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ECONOMICAL IMPORTANCE AND FUTURE PROSPECTIVE OF ALGAE

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Abstract— Algae are heterogenous group of eukaryotic, photosynthetic, unicellular or multicellular, lacking sex organs, conducting vessels with no tissue differentiation. Some algae are aquatic found in fresh water or in oceans. The marine algae plays vital role in maintaining the cycles of elements in nature. It is economically importance because they are used as food, bio-indicators, bioabsorbent and for medicine. Algae or Seaweeds can also be used as fertilizers. Seaweeds industry can be established near the coastal areas of Bhavnagar, Gujarat. As the conditions around the coastal areas of Bhavnagar is favorable for the cultivation of seaweeds. Seaweeds can be cultivated commercially and can be used to overcome the significant challenges to achieve the current yields.

Keywords— Algae, seaweed

Introduction

Algae:- Algae are chlorophyll-bearing unicellular or multicellular plants. When multicellular, they may be colonial or filamentous. Most of them are aquatic, either fresh water, (*Volvox)*, or marine (*Spirogyra*). Some are sheet-like (e.g., *Ulva*). Chlorophyll is present in chloroplasts, the number and shape of which are characteristic of each alga. Besides chlorophyll, they also show various carotenoid pigments which impart different colors to algae. According to the nature of photosynthetic pigments, they are further classified into three divisions such as Chlorophyta (green), Phaeophyta (brown), and Rhodophyta (red).

Green algae (Chlorophyta)

These algae live in wide variety of habitats, marine to fresh water to damp soil.

General Characteristics

These are unicellular, colonial or filamentous. When filamentous they are unbran(S ched pirogyra) or branched. The cell wall consists of an inner layer of cellulose and outer layer of pectic compounds and may be covered by a gelatinous sheath. The protoplasm is divisible into cytoplasm and nucleus. Cytoplasm contains one or more vacuoles. Chlorophyll is present in chloroplasts, the shape and

number of which are characteristic of each alga. Pigments chlorophyll-a and chlorophyll-b are predominant. However, carotene and xanthophyll are also present. Food reserve is in the form of starch surrounding the proteinaceous refractile bodies called pyrenoids. Reproduction is vegetative by mitotic cell division in unicellular forms or by fragmentation in filamentous forms; asexual by formation of spores such as zoospores, aplanospores, hypnospore and akinates and sexual of haplontic type showing alternation of dominant haploid stage with short-lived diploid stage Examples. Chlorella, Spirogyra, Ulva, etc simply by conjugation or by gamete formation by isogamy or anisogamy or oogamy. The life-cycle is.

Brown algae (Phaeophyta)

These are multicellular, simple, filamentous or plant-like giant forms called kelps (sea weeds). These are mostly marine, found in cool shallow water.

General Characteristics:-

The body is the multicellular thallus showing the highest degree of differentiation. The unicellular colonial forms are absent. Some brown algae called kelps or sea weeds exhibit giant forms extending over 50 meters in length and showing parenchymatous organization. The cell wall is made up of two layers. The inner firm layer is of cellulose while the outer layer is gelatinous containing compounds like algin, fucosin etc. The cytoplasm show one or many vacuoles and single large, distinct nucleus, with one or more nucleoli. Chloroplasts are either discoidal or band-shaped, without pyrenoids. Yellow-brown pigment fucoxanthin a type of xanthophyll is predominant which gives golden - brown color to algae, while other pigments such as chlorophyll-a and chlorophyll-b are also present. The reserved food is in the form of soluble carbohydrates called laminarin and mannitol. Reproduction is vegetative by fragmentation, asexual by formation of haploid or diploid zoospores and sexual by gamete formation, by isogamy, anisogamy or oogamy. The life-cycle shows isomorphic alternation of generations where the gametophyte and sporophyte are morphologically similar (e.g., Ectocarpus), heteromorphic alternation or generations where the gametophyte and sporophyte are morphologically differentiated (e.g. Laminaria) while in there is no alternation of generations as gametophytic generation represented only by gametes.

Examples: Sargassum, Laminaria, Ectocarpus etc.

Method:-

A.) Collection Of Sample : -Algae samples were collected from various coastal areas of around Bhavnagar [Gujarat] from Kuda, Kodyak and Mahua.

(B.) Analysis : -Samples collected were analysed on the basis of its morphology under specific guidance.

Material:-

Contents under discussion has been gathered from various paper presentation, many books and by research journals.

