HUMAN AND ECOLOGICAL RELEVANCE OF THE ALGAE

BENEFICIAL ASPECTS

DIATOMS (Bacillariophyta)

- Algae are at the bottom of aquatic food chains
- The whole fisheries industry depends on phytoplankton, and algae rank as outstanding contributors to the world food supplies.
- Diatoms, for example, are consumed by fish that feed on plankton

DIATOMS Cont'd

- Up to 40% of a diatom's mass consists of oils that are converted to cod and other liver oils which are rich sources of vitamins for man
- The oils also may in the past have contributed to petroleum oil deposits
- Diatoms also have other extensive and more direct industrial uses

DIATOMS Cont'd

- As billions upon billions of them have reproduced and died, their microscopic glassy shells have accumulated on the ocean floor, forming deposits of **DIATOMACEOUS EARTH**

DIATOMS Cont'd

- These deposits have accumulated to depths of hundreds of metres in some parts of the world and are quarried in several areas where past geological activity has raised them above sea level
- Diatomaceous earth is a light, porous, and powdery looking material that contains about 6 billion diatom shells per litre

DIATOMS Cont'd

- It also has an exceptionally high melting point of **1750^{0}C** and is insoluble in most acids and other liquids
- These properties make it ideal for a variety of industrial and domestic uses, including many types of filtration

DIATOMS Cont'd

- The sugar industry uses diatomaceous earth in sugar refinery, and its use for swimming pool filters is widespread
- It is also used in silver and other metal polishes, in toothpaste, and in the manufacture of paint that reflects light, which is used in highway markers and signs and on the automobile license plates
- It is packed as insulation around blast furnace and boilers

USES OF GREEN ALGAE

- Sea lettuce (*Ulva* sp.) has been used for food on a limited scale in Asian countries for sometime and several countries are experimenting with the suitability of plankton for human consumption

USES OF GREEN ALGAE Cont'd

- Except for vitamin C, *Chlorella* contains most of the vitamins needed in nutrition and since it is also easy to culture, it may become an important protein source in many parts of the world
- *Chlorella* has also been investigated as a potential oxygen source for atomic submarine, in addition to its possible use in space

ALGIN

- Commercially produced ice cream, salad dressing, beer, jelly beans, latex paint, penicillin suspensions, paper, textiles, toothpaste, ceramics, and floor polish all share a common ingredient, **algin**, produced by the giant kelps and other brown algae

ALGIN Cont'd

- It is now used in so many products that one might wonder how the world used to get along without it
- Algin has the unique ability to regulate water behaviour in a wide variety of products

ALGIN Cont'd

- It can, for example, control the development of ice crystals in frozen foods, regulate the penetration of water in a porous surface, and generally stabilize any kind of suspension such as an ordinary milk-shake or other thick fluid containing water

ALGIN Cont’d

- It is produced by several kinds of seaweeds, but a major source is the giant kelp found in the cooler ocean waters of the world, usually just offshore where there are strong currents

MINERALS AND FOOD

- Brown algae also produce a number of other useful substances
- Many seaweeds, but particularly kelps, build up concentrations of iodine to as much as 20,000 times that of the surrounding sea water
- Dried kelp has been used in the treatment of goitre which results from iodine deficiency

MINERALS AND FOOD Cont'd

- Kelps are relatively high in nitrogen and potassium and have been used as fertilizer for many years
- They also have been used as source of food for fish and as livestock feed in northern Europe and elsewhere

MINERALS AND FOOD Cont'd

- In the Orient, many marine algae are used for food – in soup, confections, meat dishes, vegetable dishes, and beverages
- In Japan, there is even an industry for cultivating the red alga *Porphyra* in a manner comparable with more orthodox agriculture

MINERALS AND FOOD Cont'd

- The product is used to make a popular foodstuff
- In Japan, **acetic acid** is produced through fermentation of seaweeds
- Irish moss is an important edible red alga

MINERALS AND FOOD Cont'd

- It is used in bulking laxatives, cosmetics and pharmaceutical preparations
- Funori, obtained from yet another red alga, is used as a laundry starch, as an adhesive in hair dressings, and in some water-based paints

AGAR

- One of the most important of all algal substances is agar, produced most abundantly by the red algae *Gelidium* and *Gracilaria*
- This substance which has the consistency of gelatin is used (with nutrients added) around the world in laboratories and

AGAR Cont'd

- ✓ and medical institutions as a culture medium for the growth of bacteria and fungi
- When various nutrients are added to it, it can also be used as a culture medium for the growth of both plant and animal cells

AGAR Cont'd

- Its use in making capsules containing drugs and vitamins is now worldwide
- It is also used as an agent in bakery products to retain moistness, as a base for cosmetics, and as an agent in the gelatin desserts to produce rapid setting

OTHER USES

- Current research involving red algae and other seaweeds indicates they contain a number of substances of potential medicinal value
- More than 20 seaweeds have been used in preparations designed for the expulsion of digestive tract worms, control of diarrhoea and the treatment of cancer

AGAR Cont'd

- Some have shown considerable potential as antibiotics and insecticides

DETRIMENTAL ASPECTS

- Plankton algae are not wholly beneficial to mankind
- To the waterworks engineer algae can be very troublesome
- Whatever the source of water to be treated (reservoirs, lakes, rivers) there is likely to be initially a considerable algal population

DETRIMENTAL ASPECTS Cont'd

- Much of London's water is supplied by the River Thames, which drains a large area of agricultural land and is therefore rich in mineral salts
- This high salt concentration leads to prolific growth of planktonic algae much of which must be removed by filtration

DETRIMENTAL ASPECTS Cont'd

- One of the most abundant species is the diatom *Fragilaria crotonensis* and in certain seasons more than one ton by dry weight of this alga alone is removed each day
- Other algae, notably members of the Xanthophyta (and Myxophyta), may be far less numerous but can lend an unpleasant taste or smell to the water

DETRIMENTAL ASPECTS Cont'd

- In such cases filtration may be ineffective, and chlorination or absorption with activated charcoal may be necessary to make the water acceptable to the consumer
- On the seashore, seaweeds grow in profusion

DETRIMENTAL ASPECTS Cont'd

- Seaweeds are generally restricted to the coastline where the plants can be attached to a firm substratum while at the same time near enough to the surface to receive sufficient sunlight

DETRIMENTAL ASPECTS Cont'd

- The brown alga *Sargassum natans* however exists in enormous floating masses far out into the sea, and creates navigational hazard near to the West Indies in the area known as the Sargasso Sea

DETRIMENTAL ASPECTS Cont'd

- Pacific coast fish farmers have experienced losses of salmon and cod when dense concentrations of *Chaetoceros* diatoms have developed in the aquaculture pens
- The diatoms have long hollow spines that break off and penetrate the fish gills, disrupting gas exchange and causing bleeding

DETRIMENTAL ASPECTS Cont'd

- This damage in turn may permit secondary infections and excessive mucus production to occur
- ALGAL BLOOMS ie. massive growth of algae, may severely deplete oxygen when their cells decompose , reduce the use of lakes and streams for recreation, and interfere with water purification

DETRIMENTAL ASPECTS Cont'd

- Dense growth of planktonic dinoflagellates (Pyrrophyta) produce red or brown water discolourations called RED TIDES
- Red tides most often occur in coastal waters and estuaries

DETRIMENTAL ASPECTS Cont'd

- Some dinoflagellates producing red tides are **luminiscent**, and some contain **toxins** that are released into the water or accumulate in food chains
- In severe cases, the toxins may cause fish-kills or lead to human poisoning from eating contaminated mollusks or fishes