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Impact of Water Pollution on Human Health and Environment and Its Remedial Techniques: A Review

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ABSTRACT

Now water pollution poses a threat to the environment and affects not only animals and livestock but also human health. Among these pollutants, non-toxic and organic solvents are the most important because they are toxic, persistent, and difficult to purify with existing methods. For this reason, many research groups are looking for ways to detect and treat contaminated water and wastewater. Based on the above, the situation is currently under review. The results showed that there are a variety of pollutants in water bodies in the United States that affect many people, and some have other ways to treat water pollution. It was decided that a successful challenge would be to develop regional sanitation measures based on the specific needs of the area of interest. Therefore, water treatment facilities should be designed according to the contaminants in the water in the region and treated according to the needs of the stakeholders. The impact on animal and plant life has attracted researchers and environmentalists. It is no less harmful than air and soil pollution, but it has a greater impact on them. This study focuses on the analysis of the concept of pollution and its effects on human health and sources of water pollution. The health effects of pesticides range from mild allergies, eye irritation, breathing difficulties, and reproductive abnormalities to deadly chronic diseases like cancer. This challenge to food safety may be addressed by preventive strategies that include the use of alternative sustainable agricultural practices or mitigating strategies that are based on reducing pesticide exposure from food and water by different processing techniques. This work provides a comprehensive review of the occurrence of pesticides in drinking water and their possible treatment. There are many methods of pollution besides soil pollution, the most important of which are biological pollution, physical pollution, and the disposal of materials and wastewater into rivers, lakes, and oceans.

Keywords: wastewater, treatment, environmental public health, inorganic pollutants, organic contaminants.

1. INTRODUCTION

A vital resource for human survival is water. The usage of freshwater has grown by roughly 1% per year since the 1980s and has multiplied sixfold in the last century, according to UNESCO's 2021 World Water Development Report. Water quality is suffering greatly as a result of rising water demand. Urbanization, agriculture, and industrialization have all contributed to environmental pollution and degradation, which has a negative impact on the water bodies (oceans and rivers) that are essential to life and, ultimately, human health and sustainable social development (Xu et al., 2022). An estimated 80% of urban and industrial wastewater worldwide is released into the environment untreated, endangering ecosystems and human health.

In the least developed nations, where facilities for wastewater treatment and sanitation are woefully inadequate, this percentage is higher. Bacteria, viruses, parasites, fertilisers, pesticides, pharmaceuticals, nitrates, phosphates, plastics, faeces, and even radioactive materials are the principal contaminants of water. These chemicals are frequently invisible contaminants since they don't always alter the water's colour. To ascertain water quality, little volumes of water and aquatic life are tested. Industrialisation, agriculture, natural disasters, and inadequate water supply and sewage treatment systems are the main causes of water pollution. First, the primary source of water pollution is industry, which includes the tannery, distillery, food, textile, and iron and steel industries, as well as the nuclear and pulp and paper businesses. In the course of industrial manufacturing, a variety of hazardous chemicals, organic and inorganic materials, hazardous solvents, and volatile organic compounds may be discharged. Water pollution will result from the discharge of these pollutants into aquatic habitats without proper treatment (Chowdhary et al., 2020). The industrial sector is a major source of hazardous pollutants, and heavy metals such as arsenic, cadmium, and chromium are essential pollutants released in wastewater (Chen et al., 2019).

Wastewater from industrial activity has steadily increased as urbanisation has accelerated. (Wu et al., 2020). Additionally, foreign direct investment has a significant impact on the industrialisation-related water pollution. Water contamination is mostly caused by organic farm waste, nitrogen fertilisers, and pesticides (RCEP, 1979). Nitrates, phosphates, herbicides, soil sediments, salts, and pathogens are among the contaminants that agricultural activities will introduce into the water (Parris, 2011).

Additionally, all freshwater systems in their pristine state have suffered significant harm due to agriculture (Moss, 2008). In water-scarce areas of developing nations, such as China and India, untreated or poorly treated wastewater is frequently utilized for irrigation; nevertheless, the presence of contaminants in sewage poses health and environmental problems. In order to meet the water demand of agricultural production, some developing countries, like China, have long used wastewater irrigation to meet the imbalance in quantity and quality of surface water resources. This has resulted in serious pollution of agricultural land and food, as well as pesticide residues and heavy metal pollution that pose a threat to human health and food safety (Lu et al., 2015).

