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Recent Development in Algal Biotechnology in the Production of Algal Based Food Supplement

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ABSTRACT

Algae are commonly present everywhere in water habitats. Due to their rich chemical composition and content of biologically active substances, they have been used in many industrial fields. In addition, algae are also used in the food industry as a food supplement and as a supplement for functional foods. Seaweed is also added to meat products, such as pasta, steak, hot dogs and sausages, as well as fish, fish products and oils, to improve their quality. Grain-based products, such as pasta, flour, and bread, are another group of seaweed-enriched products. Due to their properties, algae can also be used to formulate fermented functional foods. Fermented products containing seaweed are mainly dairy products, such as cheese, ice cream, dairy desserts, yoghurt, cottage cheese, and processed cheese. Combining a fermented product with a high content of lactic acid bacteria and algae with naturally occurring metabolic bio-actives creates a product with a high nutrient content and a food segment. Recently, there has been a great deal of interest in algae-based dietary supplements and bio-foods. Algae can also be exploited for the commercial production of various products such as dyes, animal feed, bioplastic, etc. The total food production of seaweed is estimated to be eight times that of terrestrial plants. Seaweed is rich in sources of protein, lipids, vitamins A, B, C and E; omega-3 fatty acids, etc. Many types of seaweed are edible, for example: - Ulva, Porphyra, Laminaria, Chlorella, Spirogyra, Gracilaria, Gelidium, etc. Many seaweed products are used in the food industry. eg Agar, carrageenan, etc.

Keywords: *Algae, food supplements, product, Biotechnology, nutrients.*

INTRODUCTION

Micro-algae and macro-algae are grown commercially to produce compounds, including carbohydrates, proteins, pigments, lipids, carotenoids, polyunsaturated fatty acids, steroids, vitamins and others. The microalgae industry has increased its significance in various biotechnological processes over the past three decades.

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Research on microalgae has focused on several key scenarios in biotechnology, manufacturing commercial products as an additive and food supplement for biofertilizer production and wastewater treatment. Spirulina platensis is filamentous blue-green algae and is characterized by its unbranched spiral multicellular cylindrical structure. In the 16th century, the Kanembu tribe living in Chad (Central Africa), consumes spirulina as food, from Lake Chad. However, commercial food or dietary supplement production due to their high nutritional value has only existed since the 1970s and in 1972 at Sosa Texcoco, an industrial plant was registered. The operating register can produce a maximum of 1 ton of Spirulina powder per day in Lake Texcoco. in Mexico City. The growing application for a healthy diet caused the increase of advanced and new products to stimulate the food trade industry widely. Food producers play a key role in supporting healthier lifestyles by enhancing and providing healthy foods.

MATERIALS AND METHODS

The research work was carried out from the Kot Dam of the Shakambari Conservation Reserve, Jhunjhunu District. Shakambari Conservation Reserve is surrounded by Aravalli Hills and spans over 13,100 hectares of forest land. The total geographical area is 144 square kilometres.

Algae Sampling- The algal samples will collect monthly from Kot Dam of shakambari conservation reserve. The Algal samples will be collected by plankton net of No.16 nylon bolting cloth (mesh size 0.07 mm), transferred into the glass bottle, and preserved in 4% formalin solution. Recognition of Algae will on the basis of their morphological feature up to the level of species according to literature in the laboratory and microscopic study.

Commonly used microalgae genera include *Spirulina, Chlorella, Tetraselmis, Chaetoceros, Nannochloropsis, Phaeodactylum, Skeletonema*, *Pavlova*, *Isochrysis* and *Thalassiosira* in fish food preparation (Behrens, 1996, Lee, 1997, Yamaguchi, 1997, Avotzron & Benamot, 1992 & Feuga, M. 2000). As a result, the high production costs of these microalgae have prevented many hatcheries from using them as feed ingredients. Several attempts have been made to reduce the cost of algae biomass production (Borowitzka, 1997). Therefore, low-cost production of algae biomass is also an essential part of the aquaculture industry. Finding nearby unique algal biomass is another substitute for reducing feed costs.

