

Analysis of Anthropogenic Activities Severely Polluting Our Water Resources

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Abstract: Water pollution is a major challenge being faced by humanity all over the world, as it is posing a major concern on our healthy existence on this planet. It is very important to study pollution of this highly valuable natural resource to proceed towards the process of finding long-lasting solution to this problem. Herein, I review some major sources of different contaminants being added in freshwater resources, their damaging effects and feasible approaches to alleviate water pollution. Emphasis has been sited on different organic and inorganic chemical pollutants including persistent organic pollutants (POPs), toxic metals getting added into the water resources and thereby affecting the normal use of water for domestic, industrial, irrigation, agriculture and aquatic life.

Keywords: Anthropogenic activities, contaminant, persistent organic pollutants, water pollution.

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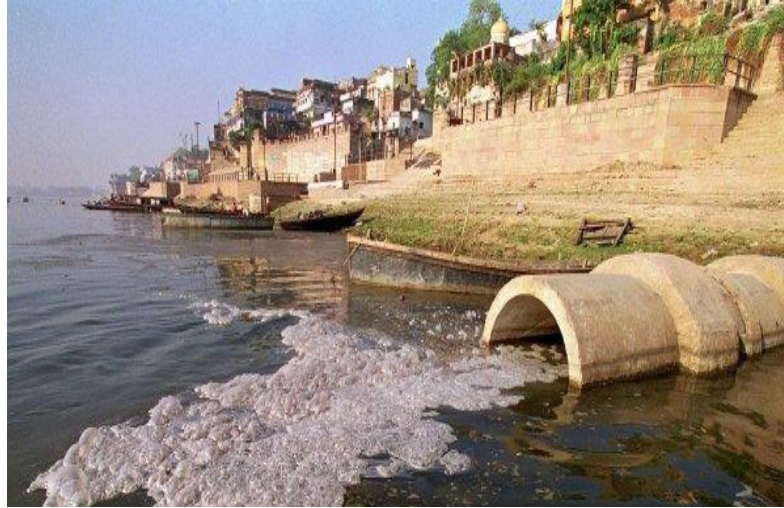
I. Introduction

Water is a highly valuable resource gifted by nature for the existence of life on this planet. But list of anthropogenic activities polluting this natural resource is very long. If we continue in this way, we will end up with polluted water all around us and it's our moral duty to conserve it for the healthy survival of life on this planet. Although Water pollution can be defined in many ways, usually it is addition of external substances termed as contaminants or energy into the water to such an extent that results in changing the physical, chemical or biological characteristics of water so that its utility for any reasonable purpose is apparently depreciated and causes harm to the aquatic life and humans. Of course this harmful effect depends upon the concentration of pollutants. If a cup of toxic chemicals is poured into a river, they will quickly disappear into the river's much larger volume of clean water. At such low concentration, the chemicals would not present any real problem. However, if gallons of chemicals are poured into a river, the chemicals will have a considerable effect on the quality of the water, affecting the whole aquatic life and also humans.

When we think of water pollution, firstly we think of pollution of surface water resources including lakes, rivers and huge oceans, the most apparent type of water pollution. List of contributors to this pollution ranges from an individual person throwing different wastes in rivers, lakes, beaches to the waste from different industries, mining, research, medical, chemical producers and so on. Pollution of groundwater stored in underground rock structures known as aquifers, which supplies much of our drinking water is much less noticeable than surface-water pollution, but is also becoming a serious problem [1]. Groundwater is getting polluted by discharge of domestic, agricultural and industrial effluents adding several pollutants thereby affecting water quality and posing several health hazards. Contribution of the pesticides that we use in our gardens cannot be neglected in this regard. Broadly speaking, there are two different ways in which water pollution generally happens. Point-source water pollution includes pollution coming from a single site, such as an oil spill from a tanker, a discharge pipe of a factory, oil pouring from a car down a drain, waste from a sewage treatment plant and so on. Nonpoint-source (NPS), water pollution happens not from one single source but from many different sources. In case of point-source pollution, the place most affected is usually the area directly around the source, but is less likely to happen in case of nonpoint source pollution. If a pollution that enters the environment in one place affects hundreds or even thousands of miles of area away, it is termed as trans-boundary pollution.

II. Major Sources Of Water Pollution

2.1 Sewage



Increase in urbanization is generating a huge quantity of waste and wastewater, whose treatment is becoming a major concern. Sewage water contains many kinds of pollutants; detergents, soaps, dishwashers, paper, plastics and other wastes that people flush down their toilets and drains, pharmaceutical drugs people take, waste from research, medical, chemical producers and so on. Sewage and waste water is one of the foremost contributors of seawater pollution. Even in many developed countries, it is a usual practice to dump directly untreated sewage water or the sewage waste generated by sewage treatment works into the nearby surface water, more often into the rivers or sea. Also so many chemicals from this untreated waste get added into the ground water through percolation [2]. This contaminated water becomes home to several kinds of bacteria and viruses into the environment and aids in spread of diseases such as hepatitis, typhoid and cholera. According to World Health Organization, some 780 million people (11 percent of the world's population) don't have access to safe drinking water, while 2.5 billion (40 percent of the world's population) don't have proper sanitation. Sewage disposal affects people's immediate environments and leads to water-related diseases such as diarrhea that kills 7.6 million children under five each year [3].