Pesticides have a negative effect on drinking water quality. When pesticide use and health life expectancy longitudinal survey data were compared, it was discovered that for every 10% increase in pesticide use, the medical disability index for people over 65 increased by 1% (Lai, 2017). In India's Musi River case, waste-water-irrigated villages have a higher rate of morbidity than households with regular water. Third, there are natural factors that contribute to water pollution. The concentration of trace elements in the water quality of the Child Loess Plateau, for instance, is higher than the global average. Hexavalent chromium pollution is the most common type of water pollution in the central region of the Loess Plateau. It is brought on by both human activity and the natural environment. The primary sources of surface water pollution are mudstone and loess, and groundwater containing high levels of hexavalent chromium also plays a significant role, particularly in developing nations, sewage treatment and water supply infrastructure have a significant impact on the quality of drinking water. Underfunding of basic water supply and treatment facilities has coincided with China's rapid economic growth, industrialization, and urbanization. This has resulted in water pollution, a rise in infectious and parasitic diseases, and increased exposure to heavy metals, industrial chemicals, and algal toxins (Wu et al., 1999). In conclusion, both natural and human-caused factors contribute to water contamination. Water quality will be directly impacted by a number of human activities,

such as population growth, urbanization, industrialization, climate change, and other factors (Halder and Islam, 2015).

2. Sources of Water Pollution:

2.1 Agricultural Waste:

A significant water polluter, the agricultural industry uses roughly 70% of the earth's surface water supplies for farming and livestock production, making it the largest consumer of freshwater resources worldwide. Water degradation worldwide is mostly caused by agriculture. Pollution from agriculture is the leading cause of contamination in rivers and streams, the second largest source in wetlands, and the third primary source in lakes in the United States. It also significantly contributes to groundwater and estuary contamination. Every time it rains, our waterways are contaminated with bacteria, viruses, and other pathogens due to fertilizers, pesticides, and animal waste from farms and livestock operations. The biggest global threat to water quality is nutrient pollution, which is brought on by too much nitrogen and phosphorus in the air or water. This can result in algal blooms, which are toxic soups of blue-green algae that can be dangerous to both humans and wildlife.

Figure-1 Pesticides Spray Machine.

2.2. Sewage and wastewater:

Wastewater includes used water. The sources of wastewater include commercial, industrial, and agricultural operations (think metals, solvents, and toxic sludge), as well as our sinks, showers, and toilets (think sewage). The term also refers to stormwater runoff, which happens when rainfall carries chemicals, oil, grease, road salts, and debris from impermeable surfaces into our waterways. According to the UN, over 80% of wastewater worldwide returns to the environment untreated or un-reused; in some least-developed nations, that percentage rises to 95%. Every day, approximately 34 billion gallons of wastewater are processed by wastewater treatment facilities in the US. These facilities filter out heavy metals and hazardous chemicals from industrial waste, as well as pathogens, phosphorus, and nitrogen from sewage, before returning the cleaned waters to rivers. Then everything works out fine. However, the EPA estimates that over 850 billion gallons of untreated wastewater are released annually by our country's ageing and easily overloaded sewage treatment systems.

2.3. Oil pollution:
The majority of oil pollution in our oceans is caused by consumers, including the oil and gasoline that leak from millions of cars and trucks every day. Large spills may make the news, but consumers are more responsible than any other factor. Furthermore, land-based sources like cities, farms, and factories account for almost half of the 1 million tonnes of oil that are thought to enter marine environments annually rather than tanker spills. About 10% of the oil in international waters is caused by tanker spills, while roughly a third is caused by regular shipping operations, including both legal and illicit discharges. Seeps are natural openings in the ocean floor that allow oil to naturally escape.

2.4. Radioactive substances:
Pollution that releases more radiation than the environment naturally produces is referred to as radioactive waste. The production and testing of military weapons, nuclear power plants, uranium mining, and hospitals and universities that use radioactive materials for research and medical purposes are the main sources of it. Because radioactive waste can linger in the environment for thousands of years, getting rid of it is very difficult. Consider the decommissioned Hanford nuclear weapons production site in Washington, where 56 million gallons of radioactive waste need to be cleaned up over the course of 2060, at an estimated cost of over $100 billion. Contaminants that are improperly disposed of or accidentally released pose a threat to marine resources, surface water, and groundwater.

2.5. Groundwater pollution:
Rainfall turns into groundwater, one of our most valuable yet least visible natural resources, when it penetrates deeply into the ground and fills the voids, fissures, and porous areas of an aquifer—basically, an underground water reserve. For drinking water, almost 40% of Americans depend on groundwater that is pumped to the surface of the earth. It is the only source of freshwater for some people living in rural areas. When pollutants, such as fertilizers, pesticides, and waste from septic tanks and landfills, seep into an aquifer, they contaminate groundwater and make it unfit for human consumption. Eliminating pollutants from groundwater can be expensive and challenging. An aquifer that has been contaminated may not be usable for decades or even millennia. Because groundwater seeps into streams, lakes, and oceans, it can also disperse pollution far from the original source.

