

Review on Water Pollution in Pakistan

Aqsa Ramzan*

Department of Earth and Environmental Sciences, University of the Punjab, Lahore, Pakistan

Abstract

Water pollution with pathogenic microorganisms is one of the serious threats to human health, particularly in developing countries. The main objective of this article is to highlight microbial contamination of drinking water, the major factors responsible for microbial contamination, and the resulting health problems in Pakistan. Furthermore, this study will be helpful for researchers and administrative agencies to initiate relevant studies and develop new policies to protect further deterioration of water supply with pathogenic microbes and ensure clean and safe drinking water to the public in Pakistan. In Pakistan, water at the source, in the distribution network, and at the consumer tap is heavily polluted with coliforms and fecal coliforms all over the country. Improper disposal of industrial and municipal wastes is the most important factor responsible for water pollution in the country followed by cross-contamination due to old and leaking pipes. There is an urgent need for emergency steps to stop further deterioration of water quality and improve the existing water quality so as to protect the public from widespread waterborne diseases.

Keywords: Coliform • Fecal coliform • Public health • Waterborne diseases • Water pollution

Introduction

Water pollution is the pollution of bodies of water such as lakes, rivers, seas, oceans as well as ground water. It occurs when pollutants reach these bodies of water without treatment. Wastes from homes, factories and other buildings get into water bodies and as a result water gets contaminated. In such issues, water pollution is an important and essential issue in the world which requires ongoing evaluation and revision. Water is considered to be safe if it has no significant health risk over lifetime consumption [1]. Unfortunately, many people in the world are deprived of this basic need.

Pakistan has been blessed by nature with enough surface and groundwater resources. Industrialization, urbanization, and rapid population growth have placed huge stress on water resources [1].

Literature Review

Water has a vital role in our life processes including growth and development. It plays significant role in our every field of life [2]. Due to technological developments, drinking water may contain various impurities, which are of physical, biological, and chemical nature. The most dangerous impurity is of biological nature, which causes human health problems or cause death [3]. Various impurities in the form of nutrient and microorganisms are transported from one place to another [4]. Water pollution occurs when microorganisms and toxic chemicals from domestic waste and industries either come in contact with water bodies or run off or leach into ground water or freshwater resources [5]. In Pakistan, drinking water sanitation system and drainage lines run in parallel, which causes leakages and intermixing result in deterioration of water quality [6]. The utilization of poor quality water causes waterborne diseases and their spread. In Pakistan, about 50% of diseases and 40% of deaths occur due to poor drinking water quality. In 1999, Faisalabad required about 64.7 million gallons of drinking water supply daily to fulfill needs. As a result, a

*Address for Correspondence: Aqsa Ramzan, Department of Earth and Environmental Sciences, School of University of the Punjab, Lahore, Pakistan; Email: aqsarani899@gmail.com

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great majority of the population in the country is deprived of safe drinking water. National statistics reveal that 56% of the total population in Pakistan has access to safe drinking water, but in rural areas safe water is hardly available to 45% of the population [7]. Other statistics reveal that 70% of the rural population in Pakistan has no access to safe water, while in urban areas only 40%-60% of the people have access to potable water (Amin et al. 2012). The aim of this review article is to summarize and highlight microbial water pollution in different regions of Pakistan with a detailed emphasis on its causes sources, and consequent health risks. Human health is adversely affected by various agents like pathogens, bacteria, various minerals, and organic substances that are present in unsafe drinking water. A significant proportion of population in developing countries is suffering from health-related issues due to unsafe drinking water and microbial contamination [8]. It is estimated that, in Pakistan, 30% of all diseases and 40% of all deaths are due to poor water quality [9].

In Pakistan, water quality in most of the cities is decreasing quickly. The major cause of decreasing water quality is the ground water supply. According to [8] the number of diarrheal cases that are registered in Pakistan each year is about one hundred million. According to Tahir et al. [10] above eighty thousand cases related to waterborne diseases were noted in healthcare units only in Rawalpindi. 20%-40% of hospitals of Pakistan are filled with people that are suffering from waterborne illness, according to United Nation International Children Emergency Fund (UNICEF). Diseases such as cholera, typhoid, dysentery, hepatitis, giardiasis, and cryptosporidiosis and guinea worm infections represent about 80% (including diseases due to sanitation problem) of all diseases and are responsible for 33% deaths.

Sources of water contamination

Microbiological contaminants: In Pakistan, microbial pollution has been discovered as one of the serious problems in rural as well as urban areas. This is due to the leakage of pipe, pollution from sewage lines intrusion into drinking water supplies, and so forth.