Discussion:-

Economic importance of Chlorella

Source of oxygen and initial food producers. Microscopic algae are the source of much of Earth's oxygen. The photosynthesis done by algae is very important to the biosphere because it reduces amount of carbon dioxide and increases the amount of oxygen in the atmosphere. Algae are also very important because they are the beginning of the food chain for other animals It serve as initial food producers and the first link in the aquatic food chain, both fresh water and marine. Phytoplankton, a mostly single-celled type of algae, are eaten by small animals called zooplankton (mostly crustaceans such as tiny shrimp) that drift near the surface of the sea. The zooplanktons are in turn fed upon by larger zooplankton, small fish, and some whales. Larger fish eat the smaller ones. At the top of the open-water food web may be fish-eating birds, seals, whales, very large fish such as sharks or bluefin tuna, and humans.
Used as food. Some 221 species of seaweed are utilized commercially. Of these, about145 species are used for food. Seaweed has been a staple food in Japan and China for a very longtime. It produces food rich in proteins, fats, vitamins and minerals. It is important as a source of food for human beings, domestic animals and fishes. Chlorella are also used as food in several countries and used as fodder for domestic animals.
Single cell protein (SCP). The rich protein and amino acid content of Chlorella make it an ideal source for single cell protein production. Chlorella is a source of vitamin and used as vitaminized food.
Sewage Disposal. Algae like Chlorella are grown in large shallow tanks, containing sewage. These algae produce abundant oxygen by rapid photosynthesis. Microorganisms like aerobic bacteria use this oxygen and decompose the organic matter and thus the sewage gets purified.
Algae in space travel. Chlorella pyrenoidosa is used in space travel to get rid of C02 and other body wastes. The algae multiplies rapidly and utilize the C02 and liberate 02 during photosynthesis. It decomposes human urine and faeces to get N2 for protein synthesis.
Antibiotic production. An antibiotic chlorellin is extracted from Chlorella.

Good digest and regularity. As we know, enzymes perform a lot of important function in our body. Chlorella also has a lot of powerful digestive enzymes we need, such as chlorophyllase and pepsin, which can help our elimination to become regular and strengthen digestion system to move smoothly. In addition, the fibrous materials in Chlorella will improve digestion and promote the growth of beneficial aerobic bacteria in the gut.
Strengthen the immune system. Besides eliminating toxin, pesticides and heavy metals from the body, the chlorella‘s cell wall also can induce interferon production in our body, which is important to immune function. As a result, we said that Chlorella could boost our immune system and stimulate our body’s natural defense against cancer. Many research showed that the nucleus of chlorella contains a substance called chlorella growth factor (CGF) is responsible for the increase of interferon. The scientists fed chlorella to laboratory mouse, which were infected with cancer cells, and the result is positive.

Support for Stiff joints .Most doctors will tell you that when you get older, you are bound to feel stiff and mover around more slowly, but that’s simply not true! In fact, if you suffer from any type of achy joints, muscle or tendon discomfort, or recurring headaches, you’ll be surprised to learn that there may be another cause of your pain may more than likely being hidden chemical irritants! Scientists

have discovered that nerves can be irritated by dozens of invisible toxins found in our everyday. As chlorella can sweep the toxins out of our body, it can support for stiff joints.
In a study, researchers gave Chlorella A+ daily for two months to a group of people who were experiencing stiff joints, sore muscles, and more. The results astonished even the researchers! Nearly 70 percent of those who took Chlorella A+ faithfully throughout the study period saw measurable improvement in how they felt. And 45 percent found comfort at last.

Economic importance of Ulva

Source of oxygen and initial food producers. Microscopic algae are the source of much of Earth's oxygen. The photosynthesis done by algae is very important to the biosphere because it reduces amount of carbon dioxide and increases the amount of oxygen in the atmosphere. Algae are also very important because they are the beginning of the food chain for other animals It serve as initial food producers and the first link in the aquatic food chain, both fresh water and marine.

Source of food. Ulva is known as Sea lettuce. It is found in moderately exposed situations on rocks, wood works or coarse algae, in pools and quiet shallow waters near the low tide mark. It also thrives in brackish water with organic pollution. This species occurs in all months of the year. It is used for human consumption. It is used as soup, mixed sea vegetable salad, cooked with other vegetables and meat, powdered green sea vegetable seasoning and in the preparation of jam. It consists of protein, carbohydrate and lipids.

Sea lettuce is an important food source for grazing animals including Brant geese, crustaceans such as amphipods, and molluscs such as sea hares, chitons, periwinkles and sea urchins.

Medicinal Value. Sea Lettuce has many medicinal values.It serves as a source of vitamin – c and tocopherols.It also exhibit antibacterial activity.

Bioindicators.Sea lettuce can be useful bioindicators, means they can be used to make inferences about the environment. Its excessive growth may indicate high nutrient concentrations (i.e. nitrogen and phosphates). The absence or poor health of sea lettuce may also indicate a problem, such as contamination of the water with heavy metals.

Economic importance of Spirogyra

Source of oxygen and initial food producers. Microscopic algae are the source of much of Earth's oxygen. The photosynthesis done by algae is very important to the biosphere because it reduces amount of carbon dioxide and increases the amount of oxygen in the atmosphere. Algae are also very important because they are the beginning of the food chain for other animals It serve as initial food producers and the first link in the aquatic food chain, both fresh water and marine.

Source of food. It is used for human consumption, cooked with vegetables and mixed with soups.

Biosorbent material. Among the algal biomass used for biosorption, Spirogyra sp. is a green filamentous, readily available source of biomass for heavy metal removal from wastewater. Investigations conducted by several researchers demonstrated that Spirogyra sp. is capable of

accumulating heavy metals like copper, chromium, zinc and fluoride [27–30], but still there is lots of scope available to use this abundantly available alga for the removal of other heavy metal ions from wastewaters.

