Environmental Science

CSS 2021

Question #07

1 Define Eutrophication. 2 Explain the difference between natural and cultural Eutrophication. 3 Discuss the methods of combating Eutrophification?

4 Explicating the term Eutrophication:

Eutrophication is derived from two words "Eu" means 'well' and "trope" means 'nurishment'. Eutrophication is the process in which excessive nutrients, particularly nitrogen and phosphorus, are introduced into aquatic ecosystem, stimulating the growth of Algeae and other aquatic plants. **Nixon (1995)** defined it as an increase in the rate of supply of organic matter in an ecosystem. This process can leads to the formation of dense vegetation, harmful algal blooms and the depletion of oxygen level in the water. Eutrophication can have significant environmental, economic and social impacts. To prevent eutrophication,

it is crucial to reduce the number of nutrients entering waterways and promote the responsible use of fertilizers and nutrient-rich products. "The European Environmental Agency (EEA) reported in 2019 that Eutrophication is one of the main environmental challenge facing Europe's freshwater system, with over 50% of the continent's lakes and rivers affected by nutrient pollution".

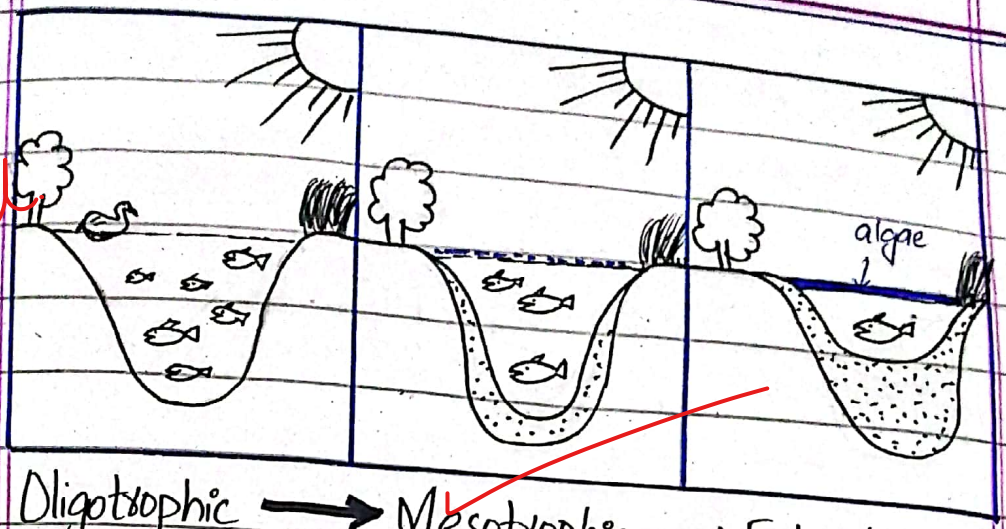
↳ Classification of Aquatic system on the basis of Eutrophication:

i- Oligotrophic:- Low in nutrients and not productive in terms of aquatic life.

ii- Mesotrophic:- Intermediate level of nutrients, fairly productive in terms of aquatic animal and plant life and showing emerging signs of water quality problems.

iii- Eutrophic:- Rich in nutrients, very productive in terms of aquatic animal and plant life and showing increasing signs of water quality problems.

good



Oligotrophic → Mesotrophic → Eutrophic

↳ Deep and Nutrient poor → ↳ Nutrient Enrichment → ↳ Nutrient saturated. Shallow algae and bacteria development.

↳ Types of Eutrophication:

There are two types of Eutrophication:

- Eutrophication
  - Natural Eutrophication
  - Cultural Eutrophication

Difference between cultural and Natural Eutrophication:

Cultural Eutrophication	Natural Eutrophication
CAUSE	
↳ Human activities, such as agricultural runoff, sewage discharge and industrial	↳ A natural, geological and ecological process that occurs over very long periods as lakes

