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Review article

Microbial, Chemical, and Radial Pollution of Freshwater in Iraq

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ABSTRACT

Water pollution in Iraq is a complex and multifaceted problem that encompasses various types of pollution, including microbial pollution, chemical pollution, and radiation pollution. These forms of contamination pose significant threats to the environment, public health, and the overall well-being of the Iraqi population. In this comprehensive article, we will explore the causes, consequences, and mitigation efforts related to microbial, chemical, and radiation pollution of water in Iraq.

Keywords: Chemical pollution**,** Freshwater, Iraq, Microbes, Radial pollution.

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1. INTRODUCTION

Iraq, known for its historical significance as the cradle of civilization, is today grappling with a modern environmental crisis of water pollution [1]. The Tigris and Euphrates rivers, which have sustained civilizations for thousands of years, are now under threat from a range of pollutants. The main sources of freshwater pollution in Iraq are industrial waste, agricultural runoff, sewage, and oil spills [2]. Industrial waste from factories, refineries, and other businesses is often dumped into rivers and streams without being treated. This waste can contain harmful chemicals, heavy metals, and other pollutants that can contaminate drinking water, harm aquatic life, and contribute to air pollution. Agricultural runoff from farms and irrigation systems can carry fertilizers, pesticides, and other chemicals into rivers and streams. These pollutants can also contaminate drinking water, harm aquatic life, and contribute to eutrophication, which is the excessive growth of algae and other plants in water bodies. Untreated sewage from homes and businesses is often dumped into rivers and streams [3]. This sewage can contain harmful bacteria, viruses, and parasites that can cause waterborne diseases such as cholera, typhoid, and dysentery. Oil spills from oilfields, pipelines, and tankers can also pollute freshwater resources [4]. Oil can harm aquatic life, contaminate drinking water, and damage shorelines. This issue is not only undermining Iraq's ecological balance but also threatening the health and livelihoods of its people.

2. MICROBIAL POLLUTION

2.1. Causes of Microbial Pollution

Microbial pollution of water sources in Iraq primarily arises from inadequate sanitation practices, wastewater disposal, and a lack of access to clean drinking water. Key contributors include inadequate sanitation facilities which a substantial portion of the population in Iraq lacks access to proper sanitation facilities, leading to the disposal of human waste in open areas or directly into water bodies. Wastewater from homes and industries is often discharged into rivers and streams without adequate treatment, resulting in the contamination of water sources with harmful pathogens such as *Escherichia coli* and other bacterial and viral infected agents [5]. Open defecation remains a problem in rural areas, further exacerbating microbial pollution as fecal matter is washed into rivers and groundwater during rainfall and that is responsible for the outbreak of different pathogens i.g. *Vibrio cholera.*

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Inadequate Water Treatment, Inefficient or outdated water treatment plants fail to adequately remove pathogens from drinking water supplies. The Conflict-Related Factors, ongoing conflicts, and displacement of populations disrupt sanitation infrastructure and exacerbate the spread of waterborne diseases.

2.2. Consequences of Microbial Pollution

Microbial pollution in Iraq has severe consequences for public health and the environment: i, Waterborne Diseases: Contaminated water sources are a breeding ground for waterborne diseases such as cholera, typhoid, hepatitis, and gastroenteritis [6]. These diseases lead to widespread illness and can be fatal, particularly among vulnerable populations. ii, Child Mortality: Waterborne diseases are a leading cause of child mortality in Iraq. Children are particularly vulnerable to these illnesses due to their weaker immune systems [7]. iii, Economic Impact: The high incidence of waterborne diseases places a heavy economic burden on the healthcare system and reduces workforce productivity. iv, Environmental Degradation: Microbial pollution affects aquatic ecosystems, disrupting the balance of microorganisms in water bodies and negatively impacting fish and other aquatic life [8].