2.6. Ocean water pollution:
Land-based sources, whether near the coast or deep inland, are responsible for 80% of ocean pollution, also known as marine pollution. Through streams and rivers, pollutants like chemicals, nutrients, and heavy metals are transported from cities, factories, and farms into our bays and estuaries before heading out to sea. Marine debris, especially plastic, is carried in by the wind or washed in through sewers and storm drains. Our oceans are constantly absorbing carbon pollution from the atmosphere, and occasionally they are spoilt by oil leaks and spills of all sizes. The ocean absorbs up to 25% of carbon emissions from human activity.

[3]. Water pollution and types of pollutants:
Water pollution is defined as the presence of any undesirable foreign material in water bodies that changes its physical, biological, and chemical characteristics and lowers the water's quality (Ukaogo et al. 2020). While anthropogenic sources of water pollution include the use of fertilizers, manures, and pesticides, natural sources include the leaching of toxic metal ions from naturally occurring ores into groundwater, as well as other natural phenomena like volcanic eruptions, storms, earthquakes, and algae blooms that alter the water's quality and harm aquatic life and people. Water pollution is also caused by excessive deforestation, mining, and household and industrial waste (Khatri and Tyagi, 2015). All life forms are harmed by the water pollutants, upsetting the

ecosystem. These pollutants are further divided into different categories, including solid suspended particles, radioactive pollutants, organic pollutants, inorganic pollutants, and nano-pollutants, among others. Chatterjee and Ghangrekar (2018). Figure. 2 lists the various types of pollutants that are detrimental to the ecosystem as a whole as well as to people.

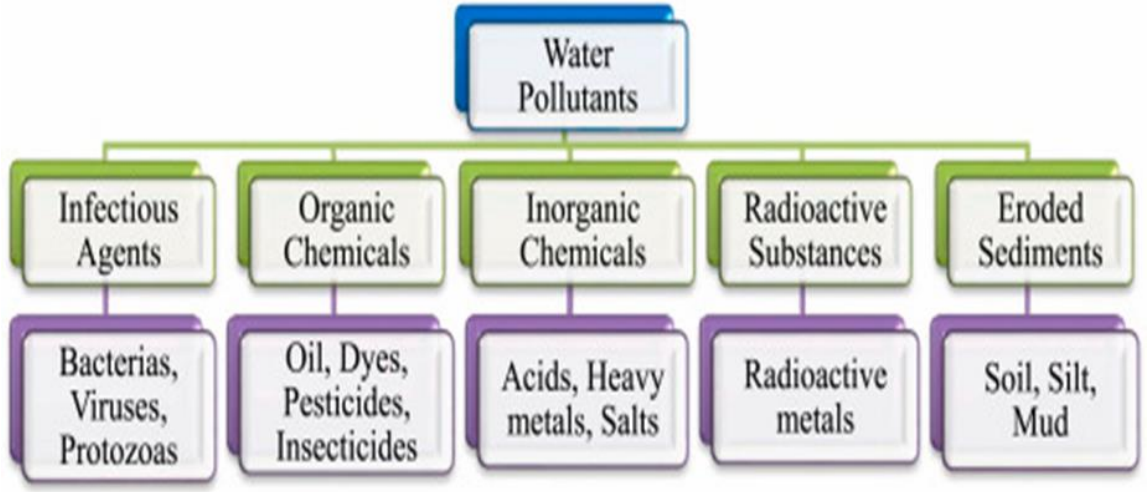

Figure-2. Various types of water pollutants.

3.1. Physical contamination:

Physical contamination comes about from natural and inorganic materials suspended in water. This sort of toxin changes the colour, taste, and scent of water. One of the shapes of physical contamination is the high temperature as a result of pouring the cool water of industrial facilities and atomic reactors into water bodies. It leads to a diminishment within the sum of broken-down oxygen and hurts oceanic life forms.

