

## WHAT ARE THE WAYS TO LIMIT EUTROPHICATION ?

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### ABSTRACT

*Eutrophication or more precisely Hypertrophication, is the enrichment of a water body with nutrients, usually with an excess amount of nutrients. This process induces growth of plants and algae and due to the biomass load, may result in oxygen depletion of water body. One example is the 'Bloom' or great increase of phytoplankton in a water body as a response to increase the levels of nutrients. Eutrophication is almost always induced by the discharge of phosphate containing detergents, fertilizers or sewage into an aquatic system. According to Ullman's Encyclopydia, "the primary limiting factor for eutrophication is phosphate." The sources of these excess phosphates are phosphates in detergents, industrial/domestic run-offs, and fertilizers. Enhanced growth of aquatic vegetation or phytoplankton and algal blooms disrupts normal functioning of the ecosystem, causing a variety of problems such as alack of oxygen needed for fish and shellfish to survive. The water becomes cloudy, tropically coloured a shaade of green, yellow, brown, or red. Health problems can occur where eutrophic conditions interfere with drinking water treatment. Therefore, in this journal are going to introduce a chemical treatment method by which we can stop the further growth of algae i.e. stop the Eutrophication.*

**Keywords :** *Algae, Eutrophication, Chemical Treatment, Phosphate, Sodium Carbonate, Nickel Salt*

### I. INTRODUCTION

Eutrophication presents as one of the most serious ecological problem of open water sources such as lakes, oceans and reservoirs it is characterised by dense algal and plant growth owing to the enrichment by phosphorous and nitrogen nutrients needed for photosynthesis. As a result it often contributes to the formation of extensive mats of floating plants. Examples of the plants include algal blooms, Nile cabbage and water hyacinths. The nutrients come from animal wastes, fertilizers and sewage which are washed by rain or irrigation into the water bodies through surface runoff. Eutrophication can also take place naturally over thousands of years as the lakes grow old and get filled with sediments. Human activities top the list that speed up the degree and rate of eutrophication through both point source and non- point source discharges of the chemical nutrients (phosphates and nitrates) into water system.

## **II. CAUSES OF EUTROPHICATION**

Eutrophication is most often the result of human activities. Farms, golf courses, lawns and other fields tend to be heavily fertilised by people. These fertilisers are the perfect type of nutrients to feed hungry algae and plankton, and when it rains, these fertilisers runoff into lakes, streams, rivers and oceans. Concentrated animal feeding operations (CAFOs) are also a major source of polluting nutrients.

Eutrophication can also come from natural events. If a stream, river or lake floods, it may wash away any excess nutrients off the land and into the water. However, Eutrophication is less likely to occur in areas that are not surrounded by fertilised lands.

### **2.1 FERTILISERS**

Eutrophication is predominantly caused by human actions due to the dependence on using nitrate and phosphate fertilisers. Agriculture practices and the use of fertilisers on lawns, golf courses, and other fields contribute to phosphate and nitrate nutrient accumulation. When these nutrients reach high concentration levels and the ground is no longer able to assimilate them, they are carried by rains into rivers and ground water that flows into lakes or sea. This causes dense growth of algal blooms and plant life such as the water hyacinths in the aquatic environment.

### **2.2 CONCENTRATED ANIMAL FEEDING OPERATIONS (CAFOs)**

The CAFOs normally discharge high scores of the nutrients that find way into rivers, streams, oceans and lakes where they accumulate in high concentrations thereby plaguing the water bodies by recurring cyanobacterial and algal blooms.

### **2.3 DIRECT SEWAGE DISCHARGE AND INDUSTRIAL WASTE INTO WATER BODIES**

In some parts of the world, especially the developing nations, sewage water is directly discharge into water bodies such as rivers, lakes and oceans. As a result, introduces high amounts of chemical nutrients thereby stimulating the dense growth of algal blooms and other aquatic plants which threatens survival of aquatic life in many ways. Some countries may also treat the sewage water but still discharge into water bodies after treatment as much as the water is treated, it can still cause the accumulation of excess nutrients, ultimately brings about Eutrophications.

