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Short Communication

Role of Algae in Commercial Environment

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Abstract

There is an urgent need for new sustainable resources to produce food for a growing population and feed for fish and live stock and biofuel for replacing fossil fuels. In order to meet the above demand algae is the best suited supplement to increase human needs. The answer to all three issues food, freshwater and energy lies in large scale production of micro-algae. In 2008 the world's population was 6.8 billion and the United Nations predict that by 2030 the population will be estimated as 8.2 billion. This presents humankind with a set of unprecedented challenges regarding food and feed production, but also concerning safe drinking water and affordable energy sources. This has to be achieved independently of the use of freshwater and with sustainable energy sources. The main objective of this research is described to determine the direct feasibility of producing various products from algae which will also grow on wastewater for simultaneous energy production and reduce chemical impurities. Hence, the next green revolution will be based on the industrial production of micro-algae.

Keywords: Micro algae, green revolution, food supplements, biofuel, biofeed and bio remediation.

Introduction

There may be more than 25,000 species of algae, living everywhere. They range in size from a single cell to giant kelp over 150 feet long. Most algae live off sunlight through photosynthesis, but some live off organic matter like bacteria.

Larger algae, like seaweeds, are macroalgae. They already have an important economic role. About 70 species are used for food, food additives, animal feed, fertilizers and biochemicals.

Microalgae can only be seen under a microscope. Some serve a vital role for breaking down sewage, improving soil structure and fertility and generating methane and fuels for energy. Others are grown for animal and aquaculture feeds, human foods, biochemicals and pharmaceuticals[1].

Micro-algae produce ten to twenty times more biomass per unit area than any terrestrial crop. More importantly, micro-algae can be grown in ocean water, while using waste nutrients and at the same time reducing greenhouse gas (GHG) emissions.

Why Algae: Algal cultures have several advantages over conventional plants viewed from the purely agricultural view. Some of these advantages are: i. High output per hectare, thus minimizing land usage, ii. Low water usage per unit of biomass, iii. Whole plant utilization, iv. High protein, lipid and vitamins output per hectare and v. Carbon utilization.

Scope: India has very favourable conditions to support algae farming.

A large number of stationary CO_2 sources like thermal power plants, steel plants, cement plants, fertilizer plants, refineries, sugar/ethanol plants and petrochemical plants provide opportunities for co-locating algae farms and recycling the CO_2.

Huge livestock population and abundant domestic and industrial wastewater sources provide renewable nutrients for algae farming.

Most suitable locations for dedicated algal cultivation facilities in India are is the western and southern parts of the country and along coastal areas.

Dedicated facilities are required to algae biorefinery model and biofuels production that should be coupled with production of high value green chemicals to ensure economic viability.

Generally, algae considered as vegetable source and 100 % safe. Now a day, algae are dominating in biofuel research and acts as a replacement of fossil fuel. Few algae's are listed with its important composition in table-1.

Major applications of various algae are given below. They are:
Nutraceuticals: Astaxanthin, Betacarotene, Poly unsaturated fatty acid (DHA and EPA),Minerals, Amino acids, Single Cell Protein and carbohydrates.

Pharmaceuticals: Antimicrobials, Antivirals and Antifungals, europrotective, Anti oxidants, cancer drugs.

Pigments (food colourants): Carotenoids, Chlorophyll, Phycocyanin, Phycoerythrin.

Cosmetics: Anti-cellulite, Skin Anti-ageing and Sensitive skin treatment – Alguronic acid.

Biofuels: Bio Diesel, Alcohol, Hydrogen, Electricity, Hydrocarbons, Bio plastics.

Biofeed: Poultry and cattle feed for protein and mineral source.

Chemicals: Paints, Dyes and Colourants;

Table-1

Strain	Protein	Carbohydrats	Lipids
Scenedesmus obliquus	50-56	10-17	12-14
Scenedesmus quadricauda	47	-	1.9
Scenedesmus dimorphus	8-18	21-52	16-40
Chlorella vulgaris	51-58	12-17	14-22
Chlorella pyrenoidosa	57	26	2
pirogyra sp.	6-20	33-64	11-21
Dunaliella bioculata	49	4	8
Dunaliella salina	57	32	6
Euglena gracilis	39-61	14-18	14-20
Prymnesium parvum	28-45	25-33	22-38
Tetraselmis maculate	52	15	3
Porphyridium cruentum	28-39	40-57	9-14
Spirulina platensis	46-63	8-14	4--9
Synechoccus sp.	63	15	11

Market survey: The market survey released by MarketResearch.com estimates that by 2014, less than 3% of total fossil fuels will be replaced by biofuels from traditional sources. The positive read on this is that, even though this sounds like a small percentage, it represents a market size of over $100 billion.