Dissolved oxygen is utmost requirement of aquatic life to survive in water. Exchange of oxygen from air to water depends upon temperature, partial pressure of gases, solubility, photosynthetic activity of plant and respiration by bacteria, plants and animals in the water. Major effect of this oxygen demanding sewage waste in a water body is depletion of dissolved oxygen concentration due to consumption of oxygen in oxidation of organic matter, which imposes threat to the aquatic life [4,5].

2.2 Industrialization

No doubt, industrialization is the backbone of the process of development of any nation. But, as industrialization has spread around the globe, the problem of water pollution has also spread along with it due to disorganized use of resources and raw materials in unplanned manner. Each year, the world generates nearly 5-10 billion tons of industrial waste, much of which is dumped untreated into the nearby surface water [6]. These industries are point source of water pollution and producing different pollutants during various industrial processes. But also this is fact that waste water is an essential by-product of industries that cannot be avoided.

A large amount of water is required in industries and the waste water containing different organic and inorganic chemicals including, petroleum hydrocarbons, phenols, fluorine, acids, bases, oil, grease, surfactants, emulsifiers, cyanide, chlorinated organic compounds, different solvents used in the manufacturing processes, detergents, lubricants, heavy metals, pesticides, dyes, suspended solids, active pharmaceutical ingredients and so on. Sludges and wastewater from metal-working industries including electroplating industry commonly contain cadmium, copper, lead, chromium, zinc, and nickel. Heavy metal pollution is consistently increasing through sedimentation of rocks, industrial effluents, and mining activities. High concentrations of these heavy metals are toxic to biological systems [7]. Many materials present in this waste water are toxic, carcinogenic and highly biodegradable. Even usual wastewater treatment methods are not simple for the complete removal of many wastewater constituents [8]. The sludge remaining after treatment of wastewater accounts for much of the generated hazardous waste. These contaminants get added into the surface water resources altering the Physical and chemical parameters viz water temperature, pH, turbidity, TSS, TDS, color, DO, BOD, COD, free CO₂, free ammonia, alkalinity and hardness [9,10]. Ammonia is commonly produced by microbial decay of organic nitrogenous matter largely due to decaying plants, sewage, industrial discharge and fertilizers containing

ammonia. Higher concentrations of free ammonia are toxic to aquatic life. Due to bacterial oxidation of ammonia, excessive use of fertilizers in agriculture, industrial discharges, animal matter, domestic effluents, sewage or sludge disposal, leachate from refuse dumps, atmospheric washout and precipitation, nitrates are produced in water and their presence causes eutrophication, hence promoting algal and aquatic plant growth. This reduces water quality by reducing dissolved oxygen, increasing alkalinity, increasing TSS, and hence reduces penetration of light which results in lower rate of photosynthesis [11,12]. Apart from the surface water, groundwater in the areas near industries is getting polluted by percolation of several pollutants including fluorides, phosphates, chlorides, sulphates, nitrates and heavy metals from the waste and wastewater being produced by the industries, affecting the ground water quality [13,14].

2.3 Irrational Use Of Agrochemicals

Irrational use of chemical fertilizers and pesticides, including herbicides, fungicides and other materials used to control pests is another human activity, especially in developing countries like India that is contributing to water pollution. Being water-soluble, ultimately they are getting added into groundwater through soil by percolation, where they can remain for decades and into surface water by runoff and atmospheric washout and precipitation processes. Even excessive amounts applied to lawns and gardens get washed off with rain water and added into the nearest stream, river, or other water body. Apart from being toxic, so many pesticides are known for their carcinogenic and mutagenic effects and apart from humans, also affect aquatic life [15]. This water contamination has been studied to cause gastric cancer, goiter, hypertension, testicular cancer, birth malformations, and stomach cancer [16-18]. One of the scariest effects of water contaminated with chemical fertilizers is something called methemoglobinemia, alternatively known as Blue Baby Syndrome in infants. The condition causes a decrease in oxygen in the blood and results in a blue-grey skin color, causes lethargy and/or irritability and can lead to coma or death [16].

Excessive air- and water-borne nitrogen from fertilizers may cause respiratory ailments, cardiac disease, and several cancers, as well as can "inhibit crop growth, increase allergenic pollen production, and potentially aids in several vector-borne diseases, including malaria, cholera and West Nile virus [19]. Also fertilizers are rich source of nutrients, such as nitrogen, phosphorus and potassium. The excessive amount of nutrients in water bodies causes growth of algae and aquatic weeds, which takes up the dissolved oxygen in the water. Low levels of oxygen in water directly harm aquatic life, creating dead zones by death of fish and crustaceans. One popular fertilizer, urea, produces ammonia discharge, contributes to acid rain, groundwater contamination and ozone depletion due to release of nitrous oxide by denitrification process. With its increased use, this problem may increase several fold in the coming days.

