

Determination of Arsenic Concentration in Groundwater from Chhuria Block, Rajnandgaon District (C.G.)

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Abstract: Water pollution represents a significant and pressing concern on a global scale, primarily due to the fact that the availability of uncontaminated and pristine water is absolutely crucial for the sustenance and well-being of all living organisms, including humans, animals, and plants alike. The absence of uncontaminated water can precipitate a multitude of serious health hazards, one of which includes an increased risk of developing cancer in the human population, particularly as water sources become tainted with toxic substances such as arsenic, which is notorious for its detrimental effects on human health. The phenomenon of arsenic contamination in water resources is predominantly a consequence of anthropogenic activities, compounded by factors such as rapid population growth, extensive industrialization, alongside various natural elements that contribute to this environmental dilemma. This research paper embarks on a comprehensive examination of the levels of arsenic present in the water sourced from five distinct villages located within the Chhuriya block of the Rajnandgaon district, aiming to provide a thorough analysis of this critical issue. In total, a systematic collection of 50 water samples was executed, focusing on groundwater sources, including but not limited to hand pumps and bore wells, and the concentration levels of arsenic were accurately quantified utilizing the method of Atomic Absorption Spectroscopy (AAS), a widely recognized and reliable analytical technique.

Keywords: Arsenic, Chhuria, Contamination, Ground water, Heavy metals.

Introduction:

Drinking water is considered a basic human right for every individual (WHO 2004, Khokhar et al., 2023). Evaluating and predicting the quality of water management are crucial points for water resource management (Yadav et al., 2002; Mijares et al., 2019). The increasing industrialization worldwide has heightened concerns about water pollution, with industrialization often leading to heavy metal contamination in water. The primary causes of this are anthropogenic waste and toxic garbage (Gad et al., 2023). These pollutants adversely affect human health as they are found in surface and groundwater, with

groundwater being essential for human use due to its abundance and high quality (Nguyen et al., 2023). Heavy metals can disrupt various organs in the human body, potentially leading to cancers and other diseases.

According to WHO, approximately 1.8 billion people worldwide consume contaminated water, exposing them to the risk of heavy metal exposure (Kumar et al., 2023; Aren et al., 2015). These heavy metals may include arsenic, lead, cadmium, iron, chromium, etc. Arsenic, in particular, is known to be toxic and can affect the skin (Luqueno et al., 2013), and has been linked to cancers of the skin, lungs, urinary bladder, and kidneys (IARC 2004; Mahwish Rani et al., 2016). Although arsenic is a natural component in the environment, it is not beneficial to humans and acts as a toxin (Morais et al., 2012; Draghici et al., 2010; Vieira et al., 2011, ATSR 2023a, 2023b & Sharma et al., 2021).

In India, due to disruptions in the water supply system, 90% of the rural and 30% of the urban population rely on surface water for domestic use (Wagh et al., 2018; Jaishwal et al., 2003; Pandey, C and Mishra, Alka, 2024). Some areas in the Ambagarh region of Chhattisgarh have shown the presence of arsenic (Patel et al., 2005, 2015; Acharya et al., 2005; Kumar et al., 2018; Singhal et al., 2018). This paper presents a general investigation of arsenic in groundwater in five villages of the Churriya block, which is adjacent to the Ambagarh Chowki block in the Rajnandgaon district.

Study Area: Groundwater is the main drinking water source in the village of Rajnandgaon district of Chhattisgarh. Samples were collected from five villages in this Chhuriyablock (Latitude 20.63934 and Longitude 80.73706): Patekohera, Chhuriya, Pandetola, Matekheda, and Keshal.

Material and method:

Sample collection:

Groundwater samples were collected from hand pumps and bore wells in the study area in April 2023. The samples were collected from five villages in the block, with 10 samples taken from different locations in each village. The samples were collected from areas where people most frequently use the ground water. To collect the water samples, clean, narrow-mouthed polyethylene bottles were used and the samples were taken in the morning. After collection, the samples were placed in bags and transported to the laboratory for analysis. for the Analysis using Atomic Absorption Spectrophotometer (ElementAS AAS4141) .



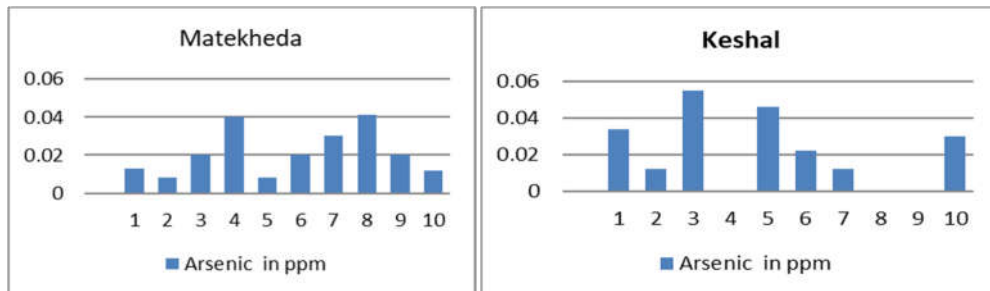
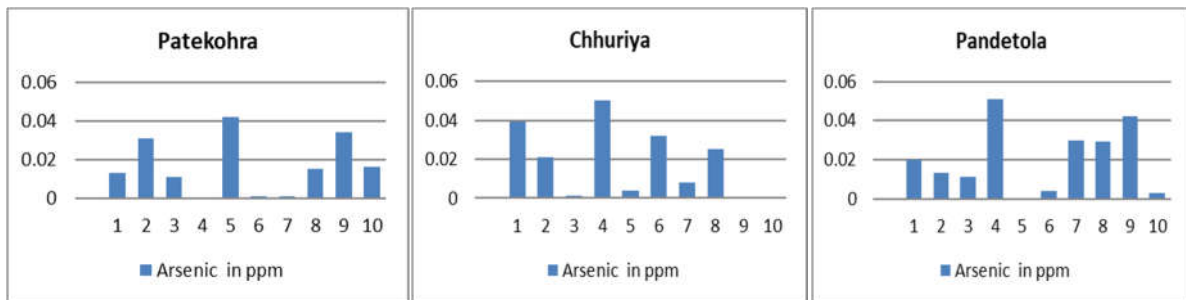
Figure No. 01: Sample Analyzing using A.A.S.(ElementAS AAS4141)

