

Understanding Water Pollution and its Solutions

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Abstract

Water contamination affects all life forms that depend on it, directly or indirectly, it can have long-lasting effects. Human activities like industrial and domestic sewage, mining effluents, and urbanization are major causes of water pollution. Ammonia from food processing waste. Heavy metals from motor vehicles and acid mine drainage. Nitrates and phosphates, from sewage and agriculture silt in runoff from construction sites or sewage, logging, slash and burn practices or land clearing sites. Water pollution can harm humans, animals, and ecosystems. Unsafe water kills more people than war and other violence. There are many ways to control and clean water, including membrane separation, biological precipitation, absorption, and photo-catalysis. New technologies like metal-organic frameworks and biochar-based sorbents are being used to treat water pollution. Freshwater is a valuable resource that is difficult and expensive to restore once contaminated. Less than 1% of the Earth's freshwater is accessible to humans. Groundwater pollutants like lead, uranium, fluoride, and nitrates can cause cancer. 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. Materials from the lands surface can move through the soil and end up in the groundwater.

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Introduction

Water is an essential natural resource on Earth & has been available for an extended period. The water that we consume has been accessible in various forms since the dinosaur era. Over 2/3 of the earth's surface is covered in water. Lakes, rivers, streams, & oceans hold slightly more than 1 octillion litres of water.

Though that is a substantial volume of water, less than 0.3 percent of it is suitable for consumption by humans. As industrialization as well as commercialization have advanced, that percentage has been declining. Water pollution has also resulted from outdated and ineffective practices, a lack of awareness, and a host of other factors.

What is Water Pollution?

The term "water pollution" emphasizes the contaminating effects of industrial and agricultural waste on groundwater, aquifers, lakes, rivers, and the ocean.

Water contamination affects all life forms that depend on it, directly or indirectly, it can have long-lasting effects.

Objectives of Water Pollution

- The main purpose of monitoring environmental water pollution is to continuously monitor the pollution of water areas distressing human health as well as the living atmosphere.
- The Objective of Water (Prevention and Control of Pollution) Act 1974 is to facilitate the prevention & control of water pollution and to maintain or restore the wholesomeness of water for the establishment, to carry out the purposes aforesaid of Boards for the prevention and control of water pollution, for conferring upon powers and functions related to matters connected therewith.

Sources of Water Pollution

Water pollution is primarily caused by various factors, with municipal sewage and industrial waste discharge being significant contributors. Several indirect sources are leading to water pollution, including pollutants that infiltrate the supply of water through groundwater systems or soil, & precipitation.

Soil and groundwater systems harbour remnants of human agricultural activities and improperly disposed industrial waste. Water pollution is further categorized into two types based on emissions:

- **Point Sources:** It pertains to the influx of pollutants into water through conventional channels, such as municipal and industrial discharge pipes.
- **Diffusion Sources:** The dispersion of pollutants from the ground into water is referred to as a diffusion source or nonpoint source, such as agricultural runoff, fertilizers, and pesticides.

Types of Water Pollutants

Water pollutants, which are responsible for water pollution, are categorized into three types

- **Biological Pollutants:** These encompass various pathogens, such as bacteria, viruses, protozoan, etc.
- **Chemical Pollutants:** It encompasses both organic & inorganic wastes, including organic biocides such as DDT and PCBs. Inorganic chemicals, including metals, phosphates, and nitrates.
- **Physical Pollutants:** These encompass hot water as well as oil spills.

Water Pollution: A Modern Epidemic

Numerous factors contribute to water pollution; however, some principal pollutants in the contemporary context include:

Industrial Waste

Numerous standard industrial activities emit substantial quantities of hazardous substances, including mercury & lead. These disseminate into living organisms once humans utilize these contaminated products on a regular basis. Additionally, it affects the aquatic ecosystem's biodiversity.

Sewage and Waste

Sewage waste is released into aquatic environments in significant quantities. In addition to creating pollution, this spreads dangerous pathogens that cause disease.

