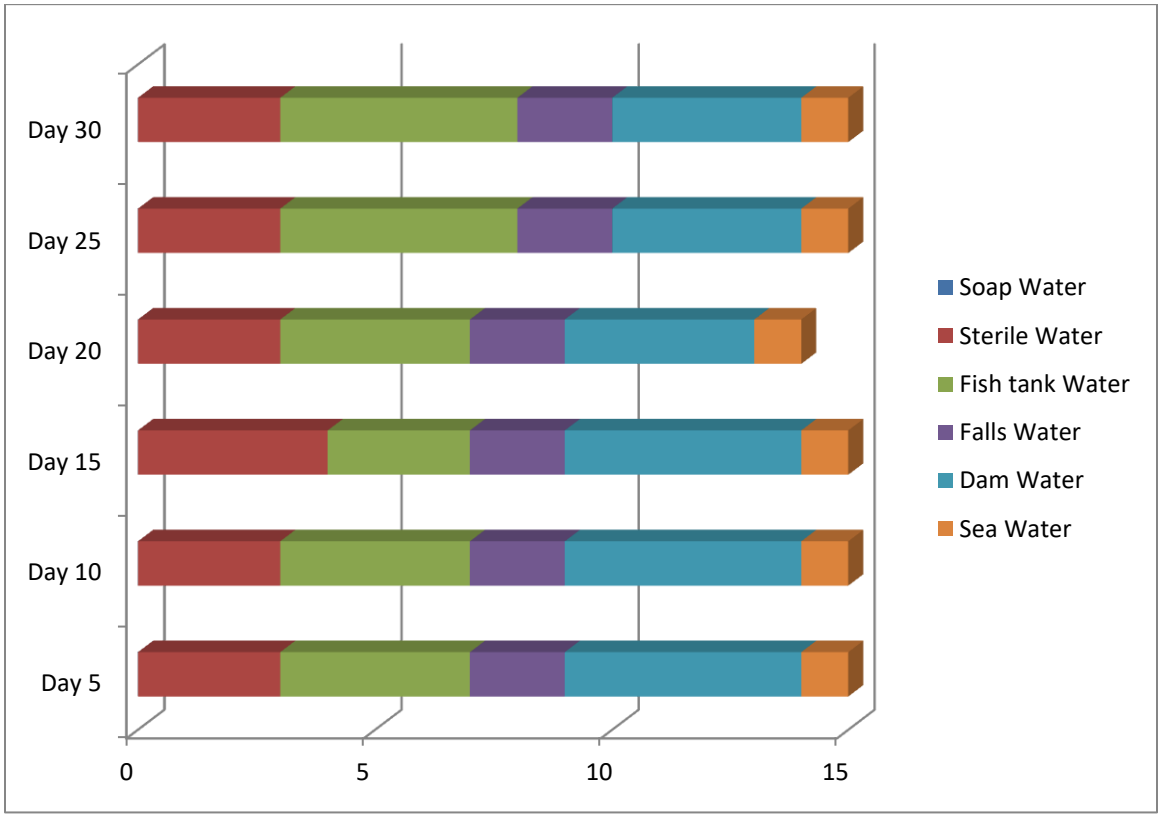
Tabulation:

