



ASSESSMENT OF EUTROPHIC STATUS OF WATER RESOURCES OF MADHYA PRADESH, INDIA: A REVIEW

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Abstract

Eutrophication is a process in water bodies that once started is difficult to control unless immediate action is taken and it will ultimately reduce oxygen in water killing fish and other organisms, reduce biodiversity and cause enormous economic losses.

Introduction

Water eutrophication is one of the most challenging environmental problems in the world. The increasing severity of water eutrophication has been brought to the attention of both the governments and the public in recent years.

Water bodies accumulating large amounts of plant nutrients are called “eutrophic” (Greek words *eu* meaning “well” and *trophe* meaning “nourishment”). It has become a worldwide environmental problem in recent years.

Madhya Pradesh, Situated in the centre of India, Madhya Pradesh is the largest geographic unit of the country. Madhya Pradesh, with its 0.46 million ha of reservoirs, has the maximum waterspread under man-made lakes of all Indian States. State government expenditure huge amount of money for maintenance, development and conservation of these water bodies but on the ground level/researches it is not sufficient. Much work still to be done.

What is Eutrophication ?

Water eutrophication is mainly caused by excessive loading of nutrients into water bodies like nitrogen and phosphorus. Excessive nutrients come from both point pollution such as waste water from industry and municipal sewage, and non-point pollution like irrigation water, surface run water containing fertilizer from farmland, etc.

The major influencing factors on water eutrophication include nutrient enrichment, hydrodynamics, environmental factors such as temperature, salinity, carbon dioxide, element balance, microbial and biodiversity etc. This deteriorated water quality inadequate for domestic,

recreational and other uses. The plants and sediments accumulate gradually, and eventually destroy the water bodies.

Characteristics of Eutrophic Bodies

Eutrophic ponds have such high material deposition that a variety of nutrients are released into the water, which support large populations of algae and higher plants. Nitrogen and phosphorus become the main constituents of the water which originate from household detergents and municipal and industrial waste water could cause negative ecological consequences on aquatic ecosystem structures, processes and functions, result in the fast growth of algae and other plankton, and deteriorate water quality.

Phosphorus is often regarded as the main culprit in cases of eutrophication in lakes subjected to point source pollution from sewage.

Following adverse ecological effects of eutrophication increased biomass of phytoplankton.

- Toxic or inedible phytoplankton species
- Decreases in water transparency
- Taste, odor problems
- Dissolved oxygen depletion
- Increased incidences of fish kills
- Loss of desirable fish species
- Decreases in perceived aesthetic value of the water body

At certain pH levels, higher NH_3 are toxic to aquatic life, therefore detrimental to the ecological balance of water bodies. Higher concentrations could be an indication of organic pollution such as from domestic sewage, industrial waste and fertilizer run-off.

The Death of a Water body

Eutrophication describes the qualitative conditions of an aquatic environment that has been disrupted. The society as a whole needs to be aware of the problem in terms of health, environment finance, imbalance in the food web that results in high levels of phytoplankton biomass in stratified water bodies and recreation as well as the costs related to its solution.

The algae may also cover the surface of the water, reducing the amount of light that decreasing photosynthesis. The decreased level of dissolved oxygen can result in the death of larger aquatic communities. The algae may use up all the oxygen in the water, leaving none for other marine life. This results in the death of many aquatic organisms such as fish, which need the oxygen in the water to live.

Effect of eutrophication on Water resources and Society

In aquatic environments, algal bloom disrupts normal functioning of the ecosystem, causing a variety of problems. Human society is impacted as well, eutrophication decreases the resource value of rivers, lakes, and estuaries such that recreation, fishing, hunting, and aesthetic enjoyment are hindered contains high concentrations of nitrates and phosphates, which led to the quick growth as well as death of plants and algae.

Eutrophication problems in context of Madhya Pradesh surface Water bodies

I. Upper Lake, Bhopal

Upper Lake is used as a prime source of drinking water supply for Bhopal city. This is organic polluted and nutrient enriched lentic ecosystem. Input of large amount of sewage effluents, human excreta, etc. are known to cause organic/Inorganic pollution load. Concentration of Total Phosphorous and Total Nitrogen are mainly responsible for Upper Lake eutrophication and having significant impacts on lake water quality. These nutrients can also enhance the rate of cultural eutrophication and increase the lake productivity which reflects through presence of floating algae such as *Microcystisaeruginosa* and several macrophytes in the Upper Lake. Decay and decomposition of these biological species may further increase the organic pollution load, reduction in the euphotic zone and hypolimnetic dissolved oxygen contents.

