Innovation and Integrative Research Center Journal
ISSN: 2584-1491 | www.iircj.org
Volume-2 | Issue-6 | June-2024 | Page 91-97

Bacteriological Analysis of Pond Water and Water Pollution

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Abstract

Water is necessary for life, but many people lack access to safe and clean drinking water, and many more suffer from bacterial diseases that can be contracted via water. The three most significant bacterial diseases that are spread by water, cholera, typhoid fever, and bacillary dysentery, are broadly described in this review with an emphasis on the biology and ecology of the causative agents as well as the traits of the diseases and their environmental life cycles. There is also a brief discussion of the significance of emerging pathogens and pathogenic Escherichia coli strains in diseases contracted through drinking water. Fecal indicator bacteria are the fundamental idea behind microbiological water analysis. (Wanja D.W., 2019) The most significant fecal indicator bacteria are presented and explored, with an emphasis on the benefits and constraints of employing them as markers. The primary bacteria found in human and animal feces are also examined, with particular attention paid to how they behave in their hosts and the environment. There is also a brief indication of significant sources of bacterial fecal pollution of environmental waterways. Which fecal pollution indicators should be utilized in the present drinking water microbiological analysis is covered in the last item. It was determined that one of the main issues of the twenty-first century is providing everyone with safe drinking water, and that microbiological control of drinking water ought to be the standard worldwide.

(OBIRE, 2017)

Significant bacterial pollution was found, potentially endangering ecosystems and human health. The statistics emphasize that in order to reduce pollution sources and protect water quality, routine monitoring and efficient management techniques are required. (Douglas, 2015)

Introduction

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Pond water, a fundamental component of aquatic ecosystems, serves as a vital resource for various human activities, including agriculture, recreation, and drinking water supply. However, the quality of pond water is often threatened by anthropogenic activities, leading to pollution and degradation of these ecosystems. Among the numerous pollutants impacting pond water quality, bacteria play a significant role, acting as indicators of contamination and potential risks to human and environmental health. (Bhavimani)

Comprehending the bacteriological makeup of pond water and its correlation with water contamination is imperative for efficient administration and preservation endeavors. By revealing the existence, diversity, and abundance of bacterial species, bacterial analysis offers important clues into the state of pond ecosystem health. In addition, it makes it easier to locate pollution sources, evaluate the quality of water, and create mitigation plans that protect the environment and public health. (Lira, 2013) Fish are one of the edible food sources that humans naturally eat while they are submerged in water. They are rich in nutrients, including protein, minerals, fat, and oil. (Ghimire, 2019)

Significance of Bacteriological Analysis

1. **Indicator of water quality**:
   Because they can detect the presence of pollutants, nutrients, and other impurities, bacteria are sensitive indicators of the quality of water. Keeping an eye on the bacterial communities in pond water can reveal important information about the ecosystem's general health and ecological integrity. Variations in the makeup and quantity of bacteria can indicate changes in the surrounding environment and possible threats to the health of people and ecosystem. (Vasile, 2017)

2. **Assessment of pollution sources**:
   In pond ecosystems, bacterial analysis aids in locating pollution sources. Particular sources of contamination, such as animal or human feces, agricultural runoff, or industrial discharges, can be linked to specific species or groups of bacteria. Management authorities can carry out focused interventions to reduce pollution and restore water quality by tracking the source of bacterial contaminants.(Singh, 2018)
3. **Public health Protection**:

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The public's health is seriously at danger from pond water tainted with harmful bacteria, especially in areas where residents depend on these bodies of water for enjoyment, swimming, or drinking. In order to prevent waterborne illnesses and outbreaks, bacterial analysis makes it possible to identify and track harmful bacteria including Salmonella, Escherichia coli, and Vibrio species. This information can be used to inform public health initiatives and early warning systems.(Jenkins, 2009)

One of the special qualities of bacteria is their ubiquity in all human settlements worldwide. They thrive in soil, acidic hot springs, water, radioactive waste, and living things like plants and animals. (Rozier, 2015)

The different water strata affect the distribution of both total aquatic bacteria and heterotrophic bacteria. (Amin, Quantitaive assessent of fecal contaAmin, N., contaminination, 2019)

The aerobic bacteria multiply quickly in the 50 cm water sources, which are close to the water's surface and contain a lot of dissolved oxygen and organic water. This leads to a high concentration of heterotrophic bacteria in this layer. (Kayal, 2023) The least amount of bacteria of the three in this water zone is found in the middle 100 cm layer, where the majority of filter-feeding fish obtain their food. (Food, 1260-1265)

Because food scraps and fish dung are present in the sediment, there are more bacteria in the silt layer.

