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Water Pollution in India – An Overview

Dr. Swagatika Panda

Assistant Professor, Department of Humanities and Social Sciences,

Siksha 'O' Anusandhan Deemed to be University, Bhubaneswar, Odisha

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ABSTRACT

India ranks among the topmost polluting nations globally. The issue of water contamination constitutes an enormous concern in that area. A significant portion - roughly eighty percent - of India's freshwater supply consists largely of contaminated water due to frequent discharge of untreated human waste through streams and ponds. Various sources of environmental contamination include agricultural pesticides and poorly regulated industrial operations. A significant portion of river and lake waters becomes contaminated due to industrial discharges, unregulated wastewater, and debris. The contamination of water renders it unfit for consumption; consequently, individuals must rely on illicit and expensive alternatives. A significant number of Indian kids suffer from stomach-aches due to contaminated drinking water. In India, significant contamination of both rivers and underground waters by toxic chemicals underscores its severe environmental problem. Across numerous regions, these aquatic resources have become unsafe for human consumption and various commercial activities such as agriculture and manufacturing. It indicates that degraded water purity exacerbates scarcity issues through diminished supplies intended for human consumption as well as ecological needs

I. Introduction:

Water pollution happens when harmful substances like sewage, metals, farm waste, factory waste, and oil from tankers get into water. The biggest causes of water pollution are nitrates from fertilizers, dirty water

from homes, and cleaning products. When people wash themselves or clothes near lakes, ponds, or rivers, they put nutrients like nitrogen and phosphorus into the water. This causes a lot of algae to grow on the surface. The algae block sunlight and air, which reduces oxygen in the water. This harms the animals and plants living in the water and can also hurt people's health.

Pollution of water resources constitutes an urgent issue within India's environmental challenges. A substantial portion, approximately seventy percent, of the nation's surface waters as well as growing quantities of underground aquifers have been contaminated by various hazardous pollutants. In many cases, this water is no longer safe for people to drink or use for other purposes like farming and industry. This shows that poor water quality leads to less water being available for people and the environment. In 1995, the CPCB discovered severely contaminated sections within 18 significant Indian rivers. A substantial portion of contaminated regions lay adjacent to bustling metropolises. It indicates that urban industries and everyday routines contribute significantly greater amounts of water contamination compared to what is implied by economic contributions alone.

II. Objectives:

The main objectives of the study are designed as follows:

1. To understand what water pollution is and how it happens in India.

2. To look into the reasons behind water pollution and the problems it causes.

3. To suggest ways to stop or reduce water pollution.

III. Methodology:

This study is an explanatory type of research. It uses information from books, journals, articles, magazines, newspapers, statistical reports, published and unpublished documents, and mostly from the internet. Considering the study's objectives, a descriptive type of research is adopted.

IV. Review of Literature:

Trivedy, (2000), provided a detailed account of water pollution and its impact on the soil environment in "Pollution and Bio monitoring of Indian Rivers". Based on this, many scientists have done extensive work on the ecology of polluted rivers. Earlier researchers have highlighted the ecological importance of heavy metals as stress factors.

Ghatak & Konar (1992) conducted studies on the effect of different industrial effluents on the Damodar River Ecosystem in West Bengal. The physical, chemical, and biological features of the Damodar River water (W.B, India) were found to change gradually because of the toxic effects of various industrial effluents. The levels of dissolved oxygen, alkalinity, phosphate, and hardness of the river water were significantly reduced, while the concentration of carbon dioxide was found to increase significantly ($P<0.05$) at different sampling points. This also led to a significant decrease in plankton populations (both zooplankton and phytoplankton) and bottom-dwelling organisms.