Algae have the potential to replace a much larger percentage of fossil transportation fuel than the traditional feedstock. This implies that fuel from algae represents a market that can grow to hundreds of billions of dollars annually[2].

Cultivation: There are two major systems for algae cultivation. They are Open and Closed systems. Open pond systems are very successful in INDIA, USA, CHINA and other countries. There are very few units are using PBR (closed) system for cultivating algae. Both systems are having advantages and disadvantages in its process. The systems to be selected based on species and location. Evaporation loss is the major disadvantage in open pond but it will not be in closed system. Cost wise earlier is cheaper than later and operation cost also very minimum when compare with later. It is very similar with agriculture and it is require major and micro nutrients for growing. Main major nutrients are Carbon, Nitrogen, Phosphorus and Potassium. Sodium bi carbonate or carbon di oxide acts as carbon source and commercial NPK for NPK sources. It also requires sufficient sunlight, adequate temperature and proper agitation.

Some Algae which is not an edible one by human that may be grown in waste water such as industrial waste, city waste and polluted water.

Generally, the industries emit the smoke during boiler operation which pollute the air drastically and increases the atmospheric temperature. This flue gas may be used as a carbon source to cultivate algae from which bio products can be produced.

Algae is converting carbon di oxide into oxygen by its photosynthetic process and converting polluted water into irrigation water[3].

Material and Methods

Tannery industry is one of the major businesses in Dindigul, south Tamilnadu of India. These industries are contaminating nearby water sources and itself releasing process water for further treatment. I used for this tannery waste for my experiment and the results are given[4].

Stabilization pond method of treatment of tannery waste by algal culture was carried out in plastic trays at lab level [5]. Fresh water was added with tannery waste in proportions 1:1, 1:2 and 1:3 ratios. Each of the mixture was placed separately in plastic trays[6]. Mixed unwashed wet mass of chlorella algae to the experiment trays and maintained the OD for 0.3 to all tanks. It was allowed to be grown for 10 days with frequent agitation and the trials were taken in open under sunlight. Samples were collected from the experimental tanks periodically and analyzed for algae growth and other chemical parameters.

Results and Discussion

The algal growth was measured by spectrophotometer and the maximum value of OD ie., 1.12 was recorded at a dilution 1:1. A highest growth was recorded being 1:1 followed by others. The P^H of the raw water (polluted water) during stabilization ranged from 4.5 to 5.5. The maximum P^H of 8.5 was recorded at a dilution 1:1. The change of P^H and OD indicates that algae are growing in given dilution and the polluted water quality is also improved. Based on this trail we achieved 30grams of dry mass per day from 10 liters of water. This 30 gms contains 10 grams of lipid and the rest will be used as cattle feed or fertilizer[7].

This trial was carried out in smaller level and the experimental results are satisfactory. The OD and P^H values of various samples are listed in table 2 and 3.We will get more benefits when we make it in industry level[8].

Table-2
pH value of different days in different ratio

Sample	1	2	3	4	5	6	7
1:1 Ratio	4.8	5.1	5.7	6.6	7.1	7.7	8.5
1:2 Ratio	4.8	5.2	5.6	6.4	7.0	7.4	8.2
1:3 Ratio	4.8	5.2	5.7	6.3	7.0	7.3	7.9
Control	4.8	4.9	5.1	5.1	5.3	5.3	5.4

Table-3
OD value of different days in different ratio

Sample	1	2	3	4	5	6	7
1:1 Ratio	0.30	0.38	0.51	0.68	0.79	0.86	0.94
1:2 Ratio	0.30	0.36	0.45	0.51	0.60	0.74	0.81
1:3 Ratio	0.30	0.35	0.43	0.51	0.58	0.66	0.78
Control	0.30	0.30	0.30	0.36	0.41	0.46	0.45

Conclusion

An Algae sector is promoting itself as the industry with a Revolution of the next basis of the world's food production by growing algae. With the new scientific findings and industrial production techniques[9], the algae industry may indeed successfully meet this challenge. The use of algae as a feedstock for biodiesel greatly increases the yields. Further, the simultaneous wastewater treatment and biofuel production acts as a sustainable model[10-12].

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