Water pollution in Uzbekistan: a short review

Alimov Atabek PhD student

National University of Uzbekistan named after Mirzo Ulugbek

alimovatabek480@gmail.com

DOI 10.66073/ReFocus-Conf/1610013

For citation: Alimov Atabek. Water pollution in Uzbekistan: a short review. In: Development of innovative climate-resilient technologies for monitoring and controlling water use efficiency and the impact of salinization on crop productivity and livelihoods in the Aral Sea region: Proceedings of the International Scientific and Practical Conference. Nukus, 2026. P. 61–63. DOI: 10.66073/ReFocus-Conf/1610013

Abstract. This paper presents the current status of water pollution levels in Uzbekistan. The latest papers regarding water pollution were downloaded from the Scopus database. Their main findings were meticulously analyzed. According to the findings of the research, the major rivers, including the Chirchik, Akhangaran, Sokh, Chodaksay, Govasay, Kasansay, Chartaksay, and Andizhansay rivers in the Tashkent region and the Ferghana valley, exhibited elevated levels of water pollution, mainly resulting from industrial activities. The water quality has also deteriorated in the territory of the Republic of Karakalpakstan due to its downstream location and arid climate, posing serious threats to human health. This study underscores the urgency of implementing water-saving technologies and restricting human impacts while maintaining the industrial activities.

Keywords: Water, Water pollution, Uzbekistan, Amu Darya, Syr Darya, human activities.

Introduction

Water is one of the most essential resources for sustaining life on Earth, covering roughly 71% of the surface of the planet. It is the fundamental building block for all biological, ecological, and societal functions. Despite its utmost importance, water is subject to contamination, pollution, and degradation. Changing climate patterns and increasing human activities seriously affect water quantity and quality, leading to its long-term degradation. Especially, water quality deterioration and pollution with chemical substances is a serious environmental issue in developing countries like Uzbekistan, which leads to severe health consequences.

Uzbekistan, a doubly landlocked country, is located in the heartland of the Eurasian continent. With about 75% to 80% of its territory consisting of desert and semi-arid plains, Uzbekistan lacks natural fresh water resources. Its main source of water is supplied by two major rivers in Central Asia, the Amu Darya and Syr Darya. These two rivers, often called the lifelines of Central Asia, are transboundary rivers, crossing Afghanistan, Tajikistan, Uzbekistan, Kazakhstan, and Turkmenistan, supplying water for irrigation, agriculture, industry and the population. However, these rivers are facing unprecedented pressure and challenges from climate change associated decreased water availability. Also, their quality is significantly deteriorating. Therefore, it is essential to assess their quality for sustainable use and distribution.

Materials and methods

For this study, the Scopus database was used as the primary source of scientific literature. The keywords “water pollution” and “Uzbekistan” were entered into the Scopus search panel. Eight recent open-access articles on water pollution, published in Scopus-indexed journals, were identified and selected for detailed review. The main findings and key conclusions of these studies are presented and discussed in the “Results and Discussion” section.

Results and discussion

Water is a critical resource for Uzbekistan since the vast majority of water comes from transboundary rivers, the Amu Darya and Syr Darya rivers. In the context of climate change and increasing water scarcity, the country faces severe ecological problems, with the pollution of water resources being one of the most critical challenges. In particular, water pollution deriving from agricultural runoff, industrial waste, untreated sewage water and wastewater discharge into open water bodies remains a pressing environmental issue, posing major risks to human health and well-being. Water bodies, particularly rivers and canals flowing through industrialized zones, are often exposed to pollution by heavy metals and other potentially toxic elements, while, in farming-dominant areas, agricultural runoff is the primary source of contamination with nutrients (N, P), pesticides, and sediments.

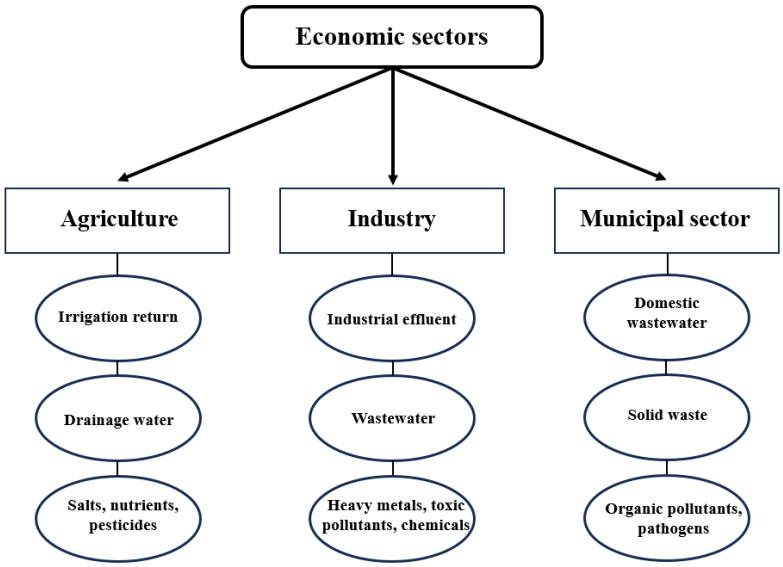


Figure 1. Overall scheme of water pollution in Uzbekistan.