Four algal genera from Cyanophyceae and Chlorophyceae were used for the present experiment as follows: -

i) Nostoc ellipsosporum (freshwater) - Cyanophyceae
ii) Synechocystispevalekii (freshwater) - Cyanophyceae
iii) Chlorella Vulgaris (freshwater) - Chlorophyceae
iv) Spirulina (fresh water) - Cyanophyceae

Algae Cultivation and Algal Biomass Production:

Algae technology is slowly developing into a global industry with a growing number of commercial tycoons. Industry is currently using algal biomass and its biochemical diversity for a variety of applications. However, cost-effective mass production of algal biomass and industrial oil production remains a major challenge for the world. Microalgae culture and its uses are poorly studied and documented compared to agricultural crops. Only a few thousand high-biomass species or strains are known, and hundreds of these have been analyzed for chemical composition. Few strains are industrially recognized and cultivated in commercial quantities. Therefore, isolating and screening algae from different environments requires a high degree of research attention. The process of growing, harvesting and extracting oil needs further improvement and should be more competent and cost nominal. Moreover, the potential applications of eutrophic wastewater for algal biomass production and oil production are still in their infancy. Algae varieties in India, especially Rajasthan, are so numerous that the state needs to make the most of its abundant algae potential.

Algae Culture Research - Algal cultures are required for research purposes. It can be used in algal morphological, physiological, Physocological, cytological, biofertilizer, genetic and ecological studies.

Types of Algal Cultures -

1. Monoalgal Cultures - containing only one algal species, usually clonal populations.

2. Aseptic culture - contains algae only. Culture conditions should resemble the natural environment of the algae as closely as possible. Requirements: Water, Carbon Dioxide, Minerals, Light, Temperature (15˚C - 35˚C.)

Broth - Algae Culture Broth Broth or medium is an artificial or synthetic growth medium in which algae can grow.

1. Bold's Basal Medium (BBM - medium) with vitamins- This is a medium for freshwater algae that does not require soil extracts or vitamins. BBM is used to culture a variety of green algae.

Example: For culturing Chlorella, Chlorococc um, etc.

2. Modified Chu Medium- Widely used for prokaryotic and eukaryotic algae like *Cyanobacteria, diatoms, green algae*.

3. Chu 13 Medium - CHU 13 contains essential minerals and trace elements required for algal growth, but does not contain a carbon source, making this medium suitable only for the growth of phototrophs. increase. Used as a growth medium for Botryococcus braunii algae.

4. Miquel's Solution - This medium is useful for freshwater algae.

Methods-

1st Step - Collection.

2nd Step - Separation

3rs Step - culture

4th Step - harvest

Collection requirements - Suitable containers, chisels or small knives, tweezers, gloves, mesh or cloth bags, ice boxes, etc.

Method - Gloves and date the container, depth, location, salinity, brackish or fresh water, etc.

I. Collection- Collect water sample in a small container and place in a cooler with ice. Some algae form water surface. Floating microalgae and macroalgae can be collected with a mesh net. Deep water samplers can collect water several meters lower to the surface. Washing or Centrifugation Procedures Repeated washing or centrifugation of water samples will separate larger organisms. The preferred species of algae can be micrographed with an inoculation needle, then streaked onto the surface of an agar plate and cultured under appropriate light and temperature conditions. Established algal groups can be transferred to culture tubes to obtain pure cultures. Collecting all or part of algae from slight or profoundal water, Larger samples may need to be shaken or lightly squeezed upon assembly to eliminate excess moisture. Carefully place the sample in a container with enough water.

II. Separation - Separates filamentous algae from bacteria using a membrane filter. Algae were collected with a mesh plankton net made of No. 18 nylon bolt fabric (mesh size 0.072 mm), transferred to a glass bottle and preserved in a 4% formalin solution. Remove microepivion by a mixture of ethanol (40-50%) and sodium hypochlorite (1%). Antibiotic screening to remove fungal contaminants (e.g. nystatin 100 mg/mL).

III. Cultivation (Culturing) Methods-

1) Cultivation of flakes - A small piece of algae is sited in a proper medium to support its growth. Single-line floating raft (SRFR) system (long-distance, line-rafting, rope, or single-line system). A long rope or nylon rope with a diameter of 10 mm is tied to two wooden stakes with two synthetic anchor cables and suspended by plastic floats Whole leaves can be collected, leaving small usable pieces for planting grow more. is used to grow Gelidiella acerosa, Gracilaria edulis etc.

