International Journal of Botany Studies
www.botanyjournals.com
ISSN: 2455-541X
Received: 09-08-2021, Accepted: 20-08-2021, Published: 15-09-2021
Volume 6, Issue 5, 2021, Page No. 154-155

Biomass intensification from lab cultured marine macro algae (*Ulva lactuca* Linn and *Chaetomorpha antennina Bory*) as a renewable energy source

Kishora Naik K[1], Parameswara Naik T[2]
[1] Research Scholar, Department of Botany, Sahyadri Science College, Kuvempu University, Shivamogga, Karnataka, India
[2] Professor, Department of Botany, Sahyadri Science College, Kuvempu University, Shivamogga, Karnataka, India

Abstract
Thallus bits of *Ulva lactuca*, and *Chaetomorpha antennina*, were cultured in enriched seawater growth media (Walne's media) under laboratory conditions. Weekly observation on growth rate of these algae showed that Walne's medium enhanced Daily Growth Rate (DGR) of *Ulva lactuca* (57.42 $^{+}$ 3.82 mg/d), and *Chaetomorpha antennina* (48.71 f 3.35 mg/d). The results are compared with the growth rate of seaweeds achieved elsewhere in *in situ* sea farming being carried out without addition of any nutrients extraneously.

Keywords: *Ulva lactuca, Chaetomorpha antennina*, walne's media, daily growth rate (DGR)

Introduction

Macro-algae or "seaweeds" are fast growing multicellular oraganisms that grows in marine environment. Seaweeds generally lower group plants with undifferentiated roots, leaves and stems. Seaweeds are classified into three major groups based on their pigmentation: (1) Brown seaweed (Phaeophyceae), (2) Red Seaweeds (Rhodophyceae) and (3) Green seaweed (Chlorophyceae) Macro algae are photo auxotrophic and thus produce and store organic carbons (i.e.,carbon sources for biorefinery) by utilizing either atmospheric CO_2 or HCO_3. Most macro algae directly uptake HCO_3 rather than CO_2 for their growth because the diffusion rate of CO_2 is found to be extremely slow in seawater. Due to the high photosynthetic ability of macroalgae, they have the potential to generate and store sufficient carbon resources needed for bio refinery. Seaweeds are considered as ecologically and biologically important component in the marine ecosystems. Seaweeds make a substantial contribution to marine primary production and provide habitat for near shore benthic communities (Mann, 1973; Williams & Smith,2007) Seaweeds are key space occupiers of rocky shores and interact with other organisms and hence play a key role in overall coastal biodiversity. They are found on rocks in the zone as a giant underwater forest. It was estimated that about 200 seaweed species support an international in primarily phycocolloid (algins, agars, and carrageenans) and food products valued at over billions of U.S. $ 6.2 (Zemke-White & Ohno, 1999). Seaweeds grow abundantly along the Indian coastline particularly in rocky shore regions; rich seaweed beds occur around Visakhapatnam in the eastern coast, Mahabalipuram, Gulf of Mannar, Tiruchendur, Tuticorin and Kerala in the southern coast; Veraval and Gulf of Kutch in the western coast; Andaman and Nicobar Islands and Lakshadweep (Uma maheswara Rao, 1967; Silva et al., 1996; Sahoo, 2001).The seaweed resources are also abundant around Mumbai, Ratnagiri, Goa, Karwar, Varkala, Vizhinjam and Pulicat in Tamil Nadu and Chilka in Orissa. About 841 taxa of marine algae were found in both inter-tidal and deep water regions of the Indian coast (Oza & Zaidi, 2001). Few cultivation methods have been established and commercialized for mass production of seaweeds. Cultivation of seaweeds, growth and biomass intensification depends on various factors like, pH, temperature, climate, salinity nutrient composition etc. Cultivation techniques focusing enhanced biomass productivity towards biofuel production has not investigated in enough numbers. Economics of macroalgae cultivation for bioenergy remains untested but evidence as efficient by majority of production in UK and Ireland. Macroalgae biomass harvest maybe possible by wild harvest or artificial cultivation in ponds. Possibly, the environmental impact on mass cultivation of macro algae may be reduced by coupling it with compatible aquaculture systems .Marine macro algae farming suffers few drawback such as introduction of invasive species, grazing of weeds by fishes, fishing difficulties, changes in nutrient composition at the cost of prolonged cultivation in a same location, etc.

Materials and Methods

Field surveys were undertaken to the selected sampling stations of the Karwar region over a period of four years from 2016 to 2019. The algal samples were collected in every season during the study period by detaching a portion from the seaweed bed, kept in polythene bags with fresh seawater, transported to the laboratory and fixed in 4% Formal deyde for further studies. The seaweeds were identified using the taxonomic keys provided by Uma maheswara Rao (1987), Desikachary et al. (1990, 1998) and Krishnamurthy (1999), and the nomenclature was updated using Appeltans et al. (2012). After acclimatizing for five days in laboratory condition at 32 ppt filterd seawater, the cleaned pre weighed (W_0) thallus bits of Ulva lactuca were cut into small bits of 3cm size and transferred to 500 ml conical flask. These explants were incubated under diffused light from two fluorescent tubes from distance of 8ft at 25^0 in a day 14 hr day/ 10 hr dark regime. Three replicates were

done for 12 days cultivation. The DGR (daily growth rate) was estimated from the following formula

$DGR = W_t - W_O / t$
Where W_0= Intial weight of wet sample incubated
Wt= final weight of wet sample after culture
T = duration of culture in days