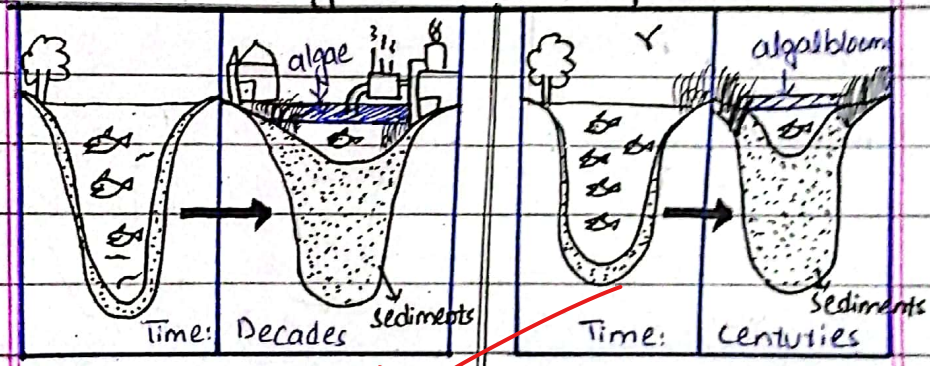
pollution, introduction of accessive nutrients (Ca, P) into water bodies.	and water bodies ages, accumulating sediments and experiencing nutrient cycle.
Speed of process	
↳ Rapid and occurs within a relatively short time frame (years to decades) due to sudden influx of nutrients from human activities.	↳ Slow as it occurs naturally over extended period (centries to millennia) as lakes and water bodies age, allowing ecosystem to adopt to gradual change.
Impact On Ecosystem	
↳ It results in an explosive growth of algae and aquatic plants. Decomposition of excessive plant material leads to oxygen depletion, causing hypoxia, or anoxia, harming fish and other aquatic organisms. Harmful Algal blooms	↳ It results in gradual increases in nutrients level and plant growth, which allows ecosystem to adjust and maintain a more balanced state. Impacts on biodiversity are generally ~~to~~ ~~adopt to the~~ less severe compared to cultural

(HAB)s and biodiversity loss can also occur.	eutrophication.

Reversibility

↳ Potentially reversible by reducing nutrients input through improved waste management, regulation and control of fertilizers and wastewater treatment.	↳ Not reversible as it is a natural process diven by geological and ecological factors.

Diagramatic Representation



Cultural Eutrophication | Natural Eutrophication

↳ Prevention and Control of Eutrophication:

Eutrophication has the potential to destory different components of a community. Therefore it is necessary to take measures to prevent and control Eutrophication in order to

make a healthy environment. Some of the methods are given below to tackle the formation and growth of eutrophication on a large scale:

A 4 Biological Methods to Control Eutrophication:

1- Biomanipulation: It involves managing the aquatic food web and zooplankton dynamics, biomanipulation offers a natural and effective approach to improve water quality in affected water bodies. It involves

i- Predatory Fish: Introduce fish that feed on herbivorous zooplankton, reducing grazing pressure on algae.

ii- Herbivorous Fish: Adding Fish that consume algae, directly reducing algal biomass.

2- Vegetation Management: Utilize aquatic plants to absorb nutrients and improve water quality. It involves

i- Plant Buffer Zones:- Create vegetated buffer zones to trap and absorb nutrients before they enter the water.

ii- Constructed Wetlands: Implement wetlands to promote nutrient removal and denitrification.

3- Biological Augmentation: Introduce beneficial micro-organisms or grazers to control nutrient level and algal growth.

i- Beneficial Bacteria:- Add bacteria to enhance nutrient cycling and breakdown of organic matter.

ii- Algal Grazers:- Introduce zooplanktons or aquatic invertebrates that consume algae.

4- Aeration and Oxygenation:

Implement technique to address low oxygen levels caused by algal growth and decomposition.

i- Aeration: Introduce air or oxygen to support aerobic microbial decomposition.

ii- Oxygenation: Encourage the growth of oxygenating plants for improved oxygen level.

5- Oyster Reef Restoration: Oysters are filter feeders and can efficiently remove particulate organic matter,

including algae and excess nutrients, from water. Restoring oyster reefs in eutrophic area can improve water quality.

B 4 Chemical Methods to Control eutrophication:

1- Algaecides:- are chemical substances used to directly target and control algal blooms. They work by disrupting algal cell structures or inhibiting their growth and Reproduction. Copper sulphate and hydrogen peroxide are common algaecides used to treat small and localized algalblooms.

2- Phosphorus Binding Agents:-

Phosphorus is a key nutrient driving algal growth. Phosphorus-binding agents, such as Aluminium sulphate (alum) or lanthanum compounds are used to: bind with and immobilize phosphorous in the water column. When these, are added to the water, these chemicals form insoluble compounds with phosphorus, preventing it from being readily available for algal uptake.

C ↳ **Manual Methods to control Eutrophication:**

1- Mechanical Removal: It involves physical removal by harvesting or removing excessive algae and aquatic vegetation from water bodies. It involves using rakes, nets or specialized machinery to scoop out or cut the vegetation.

2- Dredging and Sediment Removal: It involves the removal of sediments, which acts as a nutrient reservoir, from the bottom of water bodies. This reduces the nutrients reservoirs and prevent recycling of nutrients.

3- Floating Barriers: Floating barriers or curtains can be deployed in water bodies to contain and concentrate algal blooms in specific areas. By enclosing the bloom, manual removal of algae becomes more manageable and effective. These are specialized for controlling harmful algal blooms.

By using above all the given methods eutrophication can be controlled.

ans is well compossed and very impressive conclude the ans on 8th side max and i hope this was written in time limit

over all ans is excellent all dimensions justified 10./20 well done