2) Farming pond - The pond has an area of 0.5-1.0 ha with right to use in salt water and fresh water, so the salinity is regulated and the water is changed 2-3 times/time. Day of the week can be changed. Water changes are usually done using tidal currents

with valves that control the inflow and outflow of water. The pH of the fresh water is very important - slightly basic (pH8) (eg for farming *Caulerpa*, *Gracilaria*, etc.). The pond must be exhausted to a depth of 10 feet. Cuttings of Algae in Mud After planting, water the pond slowly to a depth of about 1/2 to 3 feet.

3) In the tank (cultured in a tank) - Requires 2 to 3 feet deep translucent tank. Algae are exposed to surface light for a very short time (10 seconds) before sinking to the bottom of the tank as the carbonated water swirled around the tank. They are used for the cultivation of Condras crispus and Palmaria palmata. Macroalgae can be grown on saline soil or seawater under controlled environmental conditions such as sunlight, temperature, humidity and nutrients. Water jetting can be used in sand or multi-layer arrangements to maintain a thin film of nutrient-rich seawater on the surface of the recyclable macroalgae.

4) Tissue culture As a culture, part of the terminal part of the pod can be used, from 0.3 cm to 5.0 cm, or a blade or a handle may be used. Explosives can be cultured in enriched or artificial seawater cultures containing growth regulators, which can lead to callus formation and regeneration.

IV. Harvest- Hand picking, Use of Rotating cutters, Mesh, Harvester, Robotics.

RESULTS AND DISCUSSION

The results for the elemental configuration of the micro-algal supplements are shown in Supplementary Table 1. No statistically significant differences were observed between the altered types of algae extras for with Si, Ti, Co, Mn Ni, Rb, Cu, V, Se, Mn, Fe and Hg. Significantly higher Ca content was observed for Spirulina spp. products, while Chlorella spp. shows the maximum P level. This statement is consistent with the study conducted by Rzymski et al. (seven). AFA products have high Ca and Mo concentrations, which are statistically different from other products. The maximum concentrations of Sr, Br and Cl were identified in kelp samples and were significantly different from other products, mainly Chlorella spp. Zn levels did not differ among Spirulina spp. and Chlorella spp., but they were significantly developed than those observed in kelps and AFA.

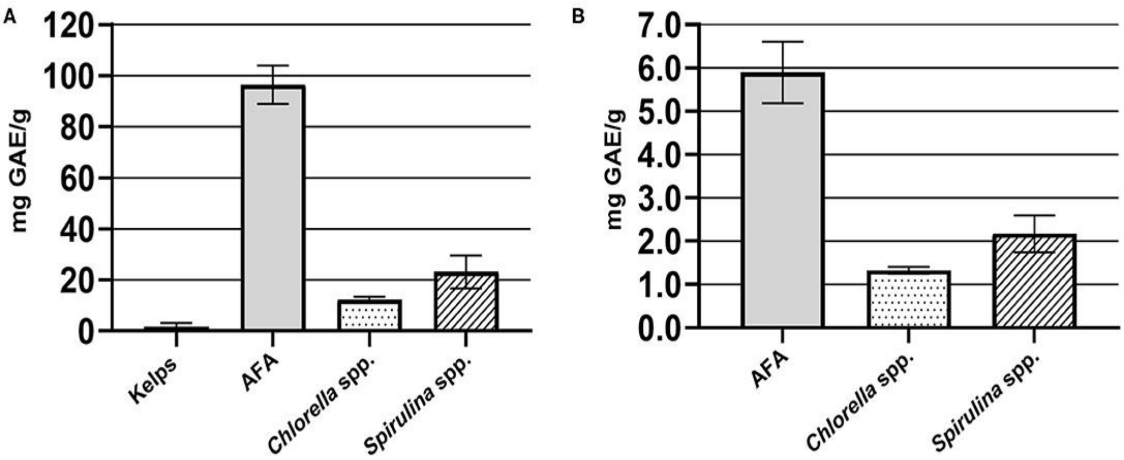
In this study, amylase, invertase and cellulase secretion in fish fed VAF and AF was significantly higher by compared with fish fed CF, supporting with the highest carbohydrate intake in seaweed feed. Parallel outcomes were detected by De Silva and Anderson (1995) in Oreochromis mossambicus, where amylase activity levels were higher with the high starch diet. Amylase, required for carbohydrate hydrolysis, responds to levels of dietary carbohydrates. Fish fed CF were found to have more liver glycogen than fish fed VAF. Glycogen deposition in the liver is harmful to fish. The increase in amylase activity in fish fed VAF and AF was attributed to the increased carbohydrate content of in the algal diet, but related to less glycogen deposition in the liver. It also indicates maximum utilization of glucose by way of an energy source. Increased digestibility was suggested to improve growth and existence of fish larva (Pedersen et al., 1990; Abiayad & Kestemont, 1994; & Cahu & Zambonino Infante, 1995a). The above results show that seaweed feed is very well accepted. Therefore, the experimental fish showed high protease, amylase and lipase activities. The results of the test showed that feeding value-added algae (Including a combination of algae - 40% for rohu and 70% for goldfish) significantly improved the growth performance of and the using feed from Labeo rohita and Carassius auratus, respectively compared with conventional feeds currently on the market. Thus, a mixture of seaweeds contained four unique genera of microalgae, viz. Phormidium tenue, Synechocystis pevalekii, Nostoc ellipsosporum and Rhizoclonium fontinale can be used with conventional fish food.

