

Topic- Water Pollution: Causes, Effects and Remedies

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Water Pollution

The water they say is life, and indeed they were right. With about 70% of the earth's cover being water, it undeniably becomes one of our greatest resources. As young students, we learned about the various ways to conserve water; coming to think of it, water is used in almost every important human chores and processes. It is an important element in both domestic as well as industrial purposes. However, a closer inspection of our water resources today, gives us a rude shock.

Infested with waste ranging from floating plastic bags to chemical waste, our water bodies have turned into a pool of poison. In simple words, the contamination of water bodies means water pollution. Thereby the abuse of lakes, ponds, oceans, rivers, reservoirs, etc is water pollution. Pollution of water occurs when substances that will modify the water in a negative fashion are discharged in it. This discharge of pollutants can be direct as well as indirect.



Water pollution is an appalling problem, powerful enough to lead the world on a path of destruction. Water is an easy solvent, enabling most pollutants to dissolve in it easily and contaminate it. The most basic effect of water pollution is directly suffered by the organisms and vegetation that survive in water, including amphibians. On a human level, several people die each day due to consumption of polluted and infected water.

Various Causes of Water Pollution

1. Industrial waste

Industries produce a huge amount of waste which contains toxic chemicals and pollutants which can cause air pollution and damage to us and our environment. They contain pollutants such as lead, mercury, sulfur, asbestos, nitrates, and many other harmful chemicals.

Many industries do not have a proper waste management system and drain the waste in the fresh water which goes into rivers, canals and later into the sea. The toxic chemicals have the capability to change the color of water, increase the number of minerals, also known as eutrophication, change the temperature of water and pose a serious hazard to water organisms.

2. Sewage and wastewater

The sewage and wastewater that is produced by each household is chemically treated and released into the sea with fresh water. The sewage water carries harmful bacteria and chemicals that can cause serious health problems. Pathogens are known as a common water pollutant; The sewers of cities house several pathogens and thereby diseases.

Microorganisms in water are known to be causes of some very deadly diseases and become the breeding grounds for other creatures that act as carriers. These carriers inflict these diseases via various forms of contact onto an individual. A very common example of this process would be Malaria.

3. Mining activities

Mining is the process of crushing the rock and extracting coal and other minerals from underground. These elements when extracted in the raw form contains harmful chemicals and can increase the number of toxic elements when mixed up with water which may result in health problems. Mining activities emit a large amount of metal waste and sulphides from the rocks which is harmful to the water.

4. Marine dumping

The garbage produced by each household in the form of paper, aluminum, rubber, glass, plastic, food is collected and deposited into the sea in some countries. These items take from 2 weeks to 200 years to decompose. When such items enter the sea, they not only cause water pollution but also harm animals in the sea.

5. Accidental oil leakage

Oil spill poses a huge concern as a large amount of oil enters into the sea and does not dissolve with water; thereby opens problem for local marine wildlife such as fish, birds and sea otters. For e.g.: a ship carrying a large quantity of oil may spill oil if met with an accident and can cause varying damage to species in the ocean depending on the quantity of oil spill, size of the ocean, the toxicity of pollutant.

6. The burning of fossil fuels

Fossil fuels like coal and oil when burnt produce a substantial amount of ash in the atmosphere. The particles which contain toxic chemicals when mixed with water vapor result in acid rain. Also, carbon dioxide is released from the burning of fossil fuels which result in global warming.

7. Chemical fertilizers and pesticides

Chemical fertilizers and pesticides are used by farmers to protect crops from insects and bacteria. They are useful for the plant's growth. However, when these chemicals are mixed up with water produce harmful for plants and animals. Also, when it rains, the chemicals mix up with rainwater and flow down into rivers and canals which pose serious damages for aquatic animals.

8. Leakage from sewer lines

A small leakage from the sewer lines can contaminate the underground water and make it unfit for the people to drink. Also, when not repaired on time, the leaking water can come on to the surface and become a breeding ground for insects and mosquitoes.

9. Global warming

An increase in earth's temperature due to the greenhouse effect results in global warming. It increases the water temperature and results in the death of aquatic animals and marine species which later results in water pollution.

10. Radioactive waste

Nuclear energy is produced using nuclear fission or fusion. The element that is used in the production of nuclear energy is Uranium which is a highly toxic chemical. The nuclear waste that is produced by radioactive material needs to be disposed of to prevent any nuclear accident. Nuclear waste can have serious environmental hazards if not disposed of properly. Few major accidents have already taken place in Russia and Japan.

11. Urban development

As the population has grown, so has the demand for housing, food, and cloth. As more cities and towns are developed, they have resulted in increasing use of fertilizers to produce more food, soil erosion due to deforestation, increase in construction activities, inadequate sewer collection, and treatment, landfills as more garbage is produced, increase in chemicals from industries to produce more materials.

12. Leakage from the landfills

Landfills are nothing but a huge pile of garbage that produces the awful smell and can be seen across the city. When it rains, the landfills may leak and the leaking landfills can pollute the underground water with a large variety of contaminants.

13. Animal waste

The waste produced by animals is washed away into the rivers when it rains. It gets mixed up with other harmful chemicals and causes various water-borne diseases like cholera, diarrhea, jaundice, dysentery and typhoid.

14. Underground storage leakage

Transportation of coal and other petroleum products through underground pipes is well known. Accidental leakage may happen anytime and may cause damage to the environment and result in soil erosion.

Effects of Water Pollution

Pollution of water affects both humans and aquatic life. Most water sources close to cities and urban centres are polluted by garbage and dumping of chemicals, legally or illegally. Below are some of the common as well as adverse effects of polluting water bodies.