### **2.4 AQUICULTURE**

Aquiculture is a technique of growing shellfish, fish and even aquatic plants (without soil) in water containing dissolved nutrients. As a highly embraced practice in the recent times, it also qualifies a top ranking contributor to Eutrophication. If aquiculture is not properly managed, the unconsumed food particles together with the fish excretion can significantly increase the levels of nitrogen and phosphorous in the water thereby resulting in dense growth of microscopic floating plants.

### III. EFFECTS OF EUTROPHICATION

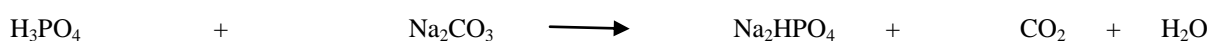
- Abundance of particulate substances (phytoplankton, zooplankton, bacteria, fungi and debris ) that determine the turbidity and colouration of the water.
- Abundance of inorganic chemicals such as Ammonia, Nitrites, Hydrogen Sulphide, etc. that in the drinking water treatment plants induce the formation of harmful substances such as Nitrosamines suspected of mutagenicity.
- Abundance of organic substances that give the water disagreeable odours or tastes, barely masked by chlorination in the case of drinking water. These substances, moreover, form complex chemical compounds that prevent normal purification processes and are deposited on the walls of the water purifier inlet tubes, accelerating corrosion and limiting the flow rate.
- Disappearance or significant reduction of quality fish with very negative effects on fishing (instead of quality species such as trout undesirable ones such as carp become established).
- Possible affirmation of toxic algae with potential damage to the population and animal drinking the affected water.
- Prohibition of touristic use of the lake and bathing, due to both the foul odour on the shores caused by the presence of certain algae, as well as the turbidity and anything but clean and attractive appearance of the water; bathing is dangerous because certain algae cause skin irritation.
- Reduction of oxygen concentration, especially in deeper layers of the lake.

### IV. HOW TO CONTROL EUTROPHICATION

Eutrophication arises from the oversupply of nutrients, which leads to overgrowth of plants and algae. After such organisms die, the bacterial degradation of their biomass consumes the oxygen in the water, thereby creating the state of hypoxia. According to Ullman's encyclopedia, "the primary limiting factor for Eutrophication is Phosphate." Therefore, by limiting the amount of phosphate the Eutrophication can be controlled. This can be done with the help of Sodium Carbonate and any Nickel Salt. While experiment we used Nickel Sulphate.

When Sodium Carbonate is added to the lake water, due to the presence of phosphate ions Sodium Hydrogen Phosphate is formed along with Carbon Dioxide and Water.

The reaction is given as,



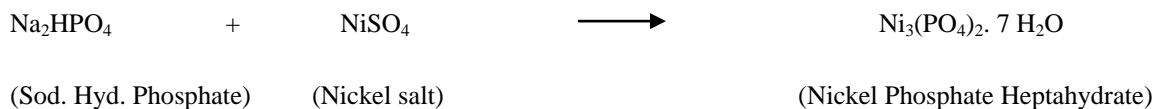
(Phosphate ions from sample) (Sodium Carbonate) (Sodium Hydrogen Phosphate) (Carbon Dioxide) (Water)

The Carbon Dioxide formed is released in air.



Now, when the Nickel Salt (Nickel Sulphate used while experiment) is added to the solution formed after above reaction a complex compound i.e. Nickel Phosphate Heptahydrate is formed.

The reaction is given as,



## V. PROPERTIES OF NICKEL PHOSPHATE HEPTAHYDRATE

- It is a light apple green precipitate.
- It is insoluble in water.
- It is heavier than water.
- It dissolves in acids and ammonia solution.

## VI. CONCLUSION

When lake water is treated with  $\text{Na}_2\text{CO}_3$ ,  $\text{Na}_2\text{HPO}_4$  is formed. When it is treated with  $\text{NiSO}_4$ ,  $\text{Ni}_3(\text{PO}_4)_2 \cdot 7 \text{H}_2\text{O}$  is precipitated. This precipitate is denser than water and also it is insoluble in water. Therefore, the precipitate is collected at the bottom of the lake. In this way the phosphate level in the lakes and ponds can be controlled with the process provided under the heading IV. The complex compound Nickel Phosphate Heptahydrate is dangerous to aquatic life only if its concentration is more than 10%. Therefore, if it is removed as soon as it is formed with physical methods then it does not harm the aquatic life. As it is a precipitate it is easy to remove it.

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