

Industrial Discharge and Water Pollution

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Abstract

Water pollution is the contamination of natural water bodies by chemical, physical, radioactive or pathogenic microbial substances. Alteration in water quality is responsible for large scale illness and deaths, accounting for nearly 50 million deaths per year across the world. Water pollution can occur naturally by sedimentation from severe rainfall events, volcanic eruptions and/or algae blooms. However, natural causes constitute only a minute proportion of the factors responsible for the world's water pollution. This review brings an insight into the various causes of water pollution with main emphasis on industrial discharge and steps that should be undertaken to solve this problem.

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INTRODUCTION

Sanitary and plentiful water lays the foundation for any prosperous community. Clean and safe water is required for survival of all the living organisms on Earth. Nearly 2/3rd of Earth's surface is covered by water, yet we are heading towards a water crisis. As the population continues to grow, people are putting ever-increasing pressure on the planet's water resources. In other words, our oceans, rivers, and other inland water resources are being 'squeezed' by human activities i.e., not so they take up less room, but also their quality is reduced. Poorer water quality means water pollution. Polluted water has become the world's biggest health risk, and continues to threaten both quality of life and public health.

WHAT IS WATER POLLUTION?

Water pollution refers to the contamination of water bodies such as lakes, rivers, oceans, aquifers and groundwater, usually occurring due to human activities. In other words, water is said to be polluted when

one or more substances have built up in water to such a level that it can have detrimental consequences on the living organisms. In a report by the United Nations (1969), water pollution is defined as: *"The introduction by man, directly or indirectly, of substances or energy into the marine environment (including estuaries) resulting in such deleterious effects as harm to living resources, hazards to human health, hindrance to marine activities, including fishing, impairment of quality for use of sea water and reduction of amenities."*^[1]

CAUSES/SOURCES OF WATER POLLUTION

Water pollution is caused by many different reasons, as a result of which it is such a difficult problem to solve. Water pollution can be caused by chemical, physical, radioactive or pathogenic microbial substances.

Chemical water pollutants: These are atoms or molecules that are discharged

into natural water bodies by human activities. Examples include compounds of nitrogen used in agriculture, mercury deriving from mining activity.

Physical water pollutants: Physical factors that affect the quality of water involve color change, offensive odor, corrosiveness or pH, and turbidity.^[2] Change in color of water is caused by metals (e.g., aluminium, copper, iron and manganese), dye (acid or basic dyes), and soil particles or by occurrence of water bloom (due to eutrophication). Dyes are discharged from the factories and contain large quantities of inorganic salts, organic acids, surfactant and water-soluble polymer compounds. Dye-contaminated water not only causes color change but also contains persistent substances that can be toxic in some cases.

As rainfall occurs, the rain water carries soil into the water bodies including rivers, lakes, reservoirs and marshes. Due to this, there occurs brown turbid appearance of water. Turbidity harms the scenery and disturbs the hydrophilic role of water, making the survival of aquatic flora and fauna unsuitable.

If the pH of any water body is far from neutral, it affects the growth of the living organisms in the ecosystem. High acidity of soil or agricultural water prevents the growth of plants and other agricultural crops.

Therefore, pH is an important index of water pollution.

Besides, other physical factors like temperature change, excessive sediment load arising from over-intense land use practices, and rubbish discarded from human manufacturing activity (e.g., plastic bags, bottles), though not so harmful to human health as chemicals or pathogens, they comprise the majority of visual impact of water pollution.

Radioactive pollutants: Radiations emitted from nuclear power plants can cause water pollution and affect human health. Radionuclides include radon, uranium, and radium. Radioactive discharges are emitted not only from the nuclear power plants but also from agricultural practices such as tobacco farming, where radioactive contamination of phosphate fertilizer is a common method of introduction of radioactive materials into the environment.

Pathogenic microbial pollutants: Common pathogenic microbes introduced into natural water bodies are pathogens from untreated sewage or surface runoff from intensive livestock grazing. Typical example is *Giardia lamblia*, a parasitic protozoan common in fecal material of many fauna including humans; this microbe is particularly insidious, due to its resistance to conventional sewage treatment. This and other protozoans and bacteria are important causes of illness and mortality in developing countries where population density, water scarcity and inadequate sewage treatment combine to occasion widespread parasitic and bacterial disease.

INDUSTRIAL DISCHARGE

Industrial discharge/effluent is one of the important sources responsible for pollution of the water environment. During the last century, a huge amount of industrial effluent has been discharged into rivers, lakes and coastal areas. This resulted in severe water pollution problems, causing negative impact to the ecosystem and human welfare. Industrial waste is defined as waste generated by manufacturing or industrial processes. There are many different types of industrial waste discharge depending upon the industries and the contaminants including cafeteria garbage, dirt and gravel, masonry and concrete, scrap metals, trash, oil, solvents, chemicals, weed grass and trees, wood and scrap lumber, and similar wastes.

Industrial solid waste can be solid, liquid or gaseous in nature and is classified as hazardous or non-hazardous waste. Hazardous waste results from manufacturing or other industrial processes. Certain commercial products such as cleaning fluids, paints or pesticides discarded by commercial establishments or

individuals can also be defined as hazardous waste. Non-hazardous industrial wastes are those that do not meet the EPAs definition of hazardous waste and are not municipal waste. Types of wastes have been classified based on the industry type they are discharged from. These are summarized in Tables 1 and 2.

Table 1. Types of Waste Discharged From Different Industries.

