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Impact of Eutrophication on Drinking Water & Fisheries

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Abstract:-

As we know that Water is the Universal constituent of all this world and Water Eutrophication has become a worldwide environmental problem in recent years. And by performing various mechanisms of Water Eutrophication, it will help for prevention and remediation of Water Eutrophication. In this paper, recent advances in current status and major mechanisms of Water Eutrophication, assessment and evolution criteria and the influencing factors were reviewed. Eutrophication increases the growth and age of planktivorous fish population in peculiar cases.

Introduction

Water Eutrophication is most challenging environmental problems in all over the world. The increasing severity of Water Eutrophication has been brought to attention of both of the government and the public in recent years. The nutrient level of lakes and rivers has increased dramatically over the past 50 years in respond to the increased discharge of domestic waste and from agricultural practices and urban development. The main purpose of this paper is to provide a brief review on recent advances on understanding the mechanisms of water Eutrophication and progresses in identifying the influence factors inducing Water Eutrophication.

What is Eutrophication?

Water Bodies can be broadly classified as Ultra oligotrophic, Oligotrophic, Mesotrophic, Eutrophic, Hypereutrophic depending on the concentration of nutrients in the water and productivity.

'Trophy' refers to the rate at which Organic matter is supplied to a water body per unit time. Natural Eutrophication is the process, which may take thousands of years for a water body to age and become more productive.

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In their natural state, rivers generally have a significant flushing rate, allowing sediments to accumulate and then be carried downstream. Surface water consumption has also continued to grow with increasing population. Many rivers are oftenly highly regulated, impacting and quality and environmental flow of the water. Slower flow allows less water for dilution and reduce the water turbidity or mixing of water.

Although a no. of elements are necessary to sustain the growth of algae, phosphorus goes into the bottom sediments, providing a permanent source of phosphorus.

Effects of Eutrophication

1. Stratified Lakes:-

   The quality of a lake and its ability to support aquatic organism are affected by the amount of mixing the lake I's subjected to, as well as other factors, such as climate, topography, inflows and the amount of vegetation. The depth, size and shape of the lake can be important factors influencing mixing. Water density peaks at 3.9^0C, any warmer or colder water is lighter in density.

   The epilimnion is the zone of warm surface water and majority of plant growth. The thermocline is the transition area between the warm water and the colder hypocline zone at the bottom. Stratification traps nutrients released from the bottom sediments in the hypolimnion. Many organisms cannot function efficiently unless O_2 (oxygen) content of water body is near saturation point.

2. Shallow Lakes:-

   Shallow lakes present different challenges to the control of Eutrophication than deep lakes. Sunshine normally penetrates to the bottom of the lake and nutrients from the sediments are bioavailable to all the plants and organisms due to lake's ability to be easily mixed by wind, storm or inflows. Changes in water depth can reduce light penetration to submerged vegetation or cover them with sediments from slit. Beaches and lake edges can be determinally affected by masses of rotting, stinking algae causing problems for tourists, beachgoers and water treatment agencies. In Sub-trophical and Trophical areas, there is little differentiation between seasons which can create Eutrophic

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blooms of algae almost all year around. Gastrointestinal disorders in human have also been linked to ingesting cyanotoxin contaminated water.

3. Problems of Eutrophication

Green algae and Cyanobacteria can produce earthy, musty or grassy odours and tastes which are mainly attributed to the compounds geosmin and methylisoborneol. Although, these cyanobacteria are able to regulate their buoyancy and actively seek water depth suitable for optimal growth.

However, this regulation process can be slow and actively seek water depth in a very regulated manner, and when the weather changes from stormy to fine, shifting the water from turbulent to stratified, buoyant cells may accumulate on the surface. Light winds may drive them to the shore forming scums. Such agglomerations are very dense, accumulating cells by a factor of 1000 or more. Million fold accumulations looking like pea soup consistency can pose a serious health risk to recreational users.

4. Fishery Production of Lentic System:-

Eutrophication can cause problems such as bad taste and odour in fishes captured from such water bodies. Sometimes it lead to the death of all the form of the life in water bodies. On the other hand, it has also been reported that eutrophication increases the growth and age of planktivorous fish populations. The increases in total catches incyprinid and slilurid populations together with the decrease in percid, clupeid and salminidis a well documented phenomenon in the eutrophic patches of rivers and reservoirs. Organic matter depositing from the increased phytoplankton crops promotes oxygen consumption in the hypolimnion, causing even anaerobic conditions in lakes, reservoirs and tanks. Thus, this is the result of inadequate predation on these fish arising from the inability of predators to see them due to increased turbidity.

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Influency factors of Water Eutrophication

1. Nutrient enrichment

   When phosphorus concentration in water is low, it may be the limiting factor and when it increases, others may become a limiting factor such as pH, water depth, temperature, light or other biological factors.

   The variation in the chemical composition of natural water are believed to be an important factor in regulating the abundance, composition, geographical and periodic distribution of phytoplankton.

2. Hydrodynamics

   It has been found that when there is no water to dilute, disturbing water itself can influence the process of Eutrophication and species succession, which is not related to disturbing water itself but is influenced indirectly by changing light and nutrient status.

   Other Environmental Factors:-

   a) Temperature
   b) Carbon dioxide
   c) Light
   d) pH and Dissolved Oxygen
   e) Microbial biomass.

Assessment of Water Eutrophication

Surface Water quality guidelines have been improved in recent years. Generally the physical and chemical evaluation parameters were used to assess the Water Eutrophication mainly nutrient concentration(N & P), algae chlorophyll, water transparency and dissolved oxygen. This table shows the critical values of Total Nitrogen (TN), Total Phosphorus (TP), TNI and primary productivity in various eutrophicated waters. So it is considered that a buffering zone of all trophic levels.

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Table: Critical values of N and P in various eutrophicated waters

(Richardson et. al., 2007)

Eutrophic Status	**TP(µg/L)**	**TN(µg/L)**	**Primary Productivity ($mgC/m^2/day$)**
Oligotrophic Status	5-10	250-600	5-300
Mesotrophic Status	10-30	500-1100	300-1000
Eutrophic Status	30-100	1000-2000	>1000
Hypereutrophic Status	>100	>2000	>1000

Conclusion:-

Human induced eutrophication has heavily degraded freshwater systems worldwide by reducing water quality and altering ecosystem structure and function. Population growth, industrialization and excessive use of fertilizers have resulted in disproportionate amounts of phosphorus in lake stimulating plant and algae overgrowth.

However, these dealings will take time and incur costs, which governments and the private sector may not be so willing to fund due to a loss of profit. Ultimately, it is imperative to increase public awareness and the environment education of citizens and also to develop an integrated strategy to abate eutrophication. Only a collective community effort can move effectively reduce nutrient input to lakes and bring eutrophication under control.

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