

The Environmental and economic importance of algae

Lujain Ibraheem Hussain, Ahmed CheadAuda , Fawzishnain Alnasur

Fculy of sciences,University of AL-Qadisiyah ,Iraq

ABSTRACT: In this review article, we will interpret the importance the algae economically and environmentally through the biological activities performed by algae to protect the ecosystem and their role in economic aspects as well as the toxins produced by these living creatures especially in Iraqi waters.

I. THE ENVIRONMENTAL AND ECONOMIC IMPORTANCE

Algae form a basic and important in all environments in it, and are the basis in the food chain in the aquatic environment where it is characterized by high content of proteins, carbohydrates and vitamins.the primary photo- synthetic organisms in freshwater and marine food chains. As a food source for zooplankton and filterfeeding shellfish, the algae are an extremely important group(1).

Algae play a role in the economies of some countries and these materials are Alginicacid,Agar,*carrageenin* ,*ditamite*and some algae is used for the manufacture of glycerol such as *Dunaliella*.(2)

Algae plays effectively to purify the residues of factories which rich in organic and inorganic pollutants to remove these pollutants and provide the aquatic environment with oxygen photosynthesis process and thus increase the bacterial activity of the analysis of pollutants. Some algae are used as insecticides and some are involved in the pharmaceutical industry to treat many diseases, including malnutrition and treatment of thyroid diseases and many others.Some use its extracts to inhibit bacterial and fungal activity and also used against tumors such as *Nitzchiapalea*, *Spirulina* sp. , *Oscillatoriapseudogeminata*.(3)

Due to the availability of sunlight, surface water is common in blue-green algae (Cyanobacteria), and like any other organism that generates amounts of secondary metabolic compounds from intracellular building and demolition. A toxic or fatal effect, called Algal Toxin, so its secretions in its negative effect on water quality have exceeded the toxicity and risk of altering taste and odor.These toxic compounds may sometimes be associated with the death and decomposition of algae. This means that water treatment systems may cause this when inappropriate algae removal methods are used. Some recent studies have praised the safety of aluminum sulfate in terms of its ability to remove algae by sedimentation and coagulation in water treatment plants while ensuring that no toxins are released.

Algae can be harmful in two basic ways :

1-Producing large populations in the aquatic environment Large growths of some algae (e.g., the diatom *Chaetoceros* or the *prymnesiophyte* *Chrysochromulina*) can clog the gills of fish and can be particularly a problem in aquaculture systems. Anoxic conditions, resulting in fish kills, can occur at the end of blooms of other algae (e.g., green algae) as the algae die and decompose.

2- Production of toxins Some algae produce toxins that sicken and kill other organisms that prey on these algae. Indeed, this probably was the reason that these algae were selected for in the evolutionary process since it reduced predation by grazers . Filter-feeding shellfish can accumulate large quantities of these toxins as they filter the algae out of the water. Consumption of the shellfish by man, birds, and animals results in sick ness and death.(4,5)

Both planktonic and benthic algae can form huge agglomeration which can become very dense and concentration, this metals take long time to desperse and become risk for man and animals health.

Lyngbya is a poisonous algae, often which does not have long strands of non-branched length ,cells are shorter than their width and the yarn is surrounded by a casing or cover named Sheath consists of a gel mucilage and a small amount of cellulose which is either unilayer or bilayer .Studies have shown that this cover is used by algae adapted as an adaptive means to resist environmental conditions

and that most types of this species are either adhesives to benthic materials or floating on the surface or planktonic.(6,7)

Type of Algae toxins

There are three main types of algae toxins :

- 1- Neurotoxins : act blocking neural signal transmission with many machains :
- A- Anatoxin-a :act as acetyle choline mimic .
- B- Anatoxin -a (s) :act as choline estraseinhibitor causing an organophosphate like syndrome.

C- Saxtoxine : act by blocking sodium channel thus disrupting sodium balance in nerve cell.

2- Cytotoxin : it is alkaloid block protein synthesis by binding to DNA or RNA ,its responsible for cytogenetic damage via DNA strand break and loss whole chromosomes and it may be carcinogenic and associated with losses of glutathione and depletion of glutathione result in cell death , this low level due to inaction of the final pathways of glutathione, many of reports involving that many of wild and farm animals poisoning after drinking water from lake and ponds containing cyanobacterial blooms.

