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RESEARCH ARTICLE

Groundwater and Surface-water Analysis for Arsenic Concentrations in Some West U.P. Regions, India

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ABSTRACT

The aim of this survey is to determine the concentration of Arsenic in underground water and surface water sources in two districts viz. Moradabad and Rampur of western U.P. Water samples collected from five different locations of each district were filtered and acidified with nitric acid and then stored in double-capped polyethylene bottles for further analysis by an Atomic Absorption Spectrophotometer. After comparing the data to the WHO (2011) permissible limit, the study revealed that the concentration of Arsenic was higher than the regulatory threshold; therefore, the underground water system is seriously affected by Arsenic toxicity.

Keywords: Arsenic toxicity, Atomic Absorption Spectrophotometer, western U.P.

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INTRODUCTION

Heavy metals are highly toxic metals that are usually present in industrial, municipal and urban runoff and can be harmful to humans and biotic life. Increased urbanization and industrialization are responsible for increases in levels of trace metals, especially heavy metals, in our waterways.[1] In India, the major source of water used for drinking purposes and domestic needs is the Groundwater. Life cannot be sustained more than few days without water, while an inadequate supply of water may change the pattern of distribution of organisms as well as of human beings. But due to anthropogenic activities, the water necessary for our survival is becoming hazardous every day.[2]

Water samples from Ramganga and Kosi rivers and surrounding areas of two districts i.e. Moradabad and Rampur (U.P., India), from atleast five locations were collected in triplicates. The river Ramganga is first significant tributary of the Ganges to join it. The Ramganga river is 596 Km long from the origin to the Ganges junction. It runs over Uttarakhand and Uttar Pradesh. On the Ramganga banks are situated the largest town Moradabad on the right bank, which is popularly known as 'Brass city' with the establishment of steel, iron, brass, sugar, paper and food industries. The other study area river Kosi is one of the tributary of river Ramganga which pass through district Rampur, Uttar Pradesh. The Kosi river's water is utilized for agriculture, residential usage, and drinking. Illegal incineration and dumping of E-waste were likely to seen in these regions, and the discharge of toxic heavy metals from industrial waste into these rivers may have harmed their quality.

MATERIAL AND METHOD

Water samples of two districts i.e. Moradabad and Rampur (U.P., India) from five locations were collected (Figure 1). Samples of water were collected in triplicates from the tap and hand-pumps of different boring depths (30-150 feet below ground level) in prewashed double-capped glass bottles. Samples were collected in the month of May (Pre-monsoon) and October (Post-monsoon) from the river and the nearby regions from both the districts. One litre sterilized bottles were used to collect water samples for heavy metal analysis.

Water samples collected were filtered and acidified with Nitric acid and stored for heavy metal analysis. The heavy

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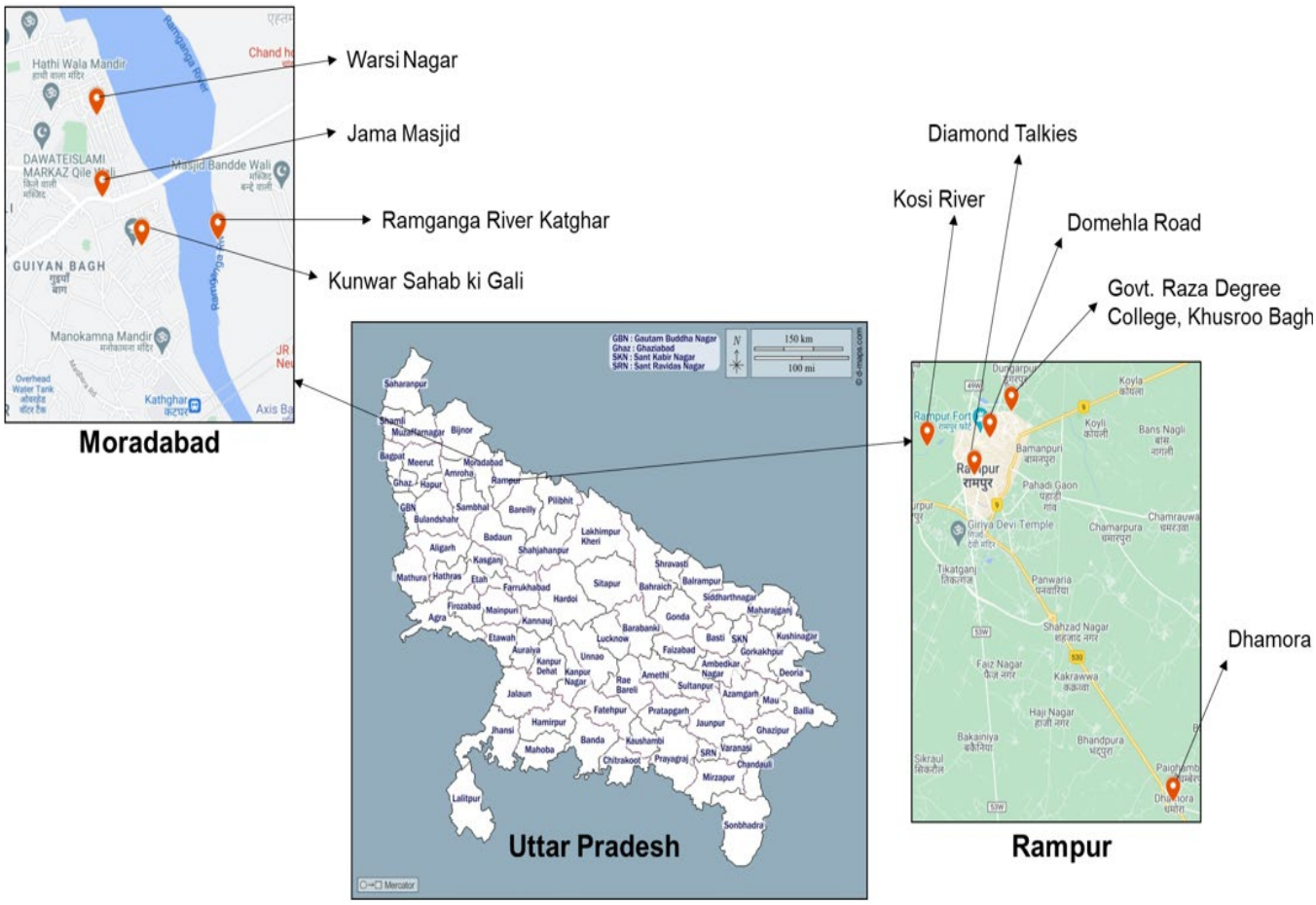