Result and Discussion

Weekly observation on growth rate of these algae showed that Walne's medium enhanced Daily Growth Rate (DGR) of *Ulva lactuca* (57.42 ± 3.82 mg/d), and *Chaetomorpha antennina* (48.71 ± 3.35 mg/d) . *Ulva* species should, be ideal species for cultivation due to their cosmopolitan distribution (Kirkendale et al., 2013), shows very high growth rates (Bruhn et al., 2011), and tolerate wide environmental condition (Luo and Liu, 2011). However,in previous studies (Oza and Sreenivasa Rao, 1977, Ale et al., 2011, Bruhn et al., 2011, Castelar et al., 2014) [11, 10, 11] had faced marked difficulty in maintaining a vegetative state for most *Ulva* species in lab culture. Vegetative fragmentation or the formation of reproductive cells effectively terminates *Ulva* growth and leads to a disintegration of part or all of the thalli, which dramatically reduces *Ulva* productivity (Oza and Sreenivasa Rao, 1977) [15]. Ale et al.'s (2011) [11] study showed that the specific growth rate of *U. lactuca* reached the maximum of 16.4 ± 0.18% on day five when NH4- was used as the nitrogen source and the maximum of 9.4 ± 0.72% on day six when NO3- was used as the nitrogen source during 10 days of laboratory culture. After that, growth began to decrease and was nearly zero for both conditions at the end of culture. Outdoor cultivation also demonstrated the notic able fluctuation of *Ulva* growth over time. For example, the daily growth rate of *U. flexuosa* grown at sea after 15 days of culture was 17.9 ± 4.3% but it decreased to 6.6 ± 1.1% after 30 days of culture (Castelar et al., 2014) [11]. The growth rate of *U. lactuca* grown in outdoor tanks also showed periodic fluctuations of between 0.3 ± 0.5% and 9.2 ± 2.1% (Bruhn et al., 2011). Apart from the change of environmental factors (light, temperature, etc.), periodic reproduction was the main reason behind the growth fluctuations (Bruhn et al., 2011). A longer term study (from 1981 to1983) that attempted year round cultivation of *U. lactuca* was conducted in outdoor tanks in Florida. However, the cultivation could not be maintained in summer (June and July) due to fragmentation of the *U. thalli* although they grew well in the winter and spring (De Busk et al., 1986) [16].

Conclusion

Biomass intensification of seaweeds was possible by culturing in suitable medium. The Walne's medium was obereved to be better medium for growth of *Ulva lactuca* and *Chaetomorpha antennina* species.

Acknowlodgement

Authors are Thankful to Dept. of Botany and Seed technology, Sahaydri Science College, shivamoga. And SC, ST Cell Kuvempu University for financial assistance for this research work.

References

1. McHugh DJ.A guide to the seaweed industry (FAO Fisheries Technical Paper). Rome: FAO, 2003, 441.
2. Demirbas A, Demirbas FM. Importance of algaeoilasa source of biodiesel. Energy,52:163-70.
3. Gao K, Mc Kinley K. Use of macroalgae for marine biomass production and CO2 remediation:areview. JApplPhycol,1994:6:45-60.
4. Mann KH. Seaweeds: Their productivity and strategy for growth. Science, Williams S.L. & Smith JE,1973-2007:182:975-981.
5. A Global Review of the Distribution, Taxonomy, and Impacts of Introduced Seaweeds.
6. The Annual Review of Ecology, Evolution and Systematics, Zemke-White W.L. & Ohno M,1999:38:327-59.
7. World seaweed utilization: An end of the century summary. Journal of Applied Phycology, 11, 369-376.
8. Umamaheswara Rao M. Seaweed resources of India. In: Souvenir 20th Anniversary Central Marine Fisheries Research Institute, Mandapam-camp, India, 1967, 125-129.
9. Oza RM, Zaidi SH. A Revised checklist of Indian marine algae. Central Salt and Marine Chemicals Institute, Bhavnagar, 2001, 296.
10. Ale MT, Mikkelsen JD, Meyer AS. Differential growth response of *Ulva lactuca* to ammonium and nitrate assimilation. Journal of Applied Phycology,2011:23:345-351.
11. Castelar B, Reis RP, Calheiros ACS. *Ulva lactuca* and *U. flexuosa* (Chlorophyta, Ulvophyceae) cultivation in Brazilian tropical waters: recruitment, growth, and ulvan yield. Journal of Applied Phycology,2014:26:1989-1999.
12. Kirkendale L, Saunders GW, Winberg P. A molecular survey of *Ulva* (Chlorophyta) in temperate Australia reveals enhanced levels of cosmopolitanism. Journal of Phycology,2013:49:69-81.
13. Luo MB, Liu F, Xu ZL. Growth and nutrient uptake capacity of two co-occurring species, Ulva prolifera and Ulva linza. Aquatic Botany,2012:100:18-24.
14. Liu ZJ, Cordes JF. DNA marker technologies and their applications in aquaculture genetics. *Aquaculture*,2004:238:1-37.
15. Oza RM, Sreenivas Rao P. Effect of different culture media on growth and sporulation of laboratory raised germlings of Ulva fasciata Delile. Botanica Marina,1977:20:427-432.
16. Debusk T, Blakeslee M, Ryther J. Studies on the Outdoor Cultivation of *Ulva lactuca* L. *Botanica Marina*,1986:29:381-386.