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Research Article

Enumeration of algal species creating problems in water reservoirs, water supplies and the possible solutions

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Abstract

Algae are very important to aquatic ecosystems. Algae play an important role in the aquatic food chain, also used as food or food additives in many countries. Many of the algal species are useful. But sometimes the algal growth in water supplies diminishes the quality of water by producing objectionable odour, taste and undesirable pH changes. Their rapid growth also suffocates other creatures living in the water due to depletion of oxygen and blocking of sunlight. The algal blooms which appear in slow flowing or standing water, are aesthetically unappealing. The cyanobacterial algal members producing cyanotoxins, contaminating water may cause serious illness in humans or animals. The present paper enumerates the algae reported from the water supplies belonging to the Chlorophyceae, Cyanophyceae, Bacillariophyceae, Euglenophyceae, Chrysophyceae and Pyrrophyceae algal groups or classes. The problems created due to the growth of these algae in water reservoirs, water supplies and the possible solutions have also been presented.

Keywords: Algae, Water Supplies, Eutrophication, Algal Bloom, Cyanotoxins.

INDRODUCTION

Algae can inhabit freshwater or marine water. Water bodies in different parts of the world vary from oligotrophic (poor in nutrients) to eutrophic (rich in nutrients) due to altered pattern of precipitation (Sinha et al., 2017; Gilbert, 2020) and as such the number of algal species varies in different water bodies. Algal blooms are growing at faster rate due to suitable warming conditions (Gobler et al., 2017). Algal blooms can cause many physical problems e.g. clogging screen or can bring change in the taste and odour of water used for drinking (Walker, 2017, Kalinichenko et al., 2018), decline the oxygen level (Breitburg et al., 2018). A number of algal species are responsible for excessive accumulation of foams, scums and discoloration of the water. Polluted water reduces the water quality and thus restricts the use of water bodies for many purposes (Sen et al., 2013). Some algal forms create trouble for the water system used by animals and humans and produce certain toxins that can have ill health effects (Brooks et al. 2016, Mchau et al., 2019, Kumar, 2021).

METHODOLOGY

An analysis of various troubles creating algae in the municipal water supplies from the literature was carried out and an account of different algal species belonging to different algal groups or classes along with possible remedial measures as a solution of this problem was included in the results.

RESULT

Common algae in water supplies belong to the following groups:

(i) **Cyanophyceae (Blue green algae):** *Anabaena, Aulosira, Calothrix, Chroococcus, Coelosphaerium, Cylindrospermum, Dichothrix, Lyngbya, Merismopedia, Microcystis, Nostoc, Oscillatoria, Phormidium, Scytonema, Spirulina.*

(ii) **Chlorophyceae (Green Algae):** *Actinastrum, Ankistrodesmum, Bulbochaete, Carteria, Chara, Chlamydomonas, Chlorella, Cladophora, Coelastrum, Cosmorium, Desmidium, Elakatothrix, Gloeotaenium, Gonivm, Kirchneriella, Lagerheimla, Micractinium, Micrasterias, Microspora, Movgestia, Netrium, Nitella, Oedogonium, Oocystis, Pandorina, Pediastrum, Pithophora, Platydorina, Quadrigula, Rhizoclonium,*

Scenedesmus, Selanastrum, Sphaerocystis, Spirogyra, Stavrastrum, Stigeoclonium, Tetraedrun, Volvox, Xanthidium, Zygnema.

(iii) **Bacillariophyceae (Diatoms):** *Achnanthes, Amphora, Asterionella, cocconeis, Cyclotella, Cymbella, Gomphonema, Gyrosigma, Melosira, Navicula, Pinnularia, Rhizosolenia, Surirella*.

(iv) **Pyrrophyceae:** *Ceratium.*

(v) **Chrysophyceae:** *Dinobryon*

(vi) **Euglenophyceae:** *Euglena, Phacus, Trachelomonas.*

The growth of above algae in water reservoirs and water supplies creates the following problems:

A) Loss of Recreational and Fishing Value of water Bodies:

Excessive growth of *Microcystis, Spirogyra, Cladophora* and *Pithophora* results in the loss of recreational and fishing values of pools, ponds and lakes.