Anand (2002) covered various aspects of algal taxonomy, physiology, and ecology, with a special focus on environmental issues like pollutants and their effects on phytoplankton. The biology of algae, along with their ability to take up and accumulate metals and their detoxification mechanisms, were discussed. The effects of heavy metals on the aquatic food chain, the restoration of eutrophic lakes, and biofouling and bio corrosion caused by algae and their controls were also explored. The hydrobiology of inshore waters of the Bay of Bengal and nutritional studies of dominant planktonic diatoms have added significantly to the understanding of phytoplankton ecology. Long-term hydro biological studies on the eutrophication of a lake at Ooty were also conducted. The role of diatoms in the bioaccumulation, bio-transference, and bio-magnification of heavy metals, as well as the location of metallothioneins as detoxification mechanisms in diatoms, was also reviewed.

Verma and Khan (2007) reported that rapid urbanization and increased human activities have worsened the water quality of the Arpa River in Bilaspur, Chhattisgarh. Most of the water characteristics of the River Gomati at Sultanpur (Uttar Pradesh) exceeded permissible limits due to sewage discharge, which poses a threat to both aquatic life and human beings. The river also constantly receives daily sewage, domestic, and industrial waste water from the city.

Kurihara (2007) noted that an increase in CO2 concentration leads to higher CO2 levels and lower pH in surface ocean water due to continuous gas exchange between air and seawater, which may have serious consequences for neritic marine organisms. Currently, many scientists are focusing on research related to meiofauna, covering topics such as using meiofauna as biological indicators, relationships between macrofauna, meiofauna, and bacteria, meiofaunal biology and physiology, and community ecology and systematic taxonomy.

V. Types of Water Pollution:

Mainly five types of Water Pollution can be identified:

1. **Surface Water Pollution:** Surface water pollution includes pollution of rivers, oceans. It is often caused by nutrients, pathogens, plastics and chemicals such as antibiotics, heavy metals and pesticides. These pollutants have different Environmental effects. Excess nutrients, for instance may result in harmful algal blooms and hypoxia both in rivers and in coastal seas. Surface Water pollution is almost entirely the result of human activities. Agriculture, mining, factory effluent, landfills, human/animal waste and localized pollution are just some of the most common sources of surface water pollution. The major sources of surface water pollution are: Sewage from household, Waste water from the industry, Nitrate and fertilizers from fields and pastures.
2. **Marine Pollution:** One common path of entry by contaminants to the sea are rivers. An example is directly discharging sewage and industrial waste into the ocean. Pollution such as this occurs particularly in developing nations.
3. **Groundwater Pollution:** Ground water is one of the important sources of water for irrigation purpose. Groundwater contamination occurs when man-made products such as gasoline, oil, road salts and chemicals get into the groundwater and cause it to become unsafe and unfit for human use. Interactions between groundwater and surface water are complex. By its very nature groundwater aquifers are susceptible to contamination from sources that may not directly affect surface water bodies. Analysis of groundwater contamination may focus on soil characteristics and site geology, hydrogeology, hydrology and the nature of the contaminants. Causes of groundwater pollution include-- sewage, fertilizers and pesticide, commercial and industrial leaks, hydraulic, fracturing, landfill leachate.
4. **Microbiological Pollution:** Microbiological water pollution is a natural kind of water pollution caused by microorganisms. Different types of microorganisms like bacteria, viruses, and protozoa live in water and can make fish, land animals, and humans sick. Serious diseases like cholera are caused by microorganisms that live in water. These diseases usually affect people in poorer countries because they don't have the tools to clean polluted water.
5. **Macroscopic Pollution:** Large objects that pollute water, such as trash or garbage (like paper, plastic, or food waste) that people throw on the ground, or things that are accidentally or on purpose dumped, are washed away by rain into storm drains and then into surface waters. These items can also include small plastic pellets called nurdles, which are commonly found in water.

VI. Sources of Water Pollution:

1. **Point Source Pollution:** A point-source pollutant emanates exclusively from a particular location. To illustrate, consider how industrial facilities discharge pollutants directly into aquatic

environments. This term denotes contaminants entering a stream via conduits such as pipes or ditches. Instances of direct pollutant release encompass outflows from wastewater facilities, industrial operations, or urban runoff systems. The primary causes of water contamination include these factors.

