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A Review on Arsenic Contamination in Water in Different Cities of Punjab

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Abstract

Drinking water is being declined rapidly due to excessive industrialization that leads to the detrimental effects on the quality of water in different cities of Punjab, Pakistan after taking into account the chemical properties and the incidence of heavy metals and microbes. About 80% of the population of Pakistan is oppressed to consume unclean and contaminated drinking water due to shortage of clean water reservoirs.. However the normal level of arsenic should be 0.010 mg/L. Due to its high mobility and speciation it causes arsenicosis disease. The paper also critically reviews the arsenic led human health risks, its uptake, metabolism, and toxicity mechanisms. It focus on drinking water quality in different cities of Punjab, sources of contamination, public health situation, and effects of hazardous drinking water on humans. A number of studies reported and stated arsenic concentrations in Gujranwala (0.94 mg/L), Lahore (179 mg/L), Mailsi (0.39 mg/L), Multan (1000 mg/L), Muzaffargarh (400 mg/L), Sehwan (60.2 mg/L), andTharparker (0.002 mg/L).

Keywords: Water; Purity; Microbes; Arsenic

Introduction

Due to alarming upsurge in population and fast industrialization, consumption of drinking water quality is being declined in Pakistan. Approximately 20% of the entire inhabitants of Pakistan has access to safe and clean drinking water [1]. The residual 80% of population is obligatory to use hazardous drinking water due to the insufficiency of clean and healthy drinking water springs. The chief cause of contamination is sewerage (fecal) which is broadly settled into drinking water system supplies. Subordinate basis of contamination is the removal of toxic substances from manufacturing run-offs, insecticides, heavy metals such as Arsenic and Chromium and fertilizers from agronomy sources into the water reservoirs. Human actions cause riverine and waterborne ailments that consists approximately 80% of all sicknesses and are responsible for 33% of deaths. This review highlights the arsenic contamination in drinking water in Punjab, water quality parameters, different sources of contamination, effects of arsenic on human health and its control. There is abrupt need to take preventive actions and treatment skills to overwhelmed unclean condition of drinking water supplies in different areas of Pakistan. Arsenic (As) is major concern for human health due to its presence in ground water that is used for drinking purpose [2].

Water an Essential Component of Life

Water is considered to be an economical and financial developmental indicator and vital constituent to withstand all life processes. It has a lot of beneficial uses as it regulates all biochemical and natural reactions in our body [3]. Fresh water comprises of 3% of the entire water on earth whereas a small quantity is utilized by humans [4].

Water resources diminished slowly and put on adverse effects on life due to its insufficiency. Its maximum amount is utilized by industries and agricultural purposes [1-3]. Current information from UNICEF and WHO have exposed that about 748 million people around the world do not have access to safe and clean water and over 2.5 billion people suffering from short water supply [5]. About 2.5% of the Earth's water resources is fresh water and about 30% of the fresh water is present as groundwater [6].The small percentage of fresh water is due to a massive growth of unmanageable consumption of water in agricultural sectors, domestic and industrial usage.

Growth in population and increasing in urbanization threatens water resources. Problem is devastating in developing countries due to lack of economy [1-5]. Almost 780 million people do not have access to clean and safe drinking water as compared to the 6.6 billion people in year 2000 [5,6]. It was reported from the survey in 2011 that about two thirds of the world population and under developed countries suffering from severe water shortage in 2025 [7].

Pakistan is fortunate in the manner that it is gifted with sufficient ground water and surface water resources. Urbanization, industrialization and increase in population development have positioned huge pressure on water resources [8]. Water has an essential role in our life coursesand processes

including growth and development. It plays a significant rolein our every field of life [9].

Ground water is an essential freshwater resource in Pakistan. It is important due to its ever growing demand in different purposes such as agriculture, domestic, and industrial uses. Maximum area of Pakistan is located in the dry and parched climate zone, where the normal rainfall is below 200 mm per annum and the accessibility of groundwater is inadequate [10].

Irrigated areas of Indus Basin are major groundwater resources of Pakistan. Instead of drinking clean and fresh water, people consume brackish water in some drought affected regions of Pakistan [11]. Irrigation in water reservoirs results in an increase in water level. One of themajor problem in different areas of Indus is waterlogging and salinization of groundwater [12-13]. Drinking water isonly available to 25.61% the population [14].