3.2. Chemical contamination:

This sort of contamination comes about from the nearness of over-the-top sums of broken-down salts, acids, fluorides, metals, natural materials, fertilisers, and pesticides. The metals are, for the most part, dissolvable in water to a few degrees, counting a few harmful ones, such as barium, cadmium, lead, and mercury. Though the non-toxic metals incorporate calcium, magnesium, sodium, press, and copper, whose increment causes a few infections. Over-the-top sodium concentration, for case, makes the water unpalatable and leads to well-being dangers for heart and kidney malady and harming plants. Moreover, most of the natural materials can be broken down by water. They are either natural materials that can be broken down by the microbes displayed within the water, or they are not dissolvable, such as pesticides and cleansers. Fertilisers include mainly nitrogen and phosphorous, and their nearness within the water makes a difference in the oceanic plants developing progressively. This may result in the wonder of the untimely ageing of the lakes, which in the long run turn into swamps or dry areas.

3.2.1. Acidic and antacid compounds:

Both acidic or soluble compounds alter the pH of water. In the event that the water is sullied with acids, this will cause erosion of the channels and their erosion. This erosion causes dangers to human well-being, concurring to the sort of sullied corrosive. Other than soluble base contamination, shapes salts such as carbonates, bicarbonates, hydroxides, and chlorides. Carbon, calcium, and magnesium bicarbonate cause hardness of water. Correspondingly, chloride compounds lead to the saltiness of the earth.

[3.2.2]. Overwhelming metals:

The most common broad overwhelming metals are lead, mercury, cadmium, and

arsenic. Mercury may be a mineral whose compounds can be blended with soil and water. Defilement with mercury compounds causes unsettling influences within the central anxious framework, as well as a sleeping disorder, mental discouragement, absent-mindedness, and gingivitis and kidney irritation. Cadmium is utilised in a few businesses, such as the fabrication of plastics and batteries. Defilement of water with cadmium leads to kidney, lung, heart, and bone maladies. Moreover, lead production lines that create batteries are among the foremost vital sources of lead contamination.

4. Effect of Water Contamination on Human Well-being:

Risky water has extreme suggestions for human well-being. Agreeing to the UNESCO 2021 World Water Improvement Report, approximately 829,000 individuals kick the bucket each year from loose bowels caused by hazardous drinking water, sanitation, and hand cleanliness, counting about 300,000 children beneath the age of five, speaking to 5.3% of all passings in this age group. Information from Palestine proposes that individuals who drink civil water straightforwardly are more likely to endure from maladies such as loose bowels than those who utilize desalinated and household-filtered drinking water (Yassin et al., 2006). In a comparative ponder of tap water, decontaminated water, and bottled water, tap water was a fundamental source of gastrointestinal infection. The need for water and sanitation administrations, moreover, increases the frequency of infections such as cholera, trachoma, schistosomiasis, and helminthiasis. Information from ponderers in creating nations appears to show a clear relationship between cholera and sullied water, and family water treatment and capacity can diminish cholera (Gundry et al., 2004). In addition to illness, hazardous drinking water and destitute natural cleanliness can lead to gastrointestinal sickness, restraining supplement retention and ailing health. These impacts are particularly articulated for children.

4.1. Water Contamination and Skin Illnesses:

Opposite to common sense that swimming is sweet for well-being, studies from as early as the 1950s found that the general malady rate within the swimming bunch was significantly higher than that within the non-swimming gather. The overview appears that the frequency of the illness in individuals beneath the age of 10 is approximately 100% higher than that of individuals over 10 a long time ago.

A planned epidemiological ponder of shoreline water contamination was conducted in Hong Kong with in the summer of 1986–1987. The ponder found that swimmers on Hong Kong's coastal shorelines were more likely than non-swimmers to complain of systemic sicknesses such as skin and eyes, and swimming in more polluted shoreline waters includes a much higher chance of contracting skin infections and other infections. Swimming-related illness side effect rates are related to beach cleanliness (Cheung et al., 1990).

A ponder of arsenic-affected towns within the southern Sindh territory of Pakistan emphasised that skin maladies were caused by intemperate water quality. By examining the relationship between intemperate arsenic in drinking water caused by water contamination and skin infections (basically melanosis and keratosis), it was found that compared with individuals who expended urban low-arsenic drinking water, the hair of individuals who expended high-arsenic drinking water arsenic concentration expanded significantly. The level of arsenic in drinking water specifically influences the health of nearby inhabitants, and skin malady is the foremost common clinical complication of arsenic harming. There's a relationship between arsenic concentrations in organic tests (hair and blood) from patients with skin infections and admissions of arsenic-sullied drinking water (Kazi et al., 2009).