2. **Non-Point Source Pollution:** Sources of non-point source pollution originate widely across various locations. Water contaminated by rainfall runoff across different regions is classified as nonpoint-source pollution. Pollution in question arises from numerous minor contributors which accumulate gradually. A case study involves nitrates found in soil amendments seeping into groundwater.

VII. Causes of Water Pollution:

1. **Agriculture and Nutrient Pollution:** Farming contributes significantly to global water contamination due primarily to nutrient runoff. During rainfall events, agricultural runoff containing fertilizers, pesticides, and manure leaches into nearby streams and rivers, introducing excess nutrients along with potentially dangerous pathogens such as bacteria and viruses. Excessive nutrient inputs such as excessive amounts of nitrogen and phosphorus found both in aquatic environments like rivers and lakes, but also airborne sources affecting atmospheric conditions worldwide, pose significant threats to global water sustainability. This phenomenon may lead to harmful algae growths, posing risks to both human health and marine life. Certain pollutants such as untreated effluents, agricultural chemicals like nitrogen and phosphorus, and domestic waste contain elevated nutrient concentrations. Should they enter aquatic environments, these organisms might lead to excessive growth of algae and plants, rendering the waters unfit for consumption and obstructing filtration systems. Excessive growth of aquatic plants may deplete the water's dissolved oxygen levels, leading to anoxic conditions where organisms cannot survive.
2. **Sewage and Wastewater:** Waste water refers to treated effluent derived from domestic use. These elements originate in plumbing fixtures like faucets and bathtubs; industrial operations such as manufacturing plants and agricultural sites also contribute significantly. In this period, we encounter surface water discharge, where rainfall transports substances such as de-icing agents on roads, automotive fluids, detergents, pollutants, and debris onto streams and lakes via paved areas. Waste water refers to treated sewage discharged into bodies of water for reuse purposes. These elements originate in plumbing fixtures like faucets, bathtubs, and sewage systems; they also stem from commercial establishments such as stores, manufacturing facilities, and agricultural operations. In this period, we encounter surface run-off caused by rainfall carrying substances like

de-icing agents on roads, motor oils, greases, industrial pollutants, and litter onto streams and lakes.

3. **Surface Water Pollution:** Water pollution occurring in bodies of fresh liquid lying directly upon land surfaces includes streams, ponds, bays, and seas. Substances hazardous when they come into contact with this body of water and interact within its composition lead to contamination at the water's surface level. To illustrate, sectors contributing to such environmental degradation include those responsible for releasing petroleum leaks and hazardous chemicals directly into aquatic ecosystems.
4. **Oxygen Depletion:** Depleting oxygen levels in water habitats affect aquatic life by reducing populations of microscopic organisms such as bacteria and fungi, including those capable of respiration under either anoxic conditions or requiring atmospheric air for survival. When there's an excessive amount of organic matter decomposable by nature present in aquatic environments, this leads to increased microbial populations. These organisms consume an abundance of oxygen. When the concentration of oxygen falls below an acceptable threshold, it leads to the demise of aerobic life forms while fostering growth in anaerobic species, potentially releasing toxic substances such as ammonia and hydrogen sulphide.
5. **Groundwater Pollution**: Water contamination occurs when agricultural substances like fertilizers and insecticides leach through the ground after being applied onto fields by humans; subsequently, these pollutants infiltrate groundwater systems beneath our feet. It may contaminate groundwater sources, leading to environmental degradation. Therefore, it's crucial to purify water obtained through well drilling or whole excavation prior to its use.
6. **Oil Pollution from Oil Industries:** Spills of crude occur daily due to industrial practices involving oil extraction and transportation. Pollution incidents involving oil pose significant threats to aquatic ecosystems by harming species such as whales, ducks, and seals. Because of its inability to mix with water, oil remains at the top layer where it obstructs aquatic life by blocking oxygen intake for marine organisms. Additionally, this substance adheres closely to bird's downy feathers, thereby impeding their ability to soar through the air easily. A significant number of creatures perish due to it.