Type of industry/manufacturers	Type of waste (discharge)
Chemical manufacturers	Acids and bases spent solvents reactive waste wastewater containing organic constituents
Construction industry	Ignitable paint waste spent solvents strong acids and bases
Leather products manufacturing	Toluene and benzene
Metal manufacturing	Sludges containing heavy metals cyanide waste paint waste
Paper industry	Paint waste containing heavy metals ignitable solvents
Petroleum refining industry	Wastewater containing benzene and other hydrocarbons sludge from refining process
Printing industry	Heavy metal solutions waste inks solvents ink sludges containing heavy metals

Table 2. Distribution of Wastes Generated From Different Manufacturing Sectors.

Type of sector	Type of waste generated
Chemicals	COD, organic chemicals, heavy metals, SS and cyanide
Iron and Steel	BOD, COD, oil, metals, acids, phenols, and cyanide
Microelectronics	COD and organic chemicals
Mining	SS, metals, acids, and salts
Nonferrous metals	Fluorine and SS
Petrochemicals and refineries	BOD, COD, mineral oils, phenols, and chromium
Pulp and paper	BOD, COD, solids, Chlorinated organic compounds
Textiles and leather	BOD, solids, sulfates and chromium

Different chemicals coming out of the industries and/or manufacturing companies can cause various harmful effects to the community. These include:

- **Sulphur:** It is non-metallic and cause cause harmful effects to the life in marine environment.
- **Asbestos:** Discharge of this type possess cancer-causing properties. If inhaled, it can lead to illness called asbestosis and may even lead to cancer of varying type.
- **Lead and Mercury:** These are poisonous metallic elements that can cause environmental health problems affecting both the humans and animals. Also, once entered into the environment, they are difficult to be removed/cleaned due to their non-biodegradable nature.
- **Nitrates and Phosphates:** These are readily found in fertilizers in the agricultural farms, and are often washed away from the soils into the near-by water resources. These can cause eutrophication, which can be very problematic to the marine water bodies.
- **Oils:** Since oils do not dissolve, they stays on the water forming a thick layer on the surface and thus stop marine plants from receiving adequate light for photosynthesis. It also suffocates the fish and marine birds. Apart from fish and birds, oil spills can be extremely harmful to local marine wildlife such as sea otters and other aquatic life. A typical example of it is the BP oil spill case that occurred in 2012, which killed thousands of animal

species. Oil also gets caught in the feathers of sea birds, making it difficult for them to fly. Consequently, some animals might also die.

WHAT CAN BE DONE AND WHAT IS BEING DONE?

Waste minimization includes any source reduction and/or recycling activity undertaken by a waste generator. These activities result in a reduction of waste produced and/or a reduction in the toxicity of the waste.

Waste reduction techniques:

- (1) Change the composition of the product to reduce the amount of waste resulting from the product's use.
- (2) Reduce or eliminate hazardous materials that enter the production process.
- (3) Use technology (including measuring and cutting) to make changes to the production process; equipment, layout or piping; or operating conditions.
- (4) Purchase what you need to avoid waste from unwanted materials.

Recycling Techniques:

- (1) Return waste material to original process.
- (2) Use the waste material as a raw material substitute for another process.
- (3) Process waste material for resource recovery.
- (4) Process waste material as a by-product.
- (5) Investigate contractors to recycle waste material.
- (6) Advertise waste material.
- (7) Use packaging waste again (cardboard, bubble wrap or polystyrene).

The term Cleaner Production was coined by the United Nations Environment Program (UNEP) when it launched the Cleaner Production Program in 1989. Cleaner Production is the continuous application of an integrated preventive environmental strategy applied to processes, products, and services to increase overall efficiency and reduce risks

to humans and the environment (UNEP, 1989).

There is no easy way to solve industrial discharge-caused water pollution; if there were, it would not be so much of a problem. Broadly speaking, there are three different things that can help to tackle the problem—education, laws, and economics—and they work together as a team.

Education

Making people aware of the problem is the first step to solving it. Greater public awareness can make a positive difference.

Laws

One of the biggest problems with water pollution is its transboundary nature. Many rivers cross countries, while seas span whole continents. Pollution discharged by factories in one country with poor environmental standards can cause problems in neighboring nations, even when they have tougher laws and higher standards. Environmental laws can make it tougher for people to pollute, but to be really effective they have to operate across national and international borders.

This is why we have international laws governing the oceans, such as the 1982 UN Convention on the Law of the Sea (signed by over 120 nations), the 1972 London (Dumping) Convention, the 1978 MARPOL International Convention for the Prevention of Pollution from Ships, and the 1998 OSPAR Convention for the Protection of the Marine Environment of the North East Atlantic.

Economics

Most environmental experts agree that the best way to tackle pollution is through something called the polluter pays principle. This means that whoever causes pollution should have to pay to clean it up, one way or another.

Our Clean Future

Life is ultimately about choices—and so is pollution. We can live with sewage-strewn beaches, dead rivers, and fish that are too poisonous to eat. Or we can work together to keep the environment clean so the plants, animals, and people who depend on it remain healthy.

We can take individual action to help reduce water pollution, for example, by using environmentally friendly detergents, not pouring oil down drains, reducing pesticides, and so on. We can take community action too, by helping out on beach cleans or litter picks to keep our rivers and seas that little bit cleaner. And we can take action as countries and continents to pass laws that will make pollution harder and the world less polluted. Working together, we can make

pollution less of a problem – and the world a better place.

CONCLUSION

Adverse alteration of water quality presently produces large scale illness and deaths, accounting for approximately 50 million deaths per year worldwide.

REFERENCES

1. The original definition appeared in *UN Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection, Report of the First Session*, March 1969, 5p. It omitted the word "energy," which was added at the Stockholm Conference (the UN Conference on Human Development) in 1972.
2. <http://www.eolss.net/sample-chapters/c07/e2-19-05-04.pdf>.