Figure 1: Map showing sites of sample collection

metal content in water samples were analyzed using Atomic Absorption Spectrometer and results are expressed in mg/L.

Observations

Five sampling sites from each district i.e. Moradabad and Rampur were selected for the present analysis of Arsenic contamination. Various Physico-chemical properties like temperature, pH, Conductivity, T.D.S., B.O.D. and C.O.D. were also estimated for Pre-mosoon and Post-monsoon periods in samples of selected districts.

The t-test value obtained from the given data was calculated for Pre-monsoon and Post-monsoon periods respectively at $p<0.05$ significance level with degree of freedom i.e. 8. The

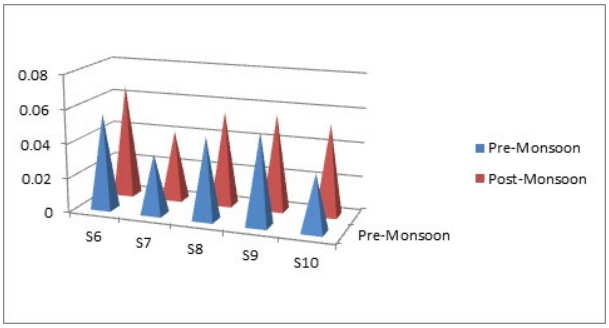

Figure 2: Comparison of Arsenic values in water samples of Moradabad

results obtained after the analysis of Arsenic concentrations in groundwater and surface water samples by the AAS method from selected districts viz. Moradabad and Rampur of western Uttar Pradesh, India, are shown in Tables 1 and 2.

RESULT AND DISCUSSION

Arsenic contamination in groundwater may be due to dumping of untreated discharge and hazardous waste materials from industries.[3] The permissible level of arsenic is 0.05 mg/l.[4] Arsenic concentration in the study area Moradabad range from 0.053 to 0.083 mg/l in pre-monsoon and 0.058 to 0.097

Table 1: Arsenic values in water samples of Moradabad

S. No.	*Sampling Site*	*Pre- Monsoon*		*Post- Monsoon*		*T- test value*	*D.F.*	*p value*
		Sample Mean (mg/L)	*S.D.*	*Sample Mean (mg/L)*	*S.D.*			
1	S1	0.083	0.001	0.097	0.001	22.13	8	0.0001
2	S2	0.073	0.002	0.082	0.002	7.11	8	0.0001
3	S3	0.065	0.003	0.073	0.003	4.21	8	0.002
4	S4	0.075	0.002	0.08	0.004	2.5	8	0.03
5	S5	0.053	0.001	0.058	0.001	7.9	8	0.0001

Table 2: Arsenic values in water samples of Rampur

S. No.	*Sampling Site*	*Pre- Monsoon*		*Post- Monsoon*		*T- test value*	*D.F.*	*p value*
		Sample Mean (mg/L)	*S.D.*	*Sample Mean (mg/L)*	*S.D.*			
1	S6	0.056	0.001	0.066	0.001	15.81	8	0.0001
2	S7	0.035	0.001	0.041	0.002	6.0	8	0.0003
3	S8	0.048	0.003	0.055	0.002	4.34	8	0.002
4	S9	0.053	0.001	0.056	0.001	4.74	8	0.001
5	S10	0.033	0.002	0.053	0.003	12.40	8	0.0001

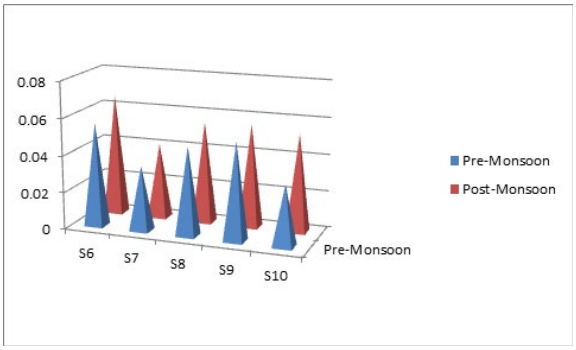

Figure 3: Comparison of Arsenic values in water samples of Rampur

mg/l in post-monsoon period while Arsenic concentration in the study area Rampur range from 0.033 to 0.056 mg/l in pre-monsoon and 0.041 to 0.066 mg/l in post-monsoon period. It is observed that all samples of Moradabad region in pre-monsoon and in post-monsoon had exceed this limit (Figure 2) while in Rampur region, three samples of pre-monsoon and four samples in post-monsoon had exceed this limit (Figure 3). Various industrial effluents discharge into the Ramganga and Kosi rivers, so the quality of water has presently declined. This might be the reason for the concentration of this element in groundwater of study area. Arsenic in drinking water can affect the human health and considered as one of the most significant environmental causes of cancer in the world.[5]

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