Consider utilizing meta-analysis; it has appeared that presentation to contaminated marine recreational waters can have unfavourable results, counting visit skin inconvenience (such as hasty or tingling). Skin infections in swimmers may be caused by an assortment of pathogenic microorganisms (Yau et al., 2009). Individuals (swimmers and non-swimmers) uncovered to waters over edge levels of microscopic organisms had the next relative hazard of creating skin infection, and levels of microscopic organisms in seawater were exceedingly connected with skin indications. Considers have too proposed that swimmers are 3.5 times more likely to report skin maladies than non-swimmers. This contrast may be a risk recognition bias at work on swimmers, who are by and large mindful that such introduction may lead to well-being impacts and are more likely to identify and report skin disarranges. It is additionally conceivable that swimmers overstated their indications, announcing conditions that others would not classify as genuine skin clutters (Fleisher and Kay, 2006).

4.2. Water Contamination and Cancer:

According to WHO measurements, the number of cancer patients analysed in 2020 came to 19.3 million, whereas the number of passings from cancer expanded to 10 million. As of now, one-fifth of all worldwide fevers will create cancer in their lifetime. The sorts and sums of carcinogens displayed in drinking water will shift depending on where they enter: defilement of the water source, water treatment forms, or when the water is conveyed to clients (Morris, 1995). From the viewpoint of water sources, arsenic, nitrate, chromium, etc. are exceedingly related to cancer. Ingestion of arsenic from drinking water can cause skin cancer and kidney and bladder cancer (Marmot et al., 2007). The hazard of cancer within the population from arsenic within the Joined Together States water supply may be comparable to the chance from tobacco smoke and radon within the domestic environment. In any case, a person's defencelessness to the carcinogenic impacts of arsenic changes (Smith et al., 1992).

A tall affiliation of arsenic in drinking water with lung cancer was illustrated in a northern Chilean controlled ponder, including patients analysed with lung cancer and a frequency-matched clinic between 1994 and 1996. Considers have moreover appeared to have a synergistic impact of smoking and arsenic admissions in drinking water in causing lung cancer (Ferreccio et al., 2000). Presentation to tall arsenic levels in drinking water was too related to the advancement of liver cancer, but this impact was not significant at introduction levels below 0.64 mg/L (Lin et al., 2013). Nitrates are a broader contaminant that's more closely related to human cancers, particularly colorectal cancer.

5. Future Points of View:

Water contamination has ended up a major issue in the world. Water assets are sullied extremely, and the complexity of the issue escalates because of the differences in the toxins. Nanotechnology gives openings to set up the following era of water filtering frameworks. Reasonable limits for secure drinking water standards have been diminishing with time. Novel and progressed materials are required to identify and expel contaminants at such low levels. Materials, such as graphene, having huge surface zones and high reactivity, may be made as composites with NMNs (NPs or luminescent clusters) to include more alluring properties. One of the troubles in working with nanomaterials for water filtration is the partition of utilised materials from water. Making composite materials such as press oxide–Ag/Au and graphene–iron oxide nano-systems would upgrade the division of materials from treated water for reuse. It is imperative to consider the destiny of nanosized gold and silver that are entering into water amid treatment. The amount of metal particles discharged amid treatment changes from one strategy to the other. It is exceptionally imperative to consider that the outlined fabric is pertinent to remediating a huge run of contaminants (in step one or two)

shown in water. There must be a clear understanding of the mechanism of intuition. It is very vital to centre on strategies of cheap and green strategies of arrangement. Strategies including simple handling, less time utilisation, and avoiding/minimising extraordinary test conditions (such as keeping up exceptionally tall and exceptionally low temperatures, costly gear, etc.) are continuously beneficial.

6. RESULTS AND CONCLUSION

The study was undertaken to have an understanding of the overall status of the water quality of the major sources of potable water in Rajasthan and to identify the factors responsible for causing considerable impact on altering water quality. Rajasthan is one of the potential states in terms of its agricultural and mineral production in the country. The rural peoples of the state use water from these wetlands intensively for different purposes, such as for irrigation of the agricultural fields, for various household purposes such as drinking, washing clothes and utensils, bathing, etc. These wetlands support a broad spectrum of biodiversity in this region. But, steep increases in the pressure from the human population have altered these natural ecosystems considerably, and thus need critical thinking to conserve these resources. Falling apart water quality is harming the environment, well-being conditions, and the worldwide economy. The president of the World Bank, David Malpass, cautions of the financial effect: "Breaking down water quality is slowing down financial development and compounding destitution in numerous nations." Modem agriculture rely heavily biocides, although these fertilizers enhance vegetation but they dispute the entire natural aquatic ecosystem. They actually pollute the water. Pollutants include solid and gaseous substance present in greater than natural abundance, produced due to human activity, which have a detrimental effect on our environment. The nature and concentration of a pollutant determine the severity of its detrimental effects on human health.

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