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Quality of Water

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ABSTRACT

Water is the prime key to life on planet earth. Hydrogen and oxygen combine in a 2:1 ratio to form the compound called water (H2O). Gaseous oxygen gets dissolved in water and this supports all aquatic aerobic organisms to survive in water. Oxygen dissolved in water is termed as 'Dissolved Oxygen' (DO). Levels of DO vary seasonally and daily. They vary with water temperature, altitude and extent of pollution. Most of the pollution of water is caused by domestic and industrial effluents. Toxic heavy metals like lead, copper, arsenic, cadmium contaminate water resources; enter food chain, bio-accumulate, effect metabolism, various organs, organ system and human health. Organic wastes from house hold and agricultural fields also contaminate water resources. The present condition of rivers and other water bodies of India are serious and it is urgent and essential to determine the level of pollution in order to control and prevent increasing contamination of water resources.

KEYWORDS

Introduction

Increasing water pollution from various sources is an alarming threat to the aquatic environment. Aquatic organisms including fishes are at risk due this increasing water pollution [1]. Sewage effluents, agricultural land run offs contaminated with fertilizers and pesticides, industrial effluents are polluting the aquatic environment of the earth. Most of the metals those contaminate water bodies are added from industrial effluents. Some such toxic heavy metals are lead (Pb), Arsenic (As), Cadmium (Cd), Mercury (Hg) etc. Those heavy metals enter the food chain and bio-accumulate in fishes and other aquatic organisms. Studies reveal that the concentrations of pollutants go on increasing and gradually reach to such an extent that the health and physiology of the aquatic organisms get adversely affected[2].

In order to control and prevent increasing water pollution we need to adapt some easy and fast method for determination of the level of pollution. **Biochemical oxygen demand** or **B.O.D** is one such easy and handy technique for measuring pollution of water. On the other hand, Nitrates and phosphates being plant nutrients supports growth of phytoplankton and algae and their contamination in water can contribute to high BOD levels[3]. **Chemical oxygen demand or C.O.D.** is also used to determine the extent of organic contamination of water[3]. Both B.O.D and C.O.D. is used for determining organic pollution of water. Concentration of inorganic pollutants in water is directly determined by measuring the concentration of various inorganic metal ions in water. Other pollutants those are considered for studying pollution level of water are the temperature, pH, salinity, hardness, turbidity, biochemical oxygen demand (BOD), ammonia, phosphate, chloride level, sulphate, nitrate, cadmium, chromium, copper, iron, lead, manganese zinc, colour of water etc[4].

Determining Organic Pollutants

Biochemical oxygen demand or **B.O.D/ BOD** is used to measure the organic pollutants in water. Biochemical oxygen demand is the measure of the amount of dissolved oxygen needed by aerobic bio organisms in a water body to break down organic material present in a given water sample at certain temperature over a specific period of time. B.O.D. or Biochemical oxygen demand may also be defined as a measure of the amount of oxygen used by microorganisms (e.g., aerobic bacteria) in the oxidation of organic matter[4].

The BOD value is commonly expressed in milligrams of oxygen consumed per liter of sample during 5 days of incubation at 20 °C. Organic matters i.e., plant decay, pet wastes, lawn fertilizers, grass clippings, paper etc. run into nearby water bodies. These are oxidized and oxygen is used in the process. Oxygen is utilized for oxidation processes as a result of which the available oxygen for the aquatic lives decreases. Most of the bacteria in water are aerobic .Hence they use oxygen for carrying out their metabolic processes[4].

Application of Biochemical Oxygen Demand

In other words, B.O.D. also refers to the chemical procedure for determining the amount of dissolved oxygen needed by aerobic biological organisms. Under normal conditions dissolved oxygen remain in very low concentration in water. Normal levels of oxygen in aquatic systems are always depleted by aerobic bacterial activity. If more oxygen is consumed than is produced, dissolved oxygen levels decline and some sensitive animals may move away, weaken, or die. If dissolved oxygen concentrations drop below 5 parts per million (ppm), it's difficult for fish etc., to live very long[3, 4]. All clean water species such as trout or salmon will die well above this level. And low oxygen requiring fishes such as catfish and carp will be at risk below 5 ppm. BOD is often used for estimating the level of organic pollution of water. BOD can also be used for estimating the effectiveness of wastewater treatment plants. It is listed as a conventional pollutant in the U.S. The *Royal Commission on River Pollution*, which was established in 1865 and the formation of the *Royal Commission on Sewage Disposal* in 1898 selected BOD as the definitive test for organic pollution of rivers since 1908[5]. Generally, when there is some sort of "pollution" in the system, BOD increases and dissolved oxygen (DO) decreases. This can occur in the form of organic pollution for sources such as domestic sewage, septic tank leakage, and fertilizer runoff, or could be in the form of inorganic pollution from domestic or industrial sources. Natural sources of organic compounds can also come into aquatic systems by means of floods, landslides, and erosion. BOD is similar in function to chemical oxygen demand (COD). Both measure the amount of organic compounds in water. COD is less specific, since it measures everything that can be chemically oxidized, rather than just levels of biologically active organic matter.

Determining Inorganic Pollutants

Studies show that human population is extensively exposed to toxic heavy metal like mercury through food, fish being the richest source[6]. Excessive and regular consumption of fish

containing methyl mercury may lead to bioaccumulation of the toxic heavy metal, mercury in an individual which in turn can lead to mercury induced oxidative stress mediated adverse health effects and other toxic effects. Neuro-pathological effect being the most reported one. Children, aged people and pregnant women have been reported to be mostly effected by such heavy metal contamination of water and food sources. It is thus advised that pregnant women should avoid inclusion of certain fishes i.e., swordfish, shark, tuna etc., collected from polluted water, in their diet[5]. Inorganic contamination and their concentration can be easily determined by treating the collected water sample with hydrochloric acid followed by atomic absorption spectrophotometry[7]. Atomic absorption spectrophotometry is one of the most widely used techniques for determination of concentration of various metal ions in different samples including biological samples[8].

Conclusion

Water quality of various water bodies which are used extensively by human beings for domestic purpose or irrigation or for pisciculture should be regularly monitored and adequate measures should be enacted by law for prevention of pollution of those water resources. The quality of water , concentration of various pollutants and concentration of dissolves oxygen should be analysed and considered before recommending whether the particular water resource is suitable for pisciculture. Besides , measures should be taken for cleansing the already polluted water bodies. Manufacturing industries should be compelled by law to treat their effluents before discharging into water bodies.

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