Mining

Contemporary mining is a principal contributor to significant lake & river pollution. It extracts deleterious chemicals that are found far below the surface of the Earth. The repercussions of water contact are hazardous for living organisms

Marine Dumping

Daily waste is disposed of in seas and oceans, resulting in the formation of garbage islands. Properly disposing of waste in a bin can significantly diminish water pollution levels by over fifty percent.

Agricultural Activities

The usage of pesticides, chemical fertilizers, as well as other runoff during irrigation, contaminates water bodies. These chemicals rapidly pollute aquatic ecosystems.

Radioactive Wastes

Radioactive materials are typically discarded into glaciers or water bodies after being used by nuclear power plants, as a source of energy, they are, where they will instantly combine with water as temperature increases.

Urbanization and Population Growth

Urban areas cannot supply enough water to meet the demands of their expanding populations. Overuse has resulted in water loss and contamination.

Water Pollution and its Effects

Pollutant types and concentrations regulate the effects of water pollution. Pollution levels are significantly influenced by the location of water bodies.

- Water bodies near urban areas are highly contaminated. This is the consequence of the disposal of waste and hazardous substances by industrial as well as commercial entities.
- Water pollution impacts aquatic life. It impacts the behaviour as well as metabolism, resulting in illness & eventually death. A chemical called dionin can cause cancer as well as uncontrolled cell growth and reproduction, along with other problems. This chemical is bio accumulated in fish, poultry, as well as meat. Such chemicals ascend the food chain prior to entering a person's body.
- The food chain could be greatly impacted by water pollution. It throws the food chain off balance. Toxic substances like lead and cadmium can cause disruption at higher levels once they enter the food chain through animals.
- Humans are impacted by pollution, and faecal contamination of water sources can spread illnesses like hepatitis. Unfit water & inadequate treatment of drinking water can cause cholera and other infectious disease outbreaks.
- Water pollution has the potential to drastically alter, restructure, and impact the ecosystem.

Pollution of the Ganges

Certain lakes, rivers, & groundwater sources have become unsuitable for use. The world's sixth most polluted river is the Ganga River in India. It is to be expected since the river receives waste from many nearby industries. Furthermore, pollution is made worse by religious practices like cremations & burials along the coast. This river poses substantial health risks by transmitting diseases such as typhoid & cholera, in addition to its ecological implications.

A survey indicates that by the end of 2026, approximately 4 billion individuals will experience water scarcity. Currently, approximately 1.2 billion individuals globally do not have access to potable, pure water & adequate sanitary facilities. In India, it is estimated that water-related issues claim the lives of about 1000 children every year. Despite being a vital source of water, groundwater is susceptible to contamination. Consequently, water pollution constitutes a significant social issue that requires immediate attention.

Control Measures of Water Pollution

Having comprehended the concept of water pollution, let us examine the measures implemented to mitigate it. Prevention & control of water pollution can be achieved through various methods. Initially, it is essential to plant additional trees alongside water bodies, as they inherently assist in assimilating and recycling pollutants. The following significant points are delineated below-

- The plant "Water Hyacinth" assimilates dissolved toxic substances such as mercury & cadmium from aquatic environments, thereby effectively eliminating contaminants from water.

- Careful disposal of waste is crucial, & improper discharge of waste into water bodies without proper waste treatment must be avoided.
- Industries must manage waste meticulously prior to the direct disposal of chemicals & other materials into aquatic environments. Sewage treatment facilities & industrial wastewater treatment plants are constructed for treating water, henceforth, enabling its safe discharge into river systems. It facilitates the recycling of water.
- Utilizing natural fertilizers and pesticides as alternatives to chemical products benefits both plants & water quality.
- Chemical processes including ion exchange, coagulation, & reverse osmosis will significantly diminish water pollution levels.
- Ultimately, it is advisable to minimize water utilization in our daily routine & recycle water in order to mitigate overall levels of pollution, whenever feasible.

Conclusion

Numerous causes & sources of water pollution are there, but merely a few are addressed herein. Rivers and streams exhibit a degree of resilience to certain pollutants; however, lakes, bays, ponds, slow-moving rivers, and oceans demonstrate limited resilience to water pollution.

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