International Journal of ChemTech Research
CODEN (USA): IJCRGG ISSN : 0974-4290
Vol.4, No.1, pp 112-115, Jan-Mar 2012

An Algae Bioreactor from Recycle Water bottle for Cultivation of Algae

Niraj S.Topare[1]*, Shruti G. Chopade[1], V.C.Renge[2], Satish V. Khedkar[2], S.L.Bhagat[2]

***[1]Department of Chemical Engineerin g, BharatiVidyapeeth University College Of Engineering, Pune,India.**
[2]Department of Chemical Engineering, College Of Engineering And Technology, Akola,India.

***Corres author: nirajtopare06@gmail.com**
Tel.: 8888828048, 8983056527.

Abstract: The cultivation of algae provides excellent perspectives for renewable energy production and as a source of 'green' products. Algae cultivation can thus contribute substantially to a reduction of CO_2 emissions. This paper describes systems used to cultivate algae from recycle water bottle for biofuel production. For the better quality of Algae cultivation it required a treatment of Nutrients. In this paper we discussed about the construction of Algae bioreactor from recycle water bottle and the treatments of nutrients (Ammonium sulphate, Urea) which required for cultivation of Algae. Result shows that the Algae cultivated from this Algae bioreactor from recycle water bottle is containing large amount of oil than the Algae grow in a rives, wells, ponds etc.
Key Words: Algae, Bioreactor, Water bottles etc.

1. Introduction

It has been known for several decades that different algal species can produce many different useful products. [1] Pharmaceuticals, chemicals, health foods, animal feed, and human food are examples of products that can be made algae biomass.[4] Algae is well suited for producing useful products and reducing nutrients in livestock waste streams because it is a very fast growing, which results in high production of product and high consumption of nutrients from the agricultural wastes.[1,2]

Bioreactor which is used for cultivating algae on purpose to fix CO_2 or producing biomass is called an Algae bioreactor.[8] Fundamentally, this kind of bioreactor is based on the photosynthetic reaction which is performed by the chlorophyll-containing algae itself using dissolved carbon dioxide and sunlight energy[11]. The carbon dioxide is dispersed into the reactor fluid to make it accessible for the algae [2]. The bioreactor has to be made out of transparent material. [9] The algae are photoautotroph organisms which perform oxygenetic photosynthesis.

The equation for photosynthesis:

$$6CO_2+6H_2O \longrightarrow C_6H_{12}O6 + 6O_2$$

$$\Delta H^0 = +2870 \text{ KJ/Kmol}$$

2. Experimental

2.1 Material and Methods

2.1.1. Materials

(a) Nutrients: Ammonium sulphate (10 gm/bottle), Urea (10 gm/bottle)
(b) Water used: Well water
(c) Lighting medium: Sunlight

2.1.2. Methods:

Procedure for construction of an Algae Bioreactor from Recycled Water Bottles:

Here we describe how to build a bioreactor that uses algae to convert carbon dioxide and sunlight into energy. [4] The energy that is produced is in the form of algae biomass. The bioreactor is built from plastic recycled water bottles.[3] By designing the apparatus to be compartmentalized, we are able to do many experiments in parallel. [5]

By using algae as a bio-fuel, we can increase the world's supply of oil while at the same time we decrease the amount of atmospheric carbon dioxide used during its production [6]. The resulting product is a sustainable bio-fuel whose carbon footprint is neutral inasmuch as the CO_2 produced on consumption is essentially balanced by the CO_2 used in its production.[7] In this intractable, we first make the carbon dioxide delivery system, then mount the water bottles on a rack, and then inoculate the bottles with algae [10]. After letting the algae grow for a some days, we extract the biomass. [8]

The stepwise procedure for manufacturing of an Algae Bio-reactor,

For making the carbon dioxide delivery system, first we take a12-port sprinkler system manifold and it is connected to a one-inch long PVC pipe. For getting the good seals, use Teflon tape to tape the threads before attaching the pieces together. After that attach the one-inch pipe to a T-connector. Block off one end of the T-connector and attach the other end to a foot long PVC pipe. For each manifold, give the opening for each bottles of tubing and connect each piece to a port of the manifold. The manifold is used to control the rate of flow. Check all the ports that are open and allow approximately the same amount of carbon dioxide to flow through the port.Mount the air system to a wooden rack using zip ties. Attach the air system to a tank of carbon dioxide. After attaching the air system, glue the water bottles to the wooden rack. For making the algae media, a good source of algae is pond algae (fixed amount) is added to the each and every water bottles with nutrients. After several days of sunlight and CO_2 exposure, the algae are much denser. A French press is then used to extract the algae from the solution. The biomass of the dried algae can then be used as a fuel.