Studies on ground water reported that major cause of poor quality of water are high quantity of biological contaminant these includes organic wastes, heavy metals and considered them as hazardous for human health [15].

The substitute for clean water is accessible in the kind of bottled water, which is also not consistent. It is estimated that 11 brands from a total of about 109 provided unsafe, unclean and contaminated water for drinking purposes that was badly contaminated with microbes, chemicals and bacteria's that was examined in a surveying study about the drinking water quality of changed bottled water products and brands available in Pakistan [18]. Approximately, 70% of the present international groundwater is used for agricultural reasons [19]. Pakistan is an agricultural country and it is necessary for it to maximize its food production, thus it needs large quantity ofgroundwater [17-19].

Therefore, the chief use of groundwater in Pakistan is for irrigation of agricultural crops and other agricultural practices [20]. Due to anthropogenic extraction of ground water resources for industrial usage, the world groundwater removal reached to 982 km3 in 2010 [22]. Pakistan is listed in those countries that face ground water scarcity [23].

Water quality parameters

Drinking water should be colorless, odorless, having no turbidity and microbes. Human beings obtain water for drinking purposes from the external surface or from underground water such as rivers and canals. The quality of surface water is minimized speedily day by day due to the accumulation of agricultural runoff, man-made activities and industrial sewerages into these water sources [24].

River water at its highest wave action contains a large amount of solid suspended wastes. A maximum number of aquatic species and humans do not tolerate these pollutants and do not consume. Thus, there is a need to clear these sources for anthropogenic usage. Four major cities of Pakistan are listed that depends upon surface water for drinking purposes. It is estimated that nearly 70% of drinking water comes from aquifers [25].

Water logging of brackish water results in the decline in groundwater as well as freshwater. Ground water in Pakistan is saline and brackish but rivers and fresh water do not have this type of water. Water quality parameters are examined by the source and place of water from which it is collected and the state of water supply lines. There are a large number of areas in Pakistan in which people depend upon saline water for drinking purpose due to the unavailability of fresh and clean water sources [26].

One of the most important reason of bacteriological contamination is the mixing of drinking water with sewerage lines. It is estimated that there are a lot of rural areas of Pakistan that consume surface water after chlorination and filtration that is not done at fixed filtration stations. This water shortage is due to bacteriological contamination and poor water quality. Hand pumps and wells are not considered safe from surface runoff and flooding [27].

Industrial development increases pressure on water resources and causes waste water to enter into the ground water and fresh water to deteriorate its quality [28].

Water Quality Statusin Different Cities of Punjab, Pakistan

Arsenic is a major carcinogenic contaminant which is a source of number of cancers such as cancers of skin, liver, lungs, bladder, and kidney [29]. Asian countries were examined to have more arsenic contamination noteworthy in Bangladesh, China, India, Myanmar, Nepal, Pakistan, and Vietnam [30].

Discussion

Arsenic is a major carcinogenic contaminant which is a source of number of cancers such as cancers of skin, liver, lungs, bladder, and kidney. Asian countries were examined to have more arsenic contamination noteworthy in Bangladesh, China, India, Myanmar, Nepal, Pakistan, and Vietnam.

Conclusion

The review is conducted to explain arsenic contamination in different cities of Punjab, Pakistan. It summarizes the understanding of incidence, basis and distribution pattern of arsenic. It emphasizes on different sources such as anthropogenic and natural sources as a major cause of arsenic elevation in surface and groundwater with respect to its mobilization pattern in groundwater. It explain the epidemiology and some mechanisms of toxicity of arsenic in humans and in pregnant women. Various control and mitigative measures of chemical and biochemical nature based on different technologies are discussed for the removal of arsenic. Some common prevailing technologies for removal of arsenic includes oxidation, coagulation- flocculation, membrane techniques and the direct removal of AsV or converting AsIII to AsV followed by removal of AsV. Public awareness is equally important to prevent its contamination. Government should have to examine and take notice to observe industrial and agricultural activities that leads

to arsenic pollution. Increase in the frequency of sampling and analysis from industrial plants should be taken by the supervision departments. There is an instant need to take protective actions and handling machineries to overwhelmed unclean condition of drinking water supplies in different areas of Pakistan.

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