We can conclude that the algae diet is optimal for improving growth expression, shell quality and maximizing protein retention in the fingerhngs.

TABLE1. List of algae-based dietary supplement samples obtained in experimental work and purity, origin, and suggested daily use

Algae	Sample	Purity	Origin	Declared growing practice
Laminaria digitata and *Ascophyllum nodosum*	S1	Additives	Not specified	Conventional
Macrocystis pyrifera	S5	Additives	Not specified	Conventional
Aphanizomenon flos-aquae	S2	Additives	Klamath Lake	Conventional
A. flos-aquae	S10	Pure	Klamath Lake	Organic
A. flos-aquae	S11	Pure	Klamath Lake	Conventional
A. flos-aquae	S12	Additives	Klamath Lake	Conventional
Chlorella pyrenoidosa	S3	Pure	Not specified	Conventional
Chlorella sp.	S4	Pure	China	Conventional
Chlorella sp.	S7	Additives	Not specified	Conventional
Chlorella vulgaris	S8	Pure	Outside of EU	Organic
Chlorella sp.	S9	Pure	Outside of EU	Organic
Spirulina platensis	S6	Pure	Not specified	Conventional
Spirulina pacifica	S13	Additives	Hawaii	Conventional
Spirulina sp.	S14	Pure	Outside of EU	Organic
S. platensis	S15	Pure	Outside of EU	Organic
S. platensis	S16	Pure	Taiwan	Organic
S. pacifica	S17	Additives	Hawaii	Conventional
Spirulina maxima	S18	Additives	Italy	Conventional

TABLE2. (A) Average total phenolic compounds in mg GAE/g; (B) average ant oxidative potential values in different kinds of algae-based dietary supplement samples, expressed as mg Gallic acid equivalent (GAE)/g.



CONCLUSIONS

The group of organisms collectively known as algae is not a natural assembly. Although most algae are capable of photosynthesis, this ability has probably been acquired by several different taxa independently and in different ways. This multidisciplinary origin is reflected in the deep diversity of this group. Seaweed has now become the basis of a huge multi-industry that is largely undetectable, especially in India.

Here are some highlights:

1. Currently, food products sold mainly in the primary use of algae when calculated on the basis of known market value.
2. The main industrial use of algae is in the field of hydrocolloids; overall, this is a great company with a large presence in the food industry.
3. Use of many algae in the aquarium for culture many zooplanktons and fishes.
4. Key elements of the biotechnology revolution rest on the use of agar and agarose, and the continued development of specialized agarose is an important aspect of the development of these technologies.
5. Although the algae kingdom is extremely diverse and may include more than 200,000 species, today's major algae products are

based on only 10 to 20 species of algae, nearly all macroalgae species.

The development of valuable algal products is a remnant. Historically, a major obstacle to this effort has been the lack of proper agricultural systems, in which the supply of raw materials depended on harvesting from the wild. The development of culture systems for macro-algae production, mainly in the Far East, has led to a steady supply of large quantities of commercially valuable macro-algae. Similar developments in microalgae supply are taking place today. The molecular biology of algae does not grow like yeast or bacteria, and there is currently no clear commercial development or production system using this technology. Likewise, macro-algal tissue culture as single- or multi-cell is a topic of current research interest, but no commercial products have been produced in this way. The development of new algae products is expected to accelerate as these technologies evolve.

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Conflict of Interest:
There is no conflict of interest with this manuscript.

Author Contribution:
Both authors contributed equally to establishing the research and design experiment topic.

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