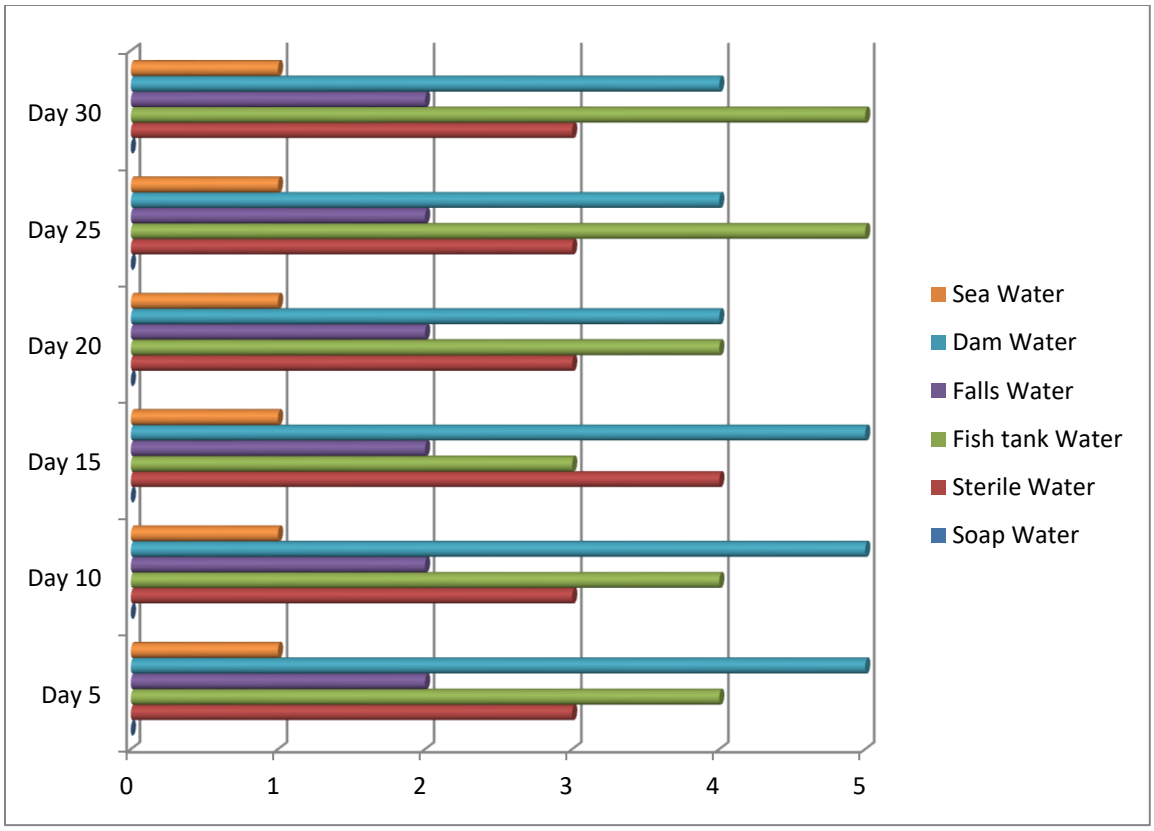
Day	*Temperature*	*How does the alga look?*					
		Sterile water	*Soap water*	*Fish tank water*	*Waterfalls Water*	*Dam water*	*Sea water*
1	23°C -29°C	Pale	Soapy	Light green	Light green	Light green	Pale
2	23°C -29°C	Pale	Soapy	Light green	Light green	Light green	Pale
3	23°C -27°C	Pale	Soapy	Light green	Light green	Light green	Pale
4	24°C -27°C	Light green	Soapy	Light green	Light green	Light green	Pale
5	24°C -27°C	Light green	Soapy	Light green	Light green	Light green	Pale
6	23°C -29°C	Light green	Soapy	Light green	Light green	Light green	Pale
7	22°C -30°C	Light green	Soapy	Light green	Light green	Light green	Pale
8	23°C -29°C	Light green	Soapy	Light green	Light green	Light green	Very Light green
9	23°C -29°C	Light green	Soapy	Light green	Light green	Light green	Very Light green
10	24°C -30°C	Light green	Soapy	Light green	Light green	Light green	Very Light green
11	23°C -31°C	Light green	Soapy	Light green	Light green	Light green	Very Light green
12	22°C -31°C	Light green	Soapy	Light green	Light green	Light green	Very Light green
13	21°C -32°C	Light green	Soapy	Light green	Light green	Light green	Very Light green
14	23°C -32°C	Light green	Soapy	Light green	Light green	Light green	Very Light green
15	24°C -31°C	Light green	Soapy	Light green	Light green	Light green	Very Light green
16	22°C -26°C	Light green	Soapy	Light green	Light green	Light green	Very Light green
17	23°C -29°C	Light green	Soapy	Light green	Light green	Light green	Very Light green
18	24°C -30°C	Light green	Soapy	Dark green	Light green	Light green	Very Light green
19	23°C -31°C	Light green	Soapy	Dark green	Light green	Light green	Very Light green