3- Microcystine : its called Nodularins too, most occurring and widespread of the cyanobacterialact by blocking protein phosphate 1 and 2a causing toxicity at the hepatic level as they use bile carrier to pass through cell membranes ,it shown accumulative as a single oral dose resulted in no hepatic damage ,while the same dose daily for several days caused hepatic damage . this type of toxin can caused tumor promoting agent they can increase the incidence hepatic tumors in human too.(8)

In fresh water algae the toxicity lower than that in cyanobacteria because algae do not have effective mechanism of accumulation and the toxic potency of their toxins .*Peridinium* this genus for dinoflagellated produced toxins called ichthyotoxins ,this toxin caused fish kills and algicidal effect , *Microcystisaeruginosa* its toxic blooms in fresh water that affect from biota in their habitats ,the toxic production considered as a defensive strategy for this algae from fish larvae preying and that genus caused allergic reaction for human .(9)

Both algae and cyanobacteria or called blue green algae produce toxin ,the toxins are secondary metabolisms which have different degree of toxicity ,the less one induce dermatitis and the most dangerous are hepatotoxic ,generally algae produce less toxins and rarely responsible to toxic episodes , the different behavior is partly responsible of the form toxin and degree of dangerous of it ,algae do not produce high amount of toxin to accumulate in the environment to threaten human or livestock ,blooms formed by cyanobacteria produce not only cells accumulation but also increase in toxins concentrations to levels hazardous to human. The main method to exposure for toxins by drinking water which contain this toxin or by absorption, ingestion contact and inhalation (10).

II. RED TIDE

One of the most important phenomena of algal toxins is the phenomenon of red tide, a natural phenomenon occurs in all fresh and salt water environments causing a lot of economic losses and health problems of humans, where a defect causes the food security of society through the death of large numbers of fish, birds and other aquatic organisms,It also disrupts seawater desalination stations.

This phenomenon is also called poisonous algal bloom, which collects large numbers of algae dinoflagellates, and up to 300 species have the ability to cause red tide, of which 80 species produce toxic substance within its cells or to the outside when it is high density growth and the water appears dark purple or Pink or red depending on the type of algae present and may be colorless.(11)

The causes of this phenomenon are unclear and may be natural and seasonal because of the cold currents that carry nutrients phosphate and nitrates resulting from the decomposition of marine organisms after their death and sediment at the bottom , these algae and multiply for the presence of nutrients and appropriate environmental conditions .In other regions, there is an increase in nutrients loaded into the sea from human activities.Usually the phenomenon of red tide occurs because of the presence of some algal species consisting of vesicles or spores and these spores settle to the bottom and remain in a state of dormancy for several months and with the provision of appropriate conditions such as the availability of oxygen, nutrients, lighting and suitable temperature to reproduce. These spores move upward and begin with simple division and growth to produce few days large numbers of cells, the concentration of spores are hundreds to millions in a milliliter can be spread and carried to long distances by currents, storms and ships (12).

III. INFLUENCES OF RED TIDE

The essential environmental influences for red tide are death of large number of aquatic organisms such as fish ,snails ,birds and marine mammals ,this effect either direct by nerve toxins secretion which damage cell nerve for marine organisms ,or they have indirect effect by reduce oxygen in water Column, large populations of algae when they die and decompose by bacteria. This process depletes oxygen dissolved in water and therefore aquatic organisms will die or migrate from logic ,as well as the dense growth of algae leads to clogged of fish gills and thus will suffocate and die, the shellfish and some snails feed on the material by filtering water, which algae are found in high density , This leads to the accumulation of toxins in their bodies to be unfit for human consumption. Other impacts include damage to fish farming companies and corals.

It also leads to the deterioration of the quality of sea water in areas where this phenomenon occurs and thus disruption of desalination projects nearby sea water such as what happened in desalination plants in Oman, the United Arab Emirates and Kuwait.(13).

IV. REDUCE THE RISK OF RED TIDE

The first step to reduce the risk of this phenomenon is to control the amount of sewage discharged into the aquatic environment and work to treat it and then be used in other areas, Spreading awareness of the meaning of the red tide, its environmental problems and the extent of the damage it causes, noting that this phenomenon is not a condition that the water should be red, it may be green, brown or colorless. Here comes the role of scientific laboratories to conduct periodic tests of water. Also important is to avoid catching fish, shellfish and other seafood at the time of the red tide while avoiding swimming in these areas. (14).

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