Chemical contaminants: Chemical contaminants come from industries, soil sediments, and runoff from agriculture, that is, pesticides and fertilizers, and enter into water resources. In Pakistan, the application of fertilizer and pesticides is, respectively, about 5.6 million tons and 70 thousand tons according to Gross Operating Profit (GOP). These chemicals, commonly insecticides, leach into ground water resources by mixing with irrigated and rain water. During 1988-2000, about 107 samples were collected from ground water and 31 samples indicated pesticide contamination that was clearly beyond the Food and Agriculture Organization (FAO) and WHO permissible limits. In Pakistan, another important trouble with ground water is highest concentration of salts, which is mainly due to irrigation, soil salts dissolution, sea water encroachment, and chemical industries. Salinity impacts the major areas of Baluchistan, KP, and Punjab (Figure 1).

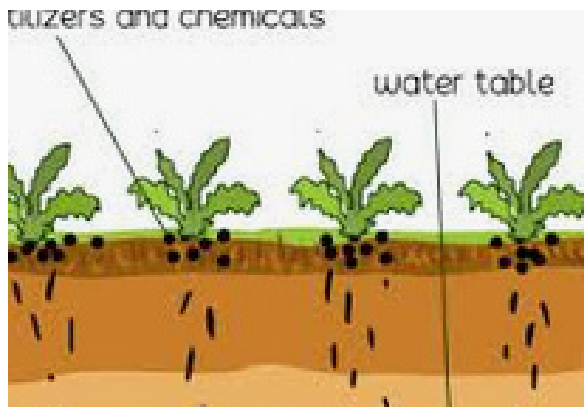


Figure 1. Water Pollution due to Chemicals.

Floods cause major damage to drainage system

In Pakistan, floods have been creating great environmental problems. They damage drains and ultimately cause spillage of sewage water into water bodies. Severe flooding destroys buildings and standing crops. All these may cause release of toxic chemicals and oil into river, streams, and lakes, and so forth and may lead to death of aquatic life. A lot of chemical contaminants mix with flood water on its way. The current severe flood (2010) and heavy rains damaged 80% of Nowshera, devastating 40% of infrastructure. The total destroyed and damaged houses were in the range of 10,000 and 40,000, respectively [11].

Discussion

Water quality status in provinces of Pakistan

Water quality status in Punjab: Faisalabad is known as polluted industrial city due to the inadequate treatment facilities. The microbial analysis showed that all samples were contaminated with total coliforms and *E. coli* [12]. Bacteria were also found in water samples which showed fecal contamination. All these analyses indicate that water is not fit for drinking purposes [13].

Drinking water quality test carried out in twelve districts of Punjab showed that microbial and heavy metal (arsenic) were major contamination found in all districts. At least 45% of the samples of Kasur district were found to be contaminated with microbes. About 73%, 100%, 64%, 94%, 100%, and 88% of drinking water samples of Sheikhpura, Lahore, Gujranwala, Multan, Kasur, and Bahawalpur were highly contaminated with arsenic. Total Dissolved Solids (TDS) were found above the permissible limits in Sargodha, Sheikhpura, Kasur, Faisalabad, and Rawalpindi [14]. The poor drainage system and improper waste dumping in villages of Pakistan are the main source of drinking water contamination.

Water quality status in Khyber Pakhtunkhwa (KPk): Water samples were collected from tube wells and storage tanks to determine the drinking water quality in rural areas of Peshawar. Results indicated that 47% of the samples were found to be highly contaminated with *E. coli* [12]. Magnesium was higher than critical level [15]. In districts Bannu and Haripur, physicochemical and microbial analyses of various portable water samples indicated that the water quality was poor [16]. The analysis of heavy metal contamination in drinking water of urban as well as rural areas of Peshawar described that the drinking water was highly contaminated with Pb and Cd. However, the concentrations of As, Cu, Co, Hg, Ni, and Zn were significantly higher than WHO limits making water unfit for drinking purpose. The samples of drinking water collected from various reservoirs (streams, tube wells, and water storage tanks) in Kohat (KP) showed that samples collected from tube wells in Shakarda, Ara Khail, and Lachi were found to be safe for drinking but storage tanks and wells were highly contaminated.