1. Effects on Human Beings

Life is a cycle, and humanity's irresponsible behaviour often comes back to haunt it. Adding contaminants to water bodies has affected the human family in several ways. According to a 2017 WHO report, 2.1 billion people do not have access to safe water. In 2019, it stated that 785 million people lack access to essential drinking water.

One of the main effects of this is diseases. World Health Organisation notes that there are about 120,000 cholera-related deaths annually. Also, the Fukushima tragedy, for example, increased the prevalence of thyroid cancer in exposed infants by 70%.

2. Death of Aquatic Life

Animals and plants that depend on water for life are the most affected by polluted water. Statistics from the Centre for Biological Diversity on the effects of the Deep Horizon spill provides a useful glimpse of the impact of pollution on aquatic life.

3. Food Chain Disruption

Pollution disrupts the food chain by moving the toxins from one level in the chain to higher levels. In some cases, pollution can wipe out an entire part of the food chain. Such affect the other organisms by either causing excessive growth, in case the predator dies or death.

4. Destruction of Ecosystems

The introduction or elimination of certain microorganisms distorts the ecosystem. Nutrient pollution, for example, leads to an increase in algae, which depletes the water of oxygen, thereby leading to the death of fish and other aquatic life.

Remedies of Water Pollution

1. Municipal wastewater treatment

In urban areas of developed countries, municipal wastewater (or sewage) is typically treated by centralized sewage treatment plants. Well-designed and operated systems (i.e., with secondary treatment steps or more advanced treatment) can remove 90 percent or more of the pollutant load in sewage. Some plants have additional systems to remove nutrients and pathogens, but these more advanced treatment steps get progressively more expensive.

Nature-based solutions are also being used instead of (or in combination with) centralized treatment plants.

Cities with sanitary sewer overflows or combined sewer overflows employ one or more engineering approaches to reduce discharges of untreated sewage, including:

- utilizing a green infrastructure approach to improve storm water management capacity throughout the system, and reduce the hydraulic overloading of the treatment plant
- repair and replacement of leaking and malfunctioning equipment
- Increasing overall hydraulic capacity of the sewage collection system (often a very expensive option).

2. On-site sanitation and safely managed sanitation

Households or businesses not served by a municipal treatment plant may have an individual septic tank, which pre-treats the wastewater on site and infiltrates it into the soil. This can lead to groundwater pollution if not properly done.

Lack of access to sanitation often leads to water pollution, e.g. via the practice of open defecation: during rain events or floods, the human feces are moved from the ground where they were deposited into surface waters. Simple pit latrines may also get flooded during rain events. The use of safely managed sanitation services would prevent this type of water pollution.

3. Industrial wastewater treatment

Some industrial facilities generate wastewater that is similar to domestic sewage and can be treated by sewage treatment plants. Industries that generate wastewater with high concentrations of organic matter (e.g. oil and grease), toxic pollutants (e.g. heavy metals, volatile organic compounds) or nutrients such as ammonia, need specialized treatment systems.

Some industries install a pre-treatment system to remove some pollutants (e.g., toxic compounds), and then discharge the partially treated wastewater to the municipal sewer system. Industries generating large volumes of wastewater typically operate their own treatment systems. Some industries have been successful at redesigning their manufacturing processes to reduce or eliminate pollutants, through a process called pollution prevention.

To remove heat from wastewater generated by power plants or manufacturing plants the following technologies are used:

- cooling ponds, man-made bodies of water designed for cooling by evaporation, convection, and radiation.
- cooling towers, which transfer waste heat to the atmosphere through evaporation or heat transfer
- Cogeneration, a process where waste heat is recycled for domestic or industrial heating purposes.

4. Agricultural wastewater treatment

Sediment (loose soil) washed off fields is the largest source of agricultural pollution. Farmers may utilize erosion controls to reduce runoff flows and retain soil on their fields. Common techniques include contour plowing, crop mulching, crop rotation, planting perennial crops and installing riparian buffers.

Nutrients (nitrogen and phosphorus) are typically applied to farmland as commercial fertilizer, animal manure, or spraying of municipal or industrial wastewater (effluent) or sludge. Nutrients may also enter runoff from crop residues, irrigation water, wildlife, and atmospheric deposition. Farmers can develop and implement nutrient management plans to reduce excess application of nutrients and reduce the potential for nutrient pollution.

To minimize pesticide impacts, farmers may use Integrated Pest Management (IPM) techniques (which can include biological pest control) to maintain control over pests, reduce reliance on chemical pesticides, and protect water quality.

5. Erosion and sediment control from construction sites

Sediment from construction sites is managed by installation of:

- erosion controls, such as mulching and hydro seeding, and
- Sediment controls, such as sediment basins and silt fences.

Discharge of toxic chemicals such as motor fuels and concrete washout is prevented by use of:

- spill prevention and control plans, and
- Specially designed containers (e.g. for concrete washout) and structures such as overflow controls and diversion berms.

6. Control of urban runoff (storm water)

Effective control of urban runoff involves reducing the velocity and flow of storm water, as well as reducing pollutant discharges.

Pollution prevention practices include low-impact development techniques, installation of green roofs and improved chemical handling (e.g. management of motor fuels & oil, fertilizers and pesticides). Runoff mitigation systems include infiltration basins, bioretention systems, constructed wetlands, retention basins and similar devices.

Thermal pollution from runoff can be controlled by storm water management facilities that absorb the runoff or direct it into groundwater, such as bio retention systems and infiltration basins. Retention basins tend to be less effective at reducing temperature, as the water may be heated by the sun before being discharged to a receiving stream.