Results and discussion: A study was conducted to determine the concentration of arsenic in groundwater across five villages in the Chhuriya block of Rajnandgaon district. During the investigation, it was found that the arsenic concentration varied in each village. The average concentrations in the identified villages - Patekohra, Chhuriya, Pandetola, Matekheda, and Keshal—were 0.0164, 0.018, 0.0203, 0.0212, and 0.0211 ppm, respectively. The minimum average arsenic concentration was found to be 0.0164 ppm, and the maximum average level was 0.0212 ppm. It was also observed that the arsenic levels in these villages exceeded the standards set by WHO/BIS. This study could be useful in identifying potential health risks prevalent in the community. The arsenic concentrations were determined using an Atomic Absorption Spectrophotometer, and the results are presented in the table below.

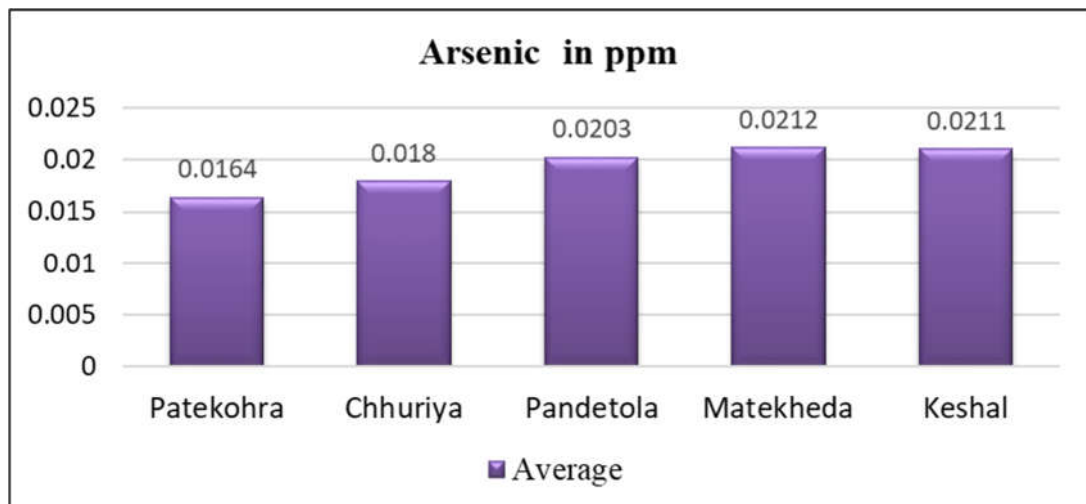
Table 1: Arsenic determination of Groundwater for Chhuriya block, Rajnandgaon.

Sampling site	Village					Unit
	Patekohra	Chhuriya	Pandetola	Matekheda	Keshal	
1	0.013	0.039	0.02	0.013	0.034	Ppm
2	0.031	0.021	0.013	0.008	0.012	
3	0.011	0.001	0.011	0.02	0.055	
4	0.00	0.05	0.051	0.04	0.00	
5	0.042	0.004	0.00	0.008	0.046	
6	0.001	0.032	0.004	0.02	0.022	

7	0.001	0.008	0.03	0.03	0.012	(Mg/l)
8	0.015	0.025	0.029	0.041	0.00	
9	0.034	0.00	0.042	0.02	0.00	
10	0.016	0.00	0.003	0.012	0.03	
Minimum	0.00	0.00	0.00	0.008	0.00	
Maximum	0.042	0.05	0.051	0.041	0.055	
Average	0.0164	0.018	0.0203	0.0212	0.0211	
WHO /BIS	0.01					



Graphs of Arsenic in Different Sampling Areas.



Comparative Graph of Arsenic in Ground Water of Different Sampling Sites.

Conclusion: Clean water is essential for a healthy life, and if the water is contaminated, it can lead to various health problems. The WHO and BIS emphasize the regular assessment of drinking water quality. For this purpose, the concentration of arsenic was determined in five villages of the Chhuriya block in Rajnandgaon district. The lowest average concentration of arsenic was found in Patekohara village, while the highest average concentration was found in Matekheda village. The concentration in the other villages was found to be in between. The arsenic levels observed in the study were higher than the guidelines set by WHO/BIS, which could pose a risk to human health in the future.

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