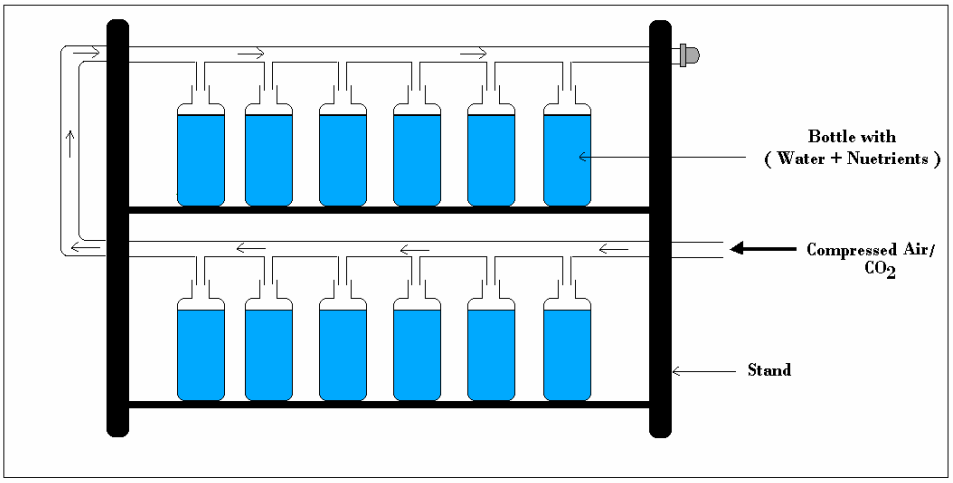

Fig1: Flow diagram of Algae bioreactor from recycles water bottles

The Process:

(1) First take the water in the recycle water bottles (24).
(2) Add the nutrients in the recycle water bottles i.e. Ammonium sulphate (10gm/bottle) and Urea (10gm/bottle)
(3) Add a good source of algae, which is a pond alga (fixed amount).
(4) Whole apparatus is exposed to sunlight to some days (12 days), for proper cultivation of Algae.

3. Results and Discussion

The samples were collected from this Bioreactor was observed and comparatively well growth Algae, having quantity 3kg. And the percentage of oil in these cultivated Algae can be analyzed by solvent extraction method using hexane solvent. Result shows that the Algae cultivated from recycle water bottle is containing larger amount of oil than Algae collecting from river.

Solvent extraction Method:
Parameters:Algae Powder (50 gm), Time (3Hr), Temperature (50 ^{0}C) for all sample.

4. Conclusions

Algae could play an important role as a potential feedstock for bio-fuels, as it offers significant advantages in terms of yield and productivity compared to conventional feed-stocks. It may even have an advantage over other emerging 2nd generation technologies since it sequesters carbon in CO_2 emissions. It is able to utilize other pollutants such as NO_2, an added environmental advantage.The best reactor type, based on photosynthetic efficiency and areal productivity, appears to be column reactors, at least on the small scale used in experiments from the literature. However, technical constraints prevent the size of this reactor type from being increased to commercial scale without the use of multiple small units, which are unlikely to be economical. Combinations of open and closed reactors seem promising from a productivity perspective. However, there is not enough economic information available to assess whether the increased productivity can offset the extra capital investment required, particularly with regard to biofuel applications. Thus, at this time, no specific reactor type is optimal for the commercial cultivation of algae for biofuel production.

Fig 2: Algae bioreactor before experimentation

Fig 3: Algae bioreactor after experimentation i.e. (After 12 days)

Table 1: Comparison of oil contain between cultivated Algae and Algae collecting from river

Sr.No	Parameters	Algae cultivated from Algae bioreactor	Algae collecting from river
1	Algae Oil Obtained	7.1gm	1.58gm

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