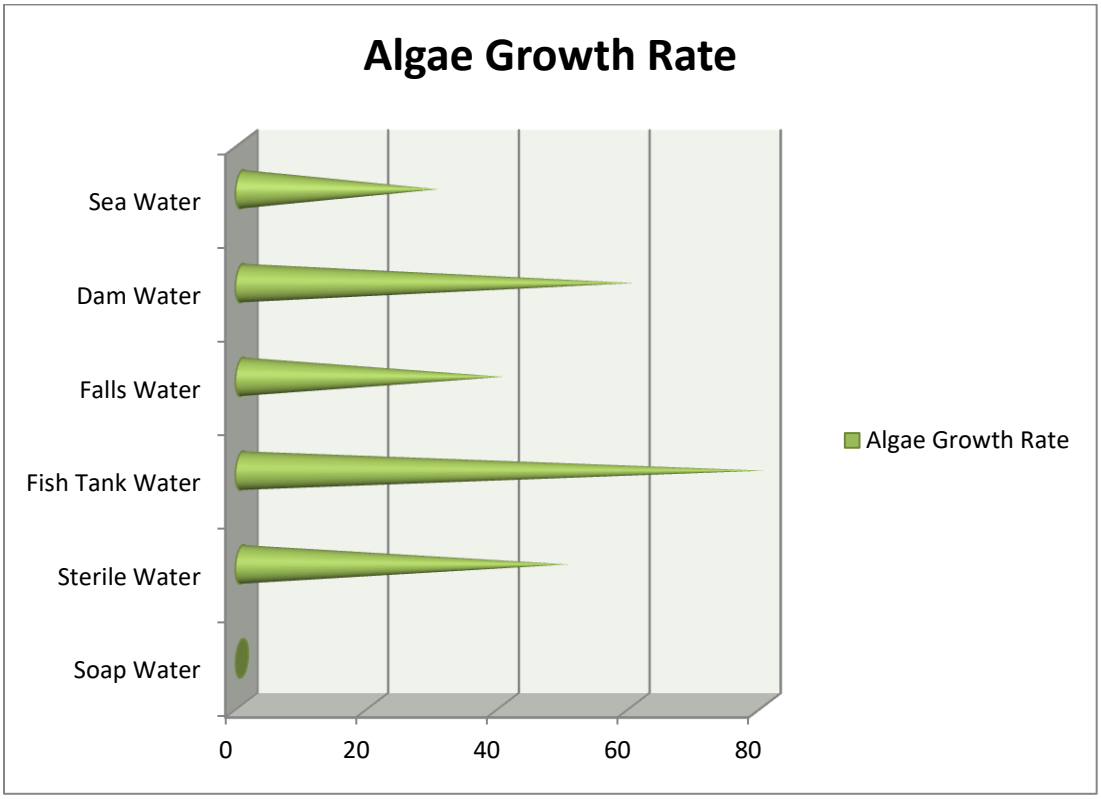
20	23°C -27°C	Light green	Soapy	Dark green	Light green	Light green	Light green
21	24°C -27°C	Dark green	Soapy	Dark green	Dark green	Light green	Light green
22	23°C -27°C	Dark green	Soapy	Dark green	Dark green	Light green	Light green
23	23°C -29°C	Dark green	Soapy	Dark green	Dark green	Light green	Light green
24	23°C -29°C	Dark green	Soapy	Dark green	Dark green	Light green	Light green
25	24°C -30°C	Dark green	Soapy	Dark green	Dark green	Light green	Light green
26	22°C -31°C	Dark green	Soapy	Dark green	Dark green	Dark green	Light green
27	21°C -32°C	Dark green	Soapy	Dark green	Dark green	Dark green	Light green
28	23°C -32°C	Dark green	Soapy	Dark green	Dark green	Dark green	Light green
29	24°C -31°C	Dark green	Soapy	Dark green	Dark green	Dark green	Light green
30	22°C -31°C	Dark green	Soapy	Dark green	Dark green	Dark green	Light green

GRAPHICAL REPRESENTATION OF THE RATE OF GROWTH OF ALGAE






Day 30
Day 25
Day 20
Day 15
Day 10
Day 5
0
1
2
3
4
5
Sea Water
Dam Water
Falls Water
Fish tank Water
Sterile Water
Soap Water


Algae Growth Rate
Sea Water
Dam Water
Falls Water
Fish Tank Water
Sterile Water
Soap Water
0
20
40
60
80
Algae Growth Rate

RESULT AND DISCUSSION

- The algae in the soap water medium seem to be died. In all the other mediums, there is a slight change in the amount of algae.
- Another interesting thing observed was during the morning time the air bubbles are seen in large amount at the mouth of the growth medium but during night time the air bubbles are not seen in any medium. This is due to the photosynthesis.
- I observed the growth of algae in all the growth medium but in different rate.
- After fifteen days, the light green colour ranges in the order of dam water, sterile water, fish tank water, falls water and sea water.
- But day by day I observed the colour changes in different order. At the end of 30^{th} day, I observed ***the rate of growth is high in the fish tank water*** and then in dam water, sterile, falls and then last in sea water.
- I found that the fish waste act as a good nutrient for the algae to grow well. If that means then why the algae growth is not much effective in the sea water which has lots of aquatic creatures.
- I had a doubt whether *the salt content of the sea water affects the growth.*

APPLICATION

Algae are emerging to be one of the most promising long-term, sustainable sources of biomass and oils for fuel, food, feed, and other co-products. What makes them so attractive are the large number and wide variety of benefits associated with how and where they grow. Nearly all these benefits stem from the fact that these plants have evolved over billions of years to produce and store energy in the form of oil, and they do this more efficiently than any other known natural or engineered process.

Here are 10 reasons why algae are a promising new source of fuel and other products:

1) Algae Grow Fast: Algae can double their numbers every few hours, can be harvested daily, and have the potential to produce a volume of biomass and biofuel many times greater than that of our most productive crops.