3. CHEMICAL POLLUTION

3.1. Causes of Chemical Pollution

Chemical pollution of water in Iraq arises from various sources, including industrial activities, agriculture, and oil production. This issue represents a major problem in Iraq and the Middle East There are several causes of chemical pollution:
i, Industrial Discharges: Many industries in Iraq, including petrochemicals, manufacturing, and food processing, release chemical pollutants into nearby water bodies. These pollutants can include heavy metals, organic chemicals, and hazardous waste [9]. ii, Agricultural Runoff: The use of fertilizers, pesticides, and herbicides in agriculture results in runoff that contaminates rivers and streams with chemicals harmful to both the environment and human health [9]. iii, Oil Pollution: Iraq's significant oil production and transportation activities can lead to oil spills, leaks, and accidents, causing oil pollution in rivers and coastal areas. This pollution has devastating effects on aquatic ecosystems and water quality [10]. iv, Household Chemicals: Improper disposal of household chemicals and waste can introduce toxic substances into the water supply [9].v, Mining Activities: Mining operations can release heavy metals and other contaminants into nearby water sources, impacting both water quality and the health of surrounding communities [9].

3.2. Consequences of Chemical Pollution

Chemical pollution poses a range of ecological and public health threats in Iraq and the affected in different fields. The Ecological Impact is that chemical pollutants can disrupt aquatic ecosystems, leading to declines in fish populations, changes in species composition, and the proliferation of harmful algal blooms. These disruptions have cascading effects throughout the food chain [11]. Exposure to chemical pollutants in contaminated drinking water can lead to a range of health problems, including cancer, neurological disorders, and reproductive issues. Contaminated water sources can harm agriculture, reducing crop yields and affecting food security. Additionally, industries may face increased costs for water treatment and pollution abatement. Moreover, the persistence of certain chemical pollutants can lead to long-term, chronic health issues that may not manifest immediately, making them difficult to address [12].

4. RADIATION POLLUTION

4.1. Causes of Radiation Pollution

Pollution of radiation in Iraq primarily stems from the legacy of conflict-related activities, including the Gulf War and the Iraq War, and that basically comes from Depleted Uranium Munitions. The use of depleted uranium (DU) munitions during these conflicts has resulted in the dispersion of radioactive materials across Iraq. DU particles can contaminate soil and water, posing long-term radiation risks. Moreover, radiological accidents come from incidents and it is involving radiological materials, such as accidents at medical facilities or industrial sites, which can lead to radiation pollution if proper containment and safety measures are not in place. Furthermore, improper disposal of radioactive waste materials, whether from medical facilities, research institutions, or industrial processes, can contribute to radiation pollution [13].

4.2. Consequences of Radiation Pollution

Radiation pollution presents unique challenges and risks as attributed a Long-term Health Effects, exposure to ionizing radiation can have long-term health effects, including an increased risk of cancer, birth defects, and genetic mutations. These health risks persist for generations. Radiation pollution can lead to soil and water contamination, affecting ecosystems and potentially entering the food chain. Fear and uncertainty regarding radiation exposure can have psychological effects on affected communities, exacerbating health concerns. Cleanup and remediation of radiation pollution can be technically challenging and expensive, often requiring specialized expertise and resources [15].

5. EFFECTS TO MITIGATE WATER POLLUTION IN IRAQ

Efforts to address microbial, chemical, and radiation pollution in Iraq require a comprehensive and coordinated approach. Investment in modern water treatment facilities and improved sanitation infrastructure is crucial for providing clean drinking water and preventing microbial pollution. Strengthening and enforcing environmental regulations related to industrial discharge, agricultural practices, and waste management can help control chemical pollution. Efforts should be made to identify and remediate areas affected by radiation pollution. International assistance and cooperation may be necessary for complex cleanup operations. Promoting sustainable and environmentally friendly agricultural practices can reduce chemical pollution from fertilizers and pesticides. Education campaigns can raise awareness about the dangers of water pollution and promote responsible water use and waste disposal practices. The most important step is cooperation with neighboring countries is essential, especially when addressing cross-border pollution issues. Collaborative efforts can lead to shared solutions for transboundary water pollution.

6. CONCLUSION

Water pollution in Iraq, whether from microbial contamination, chemical pollutants, or radiation pollution, poses grave threats to public health, the environment, and economic stability. Addressing these challenges requires concerted efforts from the Iraqi government, international organizations, and the global

community. A multifaceted approach that includes improving infrastructure, strengthening regulations, promoting sustainable practices, and raising public awareness is essential to mitigate the devastating impacts of water pollution on Iraq and its people.

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Conflict of interest
The authors declare that they have no conflict of interests.

Ethical Approval

This review was approved by the Academic Committee of the Ministry of Education, Baghdad, Iraq (No 304, 2019).

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