B) Imparting Objectionable Odours:

Certain algae impart objectionable or foul adours to potable water either due to this metabolic product or by decomposition. Algae may impart following types odour

(i) Odour resembling ripe cucumber or musk melon by *Asterionella, Tabellaria* (Both Diatoms) and *Synura* (Chrysophyceae).

(ii) Grassy odour by *Cylindrospermum, Gomphosphaeria, Rivularia*.

(iii) Fishy and Septic odour by *Chara, Zeylanica*.

(iv) Strong fishy odour *Dinobryon, Uroglenopsis, Peridinium, Ceratium, Chlamydomonas, Pondorina, Volvox.*

(v) Septic odour by *Cladophora, Hydrodictyon, Nitella, Staurastru.*

Getting rid of objectionable odours due to algae is a very costly affair.

C) Imparting Objectionable Tastes:

Objectionable tastes imparted by algae are:

(i) Sweet taste by *Cryptomonas, Gomphosphaeria, Euglena*;

(ii) Bitter taste by *Synura, Ceratium, Nitella*;

(iii) Vegetable to oily taste by *Stephanodiscus*.

D) Imparting Colour to the Water:

Where the water sources are not covered or where the treatment of raw water is not efficient or where filtration is not good and unicellular algae pass through the filters, the following algae add colour to the finished water:

(i) Cyanophyceae e.g. *Miscrocystis Oscillatoria*

(ii) Chlorophyceae e.g. *Chlamydomonas Chlorella Cosmarium Elakatothrix*

(iii) Euglenophyceae e.g. *Euglena*

(iv) Pyrophyceae e.g. *Ceratium*

These algae form coloured marginal rings in the water kept in a vessel, pot or bucket, etc. It may however, be added that the colours are not always due to algae, but they may be due to other substances also.

E) Clogging of Water Filters:

Particulate materials and marine algae are present in surface waters and therefore coagulation and sedimentation are carried out prior to passing the water through the filters, this process removes 95% of algae from water. To remove the rest of the algae the water is passed through filters for 30 to 100 hours.

Two types of filters are utilized. There are:

(i) Slow Sand Filters: *Chlamydomonas, euglena, Navicula, Nitzschia, Phacus* and *Trichomanes* can pass through there filters.

(ii) Rapid Sand Filters: *Synedra, Oscillatoria* can pass through rapid sand filters.

The water which pass through a slow sand filters is relatively free from bacteria, algae and other organisms as well as dead organic matter. Algae in such cases form a loose, slimy layer over the surface of the sand and act not only as a filter, but provide O_2 to the aerobic, saprophytic bacteria, fungi and protozoan, which are present in filters. In the absence of algae, filters will be clearer to give us clean water. Also, when the diatoms die, their cell walls which are composed of silica remain permanently there and thereby close the pores in the filters.

Clogging of these filters may be caused by:

(i) Diatoms, which are ubiquitous and pose serious problems are: *Asterionella, Cyclotella, Cymbella, Diatoma, Fragilloria, Navicula, Synedra, Tabellaria, Melosina.*

(ii) Cyanophyceae e.g. *Anabaena, Chrococcus, Oscillatoria, Phormidium, Rivularia.*

(iii) Chlorophyceae e.g. *Chlamydomonas, Chlorella, Cladophora, Closterium, Cosmarium, Dichotomosiphon, Dictyospherium, Hydrodictyon, Mougeotia, Palmella, Ulthrix, Zygnema.*

(iv) Euglenophyceae e.g. *Euglena, Trachelomonas*

(v) Other Algae Chrysophyceae: *Dinobryon, Peridinium, Tribonema, Stephanodiscus.*

As the number of microorganisms increases, the length of filter run decreases (Palmer, 1962) and clogged filter have to be washed back every now and then, resulting in the dislocation of water works. Some algae can pass even

through the filters and if they pass in greater numbers they cause turbidity.