VIII. Impact of Water Pollution:

1. **Effect of Organic Pollution on Water Quality:** All organic materials can be broken down or decomposed by microorganisms and other living things (biodegradation). Some organic and inorganic substances need oxygen for their breakdown, which is called biochemical oxygen

demand (BOD). Oxygen is necessary for almost all living things in water. If there is not enough oxygen, it can harm aquatic life. Common sources of organic pollution include sewage from homes and animals, and industrial waste from food processing, paper mills, tanneries, distilleries, sugar plants, and other agriculture-based industries.

2. **Effect of Nutrients on Water Quality:** Water supports life because it contains nutrients. The main focus is on fertilizers like nitrates and phosphates. These are important for plant growth, but too much of them can cause too much plant growth, which can harm the environment in a process called eutrophication. This can happen in small forms like algae or in bigger forms like aquatic plants. Nitrates and phosphates come from sewage, runoff from farms, and runoff from areas without proper sewage systems.
3. **Effect of High Dissolved Solids (TDS) in Water Quality:** Water is a great solvent and can dissolve many substances it comes into contact with. The amount of dissolved solids is important in deciding if water is suitable for drinking, farming, or industry. In general, water with total dissolved solids less than 500 mg per litre is best for drinking.

IX. Measures taken to reduce Water Pollution:

In latest years, there was developing attention and challenge about water pollutants round the arena. New techniques have been evolved to manipulate water sources in a sustainable way. Human beings agree that having an excellent policy framework is critical for coping with water sources well. In India, Parliament exceeded the Water Act of 1974 (Amended in 1988). This turned into the primary regulation in India to forestall the release of untreated domestic and industrial waste into rivers and lakes. This law helped create the valuable pollutants manage Board (CPCB) and state pollutants.

1. **Sewage Treatment:** Sewage must be treated before it is released into water. This limits the amount of nutrients in water. Household wastewater should be treated properly to be safe for the environment. It is important to have an effective sewage treatment system to stop polluted water from mixing with the environment. To stop water pollution, human and animal waste should not the mix with water sources. Building pit toilets and proper sewage treatment can help to solve this issue. Encouraging the growth of bacteria can help to reduce the nutrients in water and control the growth of algae.
2. **Prevent River Pollution:** River water cannot be cleaned easily through natural processes. A lot of waste is poured into rivers, making the water polluted. This can cause illness for people using

the water. So, it is important to take all steps to prevent river water from getting polluted. People should not throw waste into rivers.

3. **Treat Waste before Releasing:** Factories should treat their waste before releasing it. Toxic materials must be treated with chemicals and made into harmless substances. If possible, factories should reuse the treated water.
4. **Strict Adherence to Water Laws:** Everyone must follow pollution laws. Everyone should understand that following water laws is in their own interest.
5. **Treat Drainage Water**: In cities, a lot of water flows through drainage systems every day. This water should be properly treated before it goes into reservoirs. Harmful pollutants should be removed before water reaches reservoirs. If untreated water enters reservoirs, it will pollute them.
6. **Treatment Plants:** Large cities and towns usually have treatment plants that process wastewater. These plants remove solids and use chemical treatments to remove unwanted dissolved chemicals. The treated water is either released into reservoirs or used in homes. Sometimes, the treated water is used for farming if it is near the treatment plants.
7. **Keep the Pond Water Clean and Safe:** Washing and bathing cattle in ponds used by people should not be allowed. People washing clothes or bathing animals make pond water dirty and unsafe for humans. Continued misuse of these ponds can lead to serious problems.
8. **Regular Cleaning:** Ponds, lakes, and wells used for drinking water should be cleaned and treated regularly. This is an important step that should not be ignored. A regular testing system for pond and lake water can help ensure the water is safe.
9. **Don't Pour Insecticides in Drain**s: Do not pour household insecticides, medicines, or other chemicals down the sink, drain, or toilet. People often throw old medicines and waste into toilets. This should be avoided because mixing these chemicals can create harmful substances.
10. **Practice Good Hygiene:** Maintain good personal hygiene and avoid polluting drinking water. Drinking water should be stored in a clean, covered container. Hands should not be placed into drinking water containers. Cleaning the water storage tanks regularly is necessary. Drinking water should be purified before use. If there is no good purifier, it is better to drink boiled water. This helps prevent waterborne diseases.
11. **Improve Sanitation:** The sanitation system needs to be better. The benefits of cleanliness on health should be understood. People should avoid contact with harmful materials. After using the toilet, always flush and wash hands with soap and water.