Economic importance of Brown algae

Source of human and animal food. Laminaria is increasingly being used for human consumption, especially in China and Japan where seaweeds are processed into a wide variety of food items. However in Eastern Asia, Kombu is an important food. Laminaria japonica, Alaria crassifolia are used as green Kombu, eaten like any other vegetables or used pulverized as soup or spice. Tea can also be prepared. They are used as an additive in many foods. They can add flavor, color, and texture to soups, casseroles and many other dishes. The seaweed can also be used for making sushi (Mexican dish)

Laminaria is used in China as a livestock fodder for chickens and cattle. For this purpose Laminaria is sometimes processed into a product called "lameal" (Laminaria meal), analogous to fish meal. The largest brown algae, kelp, are the most important in the ecosystem. They are used as food for herbivorous fish and shellfish. One animal that especially likes brown algae is the sea urchin. They are very abundant in the kelp fields of the Pacific and can destroy entire forests in a very short time if there are too many urchins. Kelp also provides a home for sea otters and starfish which eat the many and create a more balanced ecosystem in that area.

urchins

Industrial Uses. The most important part of brown algae is algin, a starch-like chemical that is found in the cell walls of kelp. Algin is a hydrocolloid or phycocolloid made from extracted alginate or alginic acid which has the property of holding water in suspension. It is used as a stabilizer and emulsifier in making dairy products, prevents frosting and pies from drying out in the baking industry. Seaweeds are commercially used in cosmetics and pharmaceuticals industries. It is widely used as a binding agent in textile and printing industries. Algin is used as a thickening agent in pharmaceutical drugs and chemical and manufacturing industries, such as making toothpaste, shampoo, and a myriad of other products. It is used in making rubber products, paper, paints, and cosmetics, and it thickens printing paste which makes sharper print in the textile industry.

The dried up stocks of kelp can be easily harvested at low tide and used as fertilizers. It reduces the acidity of soils.

Future prospective of Algae :

Stages of kelp cultivation :

(1) Collecting zoospores refers to the gathering of zoospores from parent Laminaria stock. Selected parent Laminaria plants are dried for a few hours to stimulate zoospore release. Zoospores are gathered by providing a substrate (bamboo rods, seedling ropes) on which they attach. Young sporelings develop on the same substrate materials: zoospore → gametophyte → zygote --) seedling or sporeling. When zoospores are collected in mid-October the resulting young sporophyte plants are called "autumn seedlings". When collected in early July, the young plants are called "summer seedlings".

(2) Seedling-rearing of young sporelings refers to the early growth of seedlings or sporelings into young sporophyte plants. During this three month developmental stage young sporophytes reach a length of 2–5 cm. In modern ere water temperature is artificially cooled.

(3) Intermediate culture of young sporelings refers to a period lasting 2–4 weeks when young sporelings are removed from the seedling-rearing station, after reaching a length grow-out site. Sporelings are transferred of 2–5 cm, and are transferred to seawater at the raft when seawater temperature drops below 20° C, around mid-October. The purpose of this stage is to stimulate growth of sporelings to a length of 10–25 cm in preparation for transplantation. Sporelings become over-crowded in the seedling station when they reach a length of 3–5 cm and therefore transfer to seawater is necessary. During intermediate culture young sporelings grow very rapidly.

(4) Transplantation of young sporophytes refers to the procedure of removing young seedlings from the seedling ropes at the end of intermediate culture and transplanting them to thicker kelp culture ropes for final grow-out on rafts. The procedure is equivalent to transplanting rice shoots in paddy culture

(5) Raft culture grow-out of kelp plants refers to the final stage of kelp production when culture ropes with transplanted sporophytes attached are suspended from floating raft ropes anchored in shallow sea areas. The grow-out period in northern China lasts eight months, from about mid-November to mid-July of the following year.

(6) Harvest of kelp plants refers to the cropping and raw processing of mature kelp plants at the end of the grow-out stage. In northern China kelp harvest takes place between the end of June and the end of July. As seawater temperatures warm in mid-summer kelp fronds begin to deteriorate and lose weight. Plants should be harvested before serious loss of biomass occurs.

Result:-

Algae is economically very important to the world and it has many nutritional and medicinal values. And various algal products can be used for industrial uses.

We found that the coastal areas of Bhavnagar (Gujarat) suit the environment for the cultivation of seaweeds.

Conclusion:-

Since Bhavnagar coastal areas has been found to have favourable conditions for the cultivation of seaweeds. Here, seaweed industries can be established and we can take the benefits of the seaweeds. Algae, has great medicinal value and can be used for the treatment of various diseases and deficiencies. Growth of seaweeds is rapid and easy.

Seaweeds has high nutritional value and is a rich source of protein and carbohydrates etc. The population is increasing day by day and we are not able to fulfill the food requirements of the increasing population. Hence, we can cultivate various seaweeds by establishing cottage industries around the coastal areas of Bhavnagar. Cultivation of seaweeds is not expensive.

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