2.4 Toxic Chemicals From Waste

Increasing human population and urbanization is generating millions of tons of solid waste, whose management has become a highly tedious task. Because most of the wastes are disposed on or in land, most grievous effect is contaminated groundwater. Several toxic chemicals from the waste dumps and landfills get added into the groundwater by the process of leaching through rainwater. Ocean dumping of solid waste, including radioactive waste is a common practice in many countries irrespective of ban. Several toxic chemicals from spilled fuel, worn tires bits and exhaust emissions enter waste water from highway runoff. When it rains, these chemicals are washed into drains, or accumulate in the land next to a road, get added into the groundwater and also into the rivers in such concentrations that they directly spoil aquatic ecosystem. One of the examples of highly toxic chemicals is polychlorinated biphenyls (PCBs), once widely used to manufacture electronic circuit boards, fire retardants, lubricants, some printing inks, but now after realizing their harmful effects, their use is highly restricted in many countries. Approximately, half million tons of PCBs has been discharged into the environment during the 20th century, much has entered in aquatic food chain and their effects will be observed for many decades because they last a long time in the environment without breaking down [20]. Another type of toxic pollution comes from heavy metals, such as lead, cadmium and mercury. Lead was once usually used in gasoline, though its use is now restricted in many countries, but still being used in paints, pipes. Mercury is still used in batteries, thermometers, paint, dental fillings and also being released by industrial processes, combustion of coal, contaminated mining sites.

2.5 Plastics And Other Wastes

Plastic, one of the most common materials being used by human for different purposes and thrown away as waste being added finally into the nearby surface water resources. Being lightweight, it floats easily so it can travel large distances getting added into the oceans and being non-biodegradable, remains in the marine environment for a long time and also eaten by seabirds. In a study of 450 shearwaters in the North Pacific, over 80 percent of the birds were found to contain plastic residues in their stomach [21]. Also in India, it is a common practice by people to through waste generated from their religious rituals into the river, canal or other water

body by putting in plastic bags. Also the idols of god are dumped in the rivers after religious activities. Waste generated by funeral including remains of dead body, burnt wood and ash are thrown away into the rivers. Ganga river is one of the most affected victims of this type of pollution.

2.6 Oil Pollution

Regarding this type water pollution where huge amount of black oil getting added in the oceans, accidents during shipping operations resulting tanker spills are minor contributors, major contribution comes from land runoff, the oil people pouring down drains on land and ocean dumping, adding a massive amount of oil in the marine environment. Again this pollution has an adverse effect on marine life [22].

III. Approaches To Control Water Pollution

Each individual can help to reduce water pollution. For this awareness, education, legislation and economics can play a vital role. Making people aware of the problem is the first step to solve this problem. Further the individuals can play an important role by educating other people about the harmful impacts of the water pollution on environment and the whole life on our planet and ultimately our health and our future generations. Recycling and waste minimization may be the best ways to deal with hazardous wastes being generated and polluting water. Both use and manufacturing of environment friendly products should be encouraged by government, mass media, NGOs and individual persons. Educating the farmers about the harmful effects of excessive use of chemical fertilizers and pesticides, encouraging them to use smaller or no chemical fertilizers and pesticides and implementation of new scientific techniques should be encouraged by frequently organizing workshops, plays and skits in villages. As the traditional wastewater treatment methods are not sufficient for the complete removal of many wastewater contaminants, advanced higher-level treatment and analytical technologies are becoming important. Earlier, industries used to extensively dump the hazardous waste into the water bodies, but now are assuming their responsibility in terms of treating their wastewater streams. In industries, procedure for reducing hazardous waste production may include regular audits, better management, production process/equipment modifications, operational/maintenance procedures, raw material changes, volume reductions, nonhazardous material replacements, reuse and recovery. As water pollution is trans-boundary in nature, pollution discharged by industrial units in one country with poor environmental standards can cause problems in neighboring nations; strict implementation of environmental legislation, including tougher penalties against factories that pour pollution into water bodies can make a difference.

IV. Conclusion

Ultimately it's our own choice, whether we want to live with sewage-strewn beaches, dirty rivers and toxic food to eat. Or we can work together to preserve our freshwater resources to remain healthy and save the biodiversity who heavily depends upon this natural resource. At individual level, we can take many steps to lessen water pollution, for example, by reducing wastage of water, reusing the water, harvesting the rain water, using environmentally friendly detergents, not pouring chemicals and oils down the drains, reducing use of agrochemicals and so on. Community acts too can be highly fruitful by helping out in litter picks, beach cleaning to keep our surrounding rivers and seas clean. Industries need to adopt more universal and sustainable treatment practices and designs to stop water pollution. Nations need to strictly implement the firm environmental laws to reduce water pollution.

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