12. **Raise Public Awareness:** People need to know how water pollution affects them. Voluntary groups should go to homes to teach people about the environment. They can do street plays to spread awareness and set up environmental education centres. Students can help by teaching health education to stop water pollution.

X. Conclusion and Suggestions:

Water pollution is a major problem that affects people around the world. The negative effects of polluted water are everywhere. The main causes are waste from homes and farms, growing population, too much use of pesticides and fertilizers, and expanding cities. Polluted water causes diseases like bacterial, viral, and parasitic infections, which hurt human health. To fix this, we need a good system to remove waste and treat it before it goes into rivers. Educational programs should start to control water pollution. Everyone can take action to reduce the water pollution. For example, using eco-friendly cleaning products, using fewer pesticides, and not pouring harmful chemicals like paint, solvents, oil, or antifreeze into drains or on the ground. The best way to get clean water is for each person to take responsibility and properly throw away all kinds of waste. Although good wastewater treatment can help clean up the water environment, combining strong environmental policies with ongoing education about the dangers of water pollution will make a big difference in protecting water. Lastly, we should follow the four R's of resource use—Refuse, Reduce, Recycle, and Reuse—to make a real impact in fighting water pollution.

References:

Anil .k Dwivedi,"Researches in Water Pollution – A Review", ISSN- (2349 – 4077) vol.4, Issue – 1, Jan 2017.

Central Board for the Prevention and Control of Water Pollution. 1979. Waste Water Collection Treatment and Disposal in Class I Cities.

G. Allen Burton, Jr., Robert Pitt (2001). Storm water Effects Handbook: A Toolbox for Watershed Managers, Scientists, and Engineers. New York: CRC/Lewis Publishers. ISBN 0- 87371-924-7.Chapter 2.

Garg Mukesh, "water pollution in India causes and remedies", ISSN: 2249-5894, vol.2, issue 6, 2012 Royal Edwards Williams et al., "water pollution in India – an overview", ISSN: 2320 – 4168, vol.6, issue 5, February 2018.

H. Peavy, D. Rowe, and G. Tchobanoglous, “Environmental Engineering,” 1986. M. Ahmed and M. Rahman (2000) “Water Supply and Sanitation”.

N. Sarubala, N. Nagarajan, S. Sivaprakasam and K. Karthikeyan (2020), Water Pollution in India: Causes, Effects and Remedies – A Case Study, Vol 13, Pp-302-305.

Owa, F. D. (2013). Water pollution: Sources, effects, control and management. Mediterranean Journal of Social Sciences, 4(8), 65–68.

P. H. McGauhey, “Engineering Management of Water Quality,” 1968.

Subodh Kumar, Hari Mohan Meena and Kavita Verma, July, 2014, “Water Pollution in India: Its Impact on the Human Health: Causes and Remedies” pp. 275-279.

Vanapalli, K. R., Dubey, B. K., Sarmah, A. K., & Bhattacharya, J. (2021). Assessment of micro plastic pollution in the aquatic ecosystems – An Indian perspective. Case Studies in Chemical and Environmental Engineering, 3(100071), pp. 1–7.

World Health Organization, “Guidelines for Drinking- Water Quality, Volume 1: Recommendations,” 2nd Edition, Geneva, 1993.