DISCUSSION

Algae provide not only O_2, but also acts as a food for the heterotrophic organisms line protozoan, crustaceans, etc. which live in the pipes. In the absence of algae, these organisms would die and the pipes would be cleaner and cleaner. Various algal members grow in polluted aquatic system (Kumar 2016). When the algae grow in large numbers, they result in an increase in the sediments in water reservoirs after their death. In the world, many freshwater and coastal marine ecosystems are getting impaired due to eutrophication which can be managed (Chislock et al., 2013, Glibert, 2020). Water is drawn from different depths, thereby leaving the surface population of algae. Water is chlorinated not only to kill algal growths but also other micro organisms. However, a few algae are resistant to chlorination. Whenever the concentration of planktonic algae approaches a count of 500-60/ml, algicides are applied. Approximately 1ppm copper sulphate is used in water reservoirs for algal treatments. High doses of CP_2 and $CuSO_4$ are avoided as they are fatal. Undesirable tastes of algae can be eliminated by treating the water with activated carbon before it is led to filtration. Aluminium hydroxide has been used as a substitute of copper sulphate with success.

CONCLUSION

It can be concluded from the present study that algal members commonly belonging to Chlorophyceae, Cyanophyceae, Bacillariophyceae, Euglenophyceae, Chrysophyceae and Pyrrophyceae have been reported from the water supplies. Environmental factors like light intensity and temperature leading to more accumulation of algal biomass. This is responsible for change in pH, objectionable odour and taste of water, change of water colour, clogging of filters and loss of fishing and recreational values of water bodies. Water chlorination, use of algicides and activated carbon treatment of water may prove to be a solution of this problem.

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REFERENCES

Breitburg D, Levin LA, Oschlies A, Grégoire M, Chavez FP, Conley DJ, & Jacinto GS(2018). Declining oxygen in the global ocean and coastal waters. Science. 359: 7240.

Brooks BW, Lazorchak JM, Howard MDA, Johnson MVV, Morton SL, Perkins DAK, Reavie ED, Scott GI, Smith SA, & Steevens JA(2016). Are Harmful Algal Blooms Becoming the Greatest Inland Water Quality Threat to Public Health and Aquatic Ecosystems? Environmental Toxicology and Chemistry, 35(1): 6-13.

Chislock M F, Doster E, Zitomer RA, & Wilson AE(2013). Eutrophication: Causes, Consequences, and Controls in Aquatic Ecosystems. Nature Education Knowledge 4(4):10.

Glibert PM (2020). Harmful algae at the complex nexus of eutrophication and climate change. Harmful Algae, 91, Article 101583.

Gobler CJ, Doherty OM, Hattenrath-Lehmann TK, Griffith AW, Kang Y, & Litaker RW(2017). Ocean warming since 1982 has expanded the niche of toxic algal blooms in the North Atlantic and North Pacific oceans. Prod. Nat. Acad. Sci., 114: 4975-4980. https://doi.org/10.1073/pnas.1619575114

Kalinichenko A, Pavlo PP, & Kulyk M(2018). Algae in urban water bodies – control of growth and use as a biomass E3S Web of Conferences 45, 00028. DOI: 10.1051/e3sconf/20184500028

Kumar R(2016). ALGAE IN POLLUTED AQUATIC ECOSYSTEM. J. Indian bot. Soc. 95 (3 & 4): 204-210

Kumar R(2021). TOXIC ALGAE AND EFFECTS OF ALGAL POISONING IN ANIMALS AND HUMAN BEINGS. World Journal of Environmental Biosciences. 10(1): 9-12.

Mchau GJ, Makule E, Machunda R, Gong YY, & Kimanya M(2019). Harmful algal bloom and associated health risks among users of Lake Victoria freshwater: Ukerewe Island, Tanzania. J Water Health (2019) 17 (5): 826–836. https://doi.org/10.2166/wh.2019.083

Palmer CM(1962). Algae in water supplies of Ohio. Ohio J. Sci. 62: 225–244.

Sen B, Alp MT, Sonmez F, Kocer MAT, & Canpolat O(2013). Relationship of Algae to Water Pollution and Waste Water Treatment. DOI: 10.5772/51927

Sinha E, Michalak AM, & Balaji V(2017). Eutrophication will increase during the 21st century as a result of precipitation changes. Science, 357: 405-408

Walker HW(2017). Harmful Algae Blooms in Drinking Water: Removal of Cyanobacterial Cells and Toxins. CRC Press. 175pp.