Recent studies conducted in a highly industrialized zone of Uzbekistan, the Tashkent region, indicate that the Chirchik and Akhangaran rivers are both polluted with heavy metals, with the former presenting low to moderate contamination levels (Li, Be, Co, Ni, Sb, V, and Cr) and the latter exhibiting moderate to high contamination (Cu, Zn, Mo, Cd, Tl, Pb, and As) [1]. In addition, critical Polycyclic Aromatic Hydrocarbons (PAHs) concentrations near a power plant and a metal mine and metallurgical complex, Organochlorine Pesticides (OCPs), including DDT and Chlorobenzenes, and high concentrations of Polychlorinated Biphenyls (PCBs) near Tashkent city have been detected [2]. River pollution with microplastics is also a growing issue, specifically in the Ferghana province, where the Sokh, Chodaksay, Govasay, Kasansay, Chartaksay, and Andizhansay rivers present microplastic pollution with a diameter of 0.15–5 mm in water [3]. Similarly, the Samarkand and Navoi provinces exhibit the very existence of microplastic pollution, with the particles ranging from 0.15 to 3.00 mm in the Zarafshan River [4]. The microplastics detected in these studies are mainly polyethylene terephthalate originating from industrial activities and local anthropogenic factors. The rapid desiccation of the Aral Sea, the fourth largest lake in the world, has led to the emergence of multiple ecological disasters and problems, which pose a serious health risk to local people living in the region. The excessive application of organochlorine pesticides, including aldrin, lindane (γ-hexachlorocyclohexane), and dichlorodiphenyltrichloroethane, in order to increase cotton production capacity has further escalated local salinity in soil and water. Especially, the population in the Republic of Karakalpakstan has become subjected to severe chronic illness, with anemia, kidney and liver disease, respiratory infections, allergies, and cancer being widespread especially among women and children. Drinking water is highly saline, with salinity levels being six times greater than World

DOI 10.66073/ReFocus-Conf/1610013

Health Organization standards [5]. The scarcity or lack of fresh water often compels communities to use groundwater as a primary source of drinking water. However, groundwater is also contaminated by agricultural fertilization. For instance, a recent study on assessing groundwater quality in the Amudarya district of Karakalpakstan found the groundwater (10-25 m deep) to be fair (according to the Canadian Council of Ministers of the Environment Water Quality Index (CCME WQI) model), and unsuitable for drinking since certain parameters, including Total dissolved solids (TDS) and chloride (Cl), did not align with international and local standards [6]. Similarly, the Amu Darya River water exhibits higher mineralization levels in the territory of Karakalpakstan, reaching up to 2700 milliliter gram per liter, thus making it unsuitable for drinking [7]. This is because untreated industrial and domestic wastewater discharges into the Amu Darya River from settlements on the upper and middle stream areas contribute to its mineralization, leading to higher concentration in the lower part of the river [8].

In conclusion, in Uzbekistan, pollutants mainly originate from industrial activities and agricultural fertilization entering water bodies, rivers, lakes, and ponds, and directly affecting water consumers. Therefore, it is necessary to conduct regular water quality assessments, especially in downstream areas such as the Republic of Karakalpakstan.

Conclusion

Water pollution is becoming a serious problem, affecting water quality and human health worldwide. In this study, the water pollution problem in Uzbekistan was assessed using the Scopus database. The papers that present water pollution and associated problems were downloaded from the Scopus database. According to the findings of these studies, the rivers located in the Tashkent and Navoi regions and the Ferghana valley demonstrate increased levels of pollution and contamination from industrial activities. Meanwhile, the Republic of Karakalpakstan exhibits limited water availability and river water deterioration. It was also found that water quality monitoring stations are limited and unevenly distributed. Therefore, it is recommended first to install newly-equipped monitoring stations and constantly monitor water quality while sustaining agricultural development.

References

1. Fornasaro, S. et al. (2025). Geochemistry and risk assessment of potentially toxic elements in surface river sediments (Chirchik-Akhangaran basin, Uzbekistan). Environmental Geochemistry and Health, 47(4), 127. https://doi.org/10.1007/s10653-025-02441-9
2. Tomei, A. et al. (2025). Legacy, distribution and risk assessment of persistent organic pollutants in river sediments in a mixed sources area. Water Air & Soil Pollution, 237(3). https://doi.org/10.1007/s11270-025-08737-x
3. Khusanov, A. et al. (2025). Characteristics of microplastic pollution in the rivers of the Fergana Valley, Central Asia. Environmental Monitoring and Assessment, 197(8), 896. https://doi.org/10.1007/s10661-025-14351-5
4. Khusanov, A. et al. (2025). Microplastic pollution of the Zrafshan river tributary in Samarkand and Navoi regions of the Republic of Uzbekistan. Green Analytical Chemistry, 12, 100200. https://doi.org/10.1016/j.greeac.2024.100200
5. Bartrem, C. et al. (2025). Organochlorine Pesticides and Salinity in Karakalpakstan, Uzbekistan: Environmental Health Risks Associated with the Aral Sea Crisis. International Journal of Environmental Research and Public Health, 22(11), 1751. https://doi.org/10.3390/ijerph22111751
6. Rajabova, N. et al. (2025). An Assessment of Collector-Drainage Water and Groundwater—An application of CCME WQI model. Water, 17(15), 2191. https://doi.org/10.3390/w17152191
7. Crosa, G. et al. (2006). Spatial and seasonal variations in the water quality of the Amu Darya River (Central Asia). Water Research, 40(11), 2237–2245. https://doi.org/10.1016/j.watres.2006.04.004
8. Sadikova, U. et al. (2023). River water quality Amudarya in territory of Karakalpakstan. E3S Web of Conferences, 401, 02008. https://doi.org/10.1051/e3sconf/202340102008

DOI 10.66073/ReFocus-Conf/1610013