II. Lower Lake, Shahpura Lake and Motia Talab, Bhopal

Lower Lake, catchments area of 9.60 sq. km. and water spread area of 1.2 sq. km. Lower Lake is an urban eutrophic Lake receives a large amount of raw manure and unprocessed wastewater from its heavily occupied habitation. The water quality of Lake is very poor and cannot be used for drinking purpose. Organic enrichment of Lake through floral offering during ritual practices, idol immersion and decomposition of aquatic weeds are some of the significant causes of its eutrophication

The Shahpura Lake has a catchments area of 8.29 km² and a submergence area of 0.96 km². The Lake is surrounded by human habitation and receives untreated sewage from various sources. The Lake water is used for domestic and recreational activities like irrigation, fisheries etc. The water quality is deteriorating day by day not only sewage inflow, but also by siltation, domestic sewage, washing of clothes and vehicles and dumping of solid wastes.

The Moti Talab situated in old Bhopal It has a catchment area of 6 hectares and water spread area of 1.89 hectares. It receives a large amount of waste water from surface runoff, habitation, washing activities, nutrient overloading, hence leading towards eutrophication. Due to poor water quality it is unfit for human consumption and used for bathing, washing, fishing etc. Eutrophication of a water body signifies the aging of the Lake, caused by the accumulation of nutrients, sediments, silt and organic matter in the Lake from the surrounding watershed

The nutrient concentration was found maximum in Shahpura Lake minimum in Motia Talab and least in Lower Lake. The nutrient concentration in all the three water bodies was found higher which is indicated by the presence of algal blooming and leads towards hyper eutrophication. Aeration system is effective in improving water quality of these Lakes as it increases DO level and reduces BOD & nutrients.

III. Sagar Lake

Sagar Lake is situated in the heart of Sagar city with an area of 1.37 sq. km. It is a shallow lake with a small catchment (11.06 sq. km). Due to the rapid industrial and agricultural development around the city and transport of sewage water into the lake, it was observed increased contaminants were observed in the lake. All the water quality parameters of lake out of the maximum permissible limit set by WHO.

IV. Rudra Sagar Ujjain

One of perennial pond in Ujjain. It has faced the problem of pollution due to agricultural runoff, anthropogenic introduced solid and semisolid pollutants. The macrophytes were observed in high frequency. This unchecked growth of aquatic weeds in water body is a sign of pollution and it shows that the pond is on the verge of eutrophication. Water quality also has been affected due to dense macrophytic vegetation which covered almost whole surface of water. It signifies the lowering or deterioration of water quality for domestic, recreation and other uses. Due to its holy importance the water body must be taken care of so that its historical, religious and other important features should be protected.

V. Nagchoon pond, Khandwa

Physico-chemical characteristics and quality of potable water of Nagchoon pond reveals that water quality deterioration is due to organic matter of animal origin, sewage from adjacent villages and agricultural runoff reaches towards eutrophication. The trophic status of water body warrants a proper conservation and management strategy and checks siltation process and removes weeds from pond time to time and improves quality of water there should be continuous monitoring of pollution level in pond.

Similarly many scientists, researcher worked in the field of Limnology/Water quality from many years studied on various reservoirs in Madhya Pradesh viz. (Ramghat dam, Mirzapur dam and Pashupatinath Pond) in mandsour, eutrophied due to anthropogenic stress, Moghat Reservoir- Khandwa, eutrophied due to animal manures and agriculture runoff, Sakhya Sagar Lake- Shivpuri, eutrophied due to discharge of municipal sewage and runoff, Ramsagar reservoir- Datia slightly inclined towards eutrophication due to high biomass observed near agricultural area and at the points where the nallahs join the reservoir. These results represented quality status on the basis of experimental research. This shows the need to avoid nutrient loading into the water bodies as early as possible by proper management and planning practices.

Conclusions and Recommendations

About 80 per cent of India's diseases are caused by the use of eutrophicated water. Efforts to make important water bodies pollution-free should reduce the amount of waste in effluent water from industries by reutilizing or recycling their components.

Grey water footprint (GWF) is a newly developed concept in the field of eutrophication, which indicates the status of the water body. It is defined as the volume of freshwater required assimilating the load of pollutants based on existing ambient water quality standards.

Eutrophication abatement can be success by strong public support of citizens and stakeholders combined with effective legislative measures and monitoring programs. The best results were obtained when control measures began early and long before hyper-eutrophication occurred.

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