On the other hand, there is little dissolved oxygen. (Bhatnagar, 2023)

The basis for bacterial surveillance is the identification of coliform bacteria and Escherichia coli, a particular marker of human faecal contamination, which provide information about the hygienic state of the water supply. In water analysis, the term "indicator organisms" refers to microorganisms whose presence in the water indicates that the water is contaminated with human or other faecal material. (Emparanza- Knorr, 1995) Creatures with warm blood,since of this type of pollution, there is a chance that different pathogenic organisms, which occasionally appear in the intestinal tract, will enter the water. This type of water is referred to as non-potable water since it is not safe to drink. (Buras, 1987)

A class of intestinal bacteria known as coliform bacteria is used as an indication to assess whether treated water is safe for human consumption. Coliforms are unlikely to be harmful. On the other hand, the existence of coliforms in drinking water suggests the presence of pathogenic microbes. (Topalcengiz, 2017)

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The Coliform consists of the Salmonella, Klebsiella , Escherichia coli, and Enterobacter aerogenes are examples of members of the Enterobacteriaceae family. In order to assess the water quality, this study will examine the viable coliforms and other water-borne bacterial pathogens in three community ponds that are used for drinking, bathing, laundry, and other activities involving people and animals. (Ajayi, 2014)

Even while water is essential to life and is found all across the planet, its ancient natural purity appears to be fading. (Nursyirwani, 2017) The amount of fresh water that is readily available is a very small portion of the world's overall water supply, despite the fact that water is abundant. Rivers are the most vital bodies of water supply. Regrettably, sewage, industrial waste, and a multitude of human activities are polluting rivers across the world, affecting their microbiological quality and rendering them unfit for human consumption. (Krupa, 2020)

1. Impact on water pollution-

1. Human Health:Diseases: Water contaminated with contaminants can lead to skin Infections Gastrointestinal disorders , and other health problems. (Apun, 1999)
2. Ecosystem Health: Fish and aquatic plant populations may be impacted by high bacterial counts. (Gogoi, 2013)

2. Importance of Bacteriological Analysis-

1. Indicator of water Quality:

   A measure of the quality of the water is the presence of pathogens, such as E.Coli, Enterococcus, and Clostridium perfringens, which are signs of fecal pollution. (Topalcengiz Z. , 2017)

2. Contamination Origins:

   Agricultural Runoff: Fertilizers and pesticides have the potential to promote Bacterial development.

   Animal excrement can be a major source of germs in wildlife and livestock. (Dirisu, 2017)

4. Implications-

Public health professionals, environmental regulators, and conservationists will be informed about the current condition of pond water quality by the findings of this bacteriological analysis. (Devraja, 2002)This data is essential for creating strategies for safe and sustainable

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use of pond water resources, as well as for controlling pollution and implementing public health initiatives. (De Donno, 2002)

5. Methodology Overview-

Water samples from different locations in the pond are systematically collected for the study, and the samples are then analysed in the lab using molecular and culturing techniques. While PCR (Polymerase Chain Reaction) provides precise identification and quantification of particular bacterial DNA, culturing on selective media will aid in the isolation and counting of bacterial colonies. (Knappett, 2012)

Conclusion

In conclusion, bacteriological analysis of pond water is a critical tool for evaluating water quality, identifying potential contamination sources, and assessing ecosystem health. (tyagi, 2008) By examining bacterial communities through culture-based and molecular techniques, this analysis provides valuable insights into the presence of pathogenic organisms, overall microbial diversity, and pollution levels. (Laibu, 2018)Interpretation of results in the context of regulatory standards enables informed decision-making to protect both human health and the environment. Regular monitoring and analysis of pond water bacteriology are essential for maintaining water quality, preserving aquatic habitats, and safeguarding public health.

Acknowledgement

I express my sincere gratitude to all the people who have helped and supported me during my project work. Without them it would be impossible to carry out this project alone. I am thankful to my guide, Dr. Sadhna Jaiswal for her valuable guidance, encouragement and patience.

I would like to thank Dr. Priya Sutaoney (Head of Department) and DR. Priyambada Singh (Assistant Professor) who contributed directly and indirectly in shaping and achieving the desired outcome.

I thank all my colleagues and my family members, without whose emotional support nothing would have been possible.

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