

**Note: Reference may contain copyrighted material
and is therefore not published in its entirety.**

Exploring the Adverse Effects of Arsenic-contaminated Water on Fish Health and Ecosystem: A Comprehensive Study

Mahipal Singh Sankhla ^{1,2*}, Vaibhav Sharma ³, Divyansh Jain ³, Varad Nagar ⁴,
Vinay Aseri ⁵, Abhishek R. Rai ³, Kumud Kant Awasthi ⁶, Garima Awasthi ⁶

¹ Department of Forensic Science, Chandigarh University, Gharuan, Mohali, Punjab, India

² University Center for Research and Development (UCRD), Chandigarh University, Gharuan, Mohali, Punjab, India

³ Department of Forensic Science, Vivekananda Global University, Jaipur, Rajasthan, India

⁴ Department of Forensic Science, Banaras Hindu University, Varanasi, India

⁵ School of Forensics, Risk Management and National Security, Rashtriya Raksha University, Gujarat, India

⁶ Department of Life Sciences, Vivekananda Global University, Jaipur, Rajasthan, India

* Correspondence: mahi4n6@gmail.com (M.S.S.);

Scopus Author ID 57219964786

Received: 16.03.2023; Accepted: 29.04.2023; Published: 30.06.2024

Abstract: Arsenic (As) is commonly encountered in diverse water sources, such as saltwater, hot springs, wells, rivers, and lakes, with arsenate species prevalent in aquatic settings. Regrettably, anthropogenic activities, such as using arsenic-containing pesticides, industrial practices, and mining operations, have given rise to soluble As concentrations surpassing the acceptable threshold of 0.010 mg/L globally. The recurrent exposure of freshwater species, particularly fish, to low As levels triggers bioaccumulation, especially in the liver and kidneys, leading to hyperglycemia, enzyme activity loss, acute and chronic toxicities, and immune system malfunction. Exposure to elevated As concentrations from water or air pollution can result in short-term or long-term repercussions, including immune system toxicity and cytotoxicity in fish.

Keywords: arsenic; toxicity; fish; aquaculture.

© 2024 by the authors. This article is an open-access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

Arsenic (As) is an element with metalloid properties that can be found in large quantities in aquatic environments due to natural and human activities. It poses a significant threat to public health as a major environmental pollutant, with a high risk of human poisoning. As a result, it is a matter of concern for public health officials worldwide [1,2]. Various studies on the toxicity of arsenic in different species have revealed that inorganic forms of arsenic are highly toxic, while organo-arsenicals have lower toxicity levels [3,4]. Trivalent inorganic arsenic is considered the most poisonous among them [5,6]. Arsenic significantly impacts organs involved in absorption, accumulation, and excretion, such as the gastrointestinal tract, circulatory system, skin, liver, and kidneys. Fish, in particular, are vulnerable to the effects of arsenic, as it can impact their hematological, biochemical, and ionoregulatory parameters. Therefore, fish are often used as biomonitoring sentinels to study the effects of pollution on aquatic ecosystems [7,8]. According to [9], fish is a good model organism for studying the impacts of pollution on aquatic ecosystems. Because fish are sensitive to arsenic poisoning, fish have long been employed as biomonitoring sentinels for contaminants in aquatic