2) Algae Can Have High Biofuel Yields: Algae store energy in the form of oils and carbohydrates, which, combined with their high productivity, means they can produce from 2,000 to as many as 5,000 gallons of biofuels per acre per year.

3) Algae Consume CO_2: Like any other plant, algae, when grown using sunlight, consume (or absorb) carbon dioxide (CO_2) as they grow, releasing oxygen (O_2) for the rest of us to breathe. For high productivity, algae require more CO_2, which can be supplied by emissions sources such as power plants, ethanol facilities, and other sources.

4) Algae Do Not Compete With Agriculture: Algae cultivation uses both land that in many cases is unsuitable for traditional agriculture, as well as water sources that are not useable for other crops, such as sea-, brackish- and wastewater. As such, algae-based fuels complement biofuels made from traditional agricultural processes.

5) Micro-algal Biomass Can Be Used for Fuel, Feed and Food: Microalgae can be cultivated to have a high protein and oil content, for example, which can be used to produce either biofuels or animal feeds, or both. In addition, micro-algal biomass, which is rich in micronutrients, is already used for dietary supplements to advance human health.

6) Macro-algae Can Be Grown in the Sea: Macro-algae (seaweeds) are grown in the sea, or even on land with seawater, and their sugars can be converted into biofuels and chemicals.

7) Algae Can Purify Wastewaters: Algae thrive in nutrient-rich waters like municipal waste waters (sewage), animal wastes and some industrial effluents, at the same time purifying these wastes while producing a biomass suitable for biofuels production.

8) Algal Biomass Can Be Used as an Energy Source: After oil extraction, the remaining algal biomass can be dried and "pelletized" and used as fuel that is burned in industrial boilers and other power generation sources.

9) Algae Can Be Used to Produce Many Useful Products: Algae can be cultivated to produce a variety of products for large to small markets: plastics, chemical feed stocks, lubricants, fertilizers, and even cosmetics. See other products algae are used for here.

10) The Algae Industry is a Job Creation Engine: Algae can grow in a wide variety of climates in a multitude of production methods, from ponds to photo-bioreactors to fermenters, and thus will create a wide variety of jobs throughout the United States, from research to engineering, from construction to farming, from marketing to financial services. The Algal Biomass Organization projects the potential for creation of 220,000 jobs in this sector by 2020.

CONCLUSION

- My hypothesis, "The rate of growth of algae is high in dam water." was proven false.
- While collecting dam water (Vaigai dam), the water in the dam appears green and I thought it will be a good medium for algae growth. But my research proved that the algae grow well in the fish tank water than in dam water.

FUTURE ENHANCEMENT

- ***Further I want to continue the experiment;***
  - ***By growing more algae in the fish tank/pool water and thereby find out whether those algae can produce bio-oil which can be turned into bio-diesel.***
  - ***Whether the salt water affects the rate of photosynthesis.***
- Alga fuels are an alternative to commonly known biofuel.
- **Someday algae may allow us to stop burning petroleum.**

ACKNOWLEDGEMENT

First of all, I thank to the Almighty, for giving me good strength throughout my research work and enabling me to complete the fair project successfully.

I express my deep sense of gratitude to my teacher Mrs. M.Taj Nisha M,Sc, B.Ed, BA, as well as the Academic Coordinator Mrs.R.Sameem M,Sc, B.Ed, PGDCA, for their valuable guidance and suggestion throughout this project.

I am deeply grateful to my Principal, Mrs. A.Parakath Nisha and Correspondent, Mr.A.Sathakkathullah for having provided the necessary facilities to carry out the project work.

I like to thank Mr.Muhammad Ismail and Mr. Muhammad Yasin for their help in collecting the sea water (Chennai), dam water (Vaigai dam) and falls water (Kutlatampatti).

Last but not least, I would also like to thank my parents and friends for their constant encouragement and moral support for my project.

REFERENCE

- http://allaboutalgae.com/benefits/
- http://www.pbs.org/wgbh/nova/tech/algae-biodiesel.html
- http://www.e-aquarium.com.au/aquarium-plant-carbon-dioxide.htm
- http://www.nytimes.com/2009/06/29/business/energy-environment/29biofuel.html
- http://www.sciencedaily.com/releases/2008/08/080818184434.htm
- http://www.docstoc.com/docs/22054985/Growing-Lipid-Rich-Microalgae-in-Wastewater-for-Biodiesel-Production
- http://www.slideshare.net/kabronic/maximization-of-algae-lipid-yield-scenedesmus-dimorphus-for-the-production-of-biodiesel
- http://www.qsl.net/w2wdx/aquaria/diyco2.html
- http://pubs.ext.vt.edu/442/442-886/442-886.html
- http://www.starnursery.com/fertilizers/liquid-fertilizers/schultz-plant-food-plus-10-15-10-4-oz.html