Water quality status in Baluchistan: Biological and chemical water

quality of Baluchistan are not satisfactory as revealed by various studies. In four cities of Baluchistan, that is, Ziarat, Loralai, Quetta, and Khuzdar, the water quality was badly contaminated with microorganisms making water unfit for human use. Water samples of these cities showed that NO₃ concentration was higher than the recommended limits of WHO. About 50% of water samples, collected from Ziarat, were found highly contaminated with NO₃ [17]. The drinking water quality of Quetta was inadequate having bad taste, foul smell/odor, change in appearance [18]. The surface and groundwater sources of drinking water throughout Baluchistan were highly contaminated with coliforms, heavy metals, and pesticides [19,20].

Water quality status in Sindh: The drinking water quality of Khairpur, Sindh, showed high level coliform and fecal coliform contamination in drinking water at different points; therefore, it is not suitable for drinking purpose. It is evident from the results that the quality of drinking water is further deteriorated in the distribution system which may be due to the leakage of pipes where sewage water enters into the municipal water. The ground water of different villages in district Khairpur, Sindh, was analyzed for drinking and irrigation purposes, water was not fit for drinking as well as for irrigation purposes [21]. The ground water quality of various districts in Sindh showed that the pH of water samples was within limits of WHO [22].

Water shortage is a major issue in Karachi city, which is worse in slum areas having poor infrastructure and limited facilities. The physicochemical analysis of drinking water supply lines in Orangi Town, Karachi, showed that all samples were highly contaminated with total coliform, fecal coliform, and *E. coli*.

Drinking water quality of the Sindh province is also poor as that of other provinces. About 67%-93% of samples collected from different locations in three main cities, that is, Sukkur, Hyderabad, and Karachi, showed that water is unsafe for drinking purposes due to microbial and chemical contamination [12].

Human health impacts

Due to the poor sanitation system, treatment, and monitoring, drinking water quality deteriorates. The presence of toxic chemicals and bacteria in drinking water causes adverse effect on human health. Due to the fecal contamination, people have been suffering from waterborne diseases. In rural and urban areas of Pakistan, cases of waterborne diseases, typhoid, dysentery, cholera, and hepatitis are systematically reported. However, it is very difficult to properly quantify the danger due to several reasons. They include underreporting of diseases and poor record maintenance in healthcare centers and hospitals related to diseases caused by poor water quality.

Several studies have reported health-related problems due to poor drinking water quality. For example, the concentration of nitrate (NO₃) was found above the permissible limits causing blue baby syndrome in bottle fed babies. In Peshawar, most of water samples were found to be contaminated with coliform bacteria. In Rawalpindi, the gastroenteritis was reported in 2000; the contaminated water was the source. In Karachi, it was also found that the drinking water samples were heavily contaminated with total and fecal coliform. In Islamabad and Rawalpindi, 4000 cases of hepatitis were registered and were due to unfit drinking water and improper treatment. Pathogens present in drinking water including many viral, bacterial, and protozoan agents caused 2.5 million deaths from endemic diarrheal disease each year.

Management strategies

Some recommendations are made here which may help to control and minimize the problem of microbial water pollution in Pakistan. Proper filtration and disinfection of public water should be ensured before distribution, and quality of public water must be regularly monitored. The old and rusty pipelines of water distribution networks must be replaced. Water supply and sewerage pipe networks should be separated and placed at proper distance from each other to avoid cross-contamination. Industries should be forced to properly treat their waste-waters before discharging and

follow the NEQS for waste effluents. Proper sewage collecting systems and treatment plants must be installed for municipal wastewater in all big cities of the country. Public awareness programs about the importance of clean and safe water should be launched. Educational institutes, mosques as well as print and electronic media could be used for this purpose.

Awareness among the public for water treatment at home, for example by boiling or using other HWT techniques, will be helpful in reducing waterborne diseases. Environmental laws of the country must be strictly implemented with no compromise on the quality of public water. Proper budget should be allocated for improving public water, and priorities and policies toward improving water quality should be revised. Per budget should be allocated for improving public water, and priorities and policies toward improving water quality should be revised.

Conclusion

In Pakistan, drinking water at the source, in the distribution network, and at the consumer end is mostly contaminated with total coliforms and fecal coliforms beyond the WHO standards. Improper disposal of industrial and municipal wastes, poor sanitary and drinking water supply systems, and lack of water filtration and disinfection practices are the major causes of microbial contamination of drinking water in the country. Weak implementation of environmental laws and lack of public awareness further aggravate the problem. Waterborne diseases are very frequent in the country, but lack of proper diagnosis and maintenance of records at hospitals and clinics is a hindrance in knowing the exact burden of water-linked diseases. There is an urgent need for emergency steps to stop further deterioration of water quality and improve the existing quality so as to protect the public from widespread waterborne diseases.

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