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Presence of Arsenic in Drinking Water of Pakur Town (Jharkhand)

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Abstract: *Presence of arsenic was assessed in the waterbodies of Pakur town of Jharkhand, India. The objective of this study is to assess the quality of water especially in the context of arsenic of the said area where water is used for domestic as well as agricultural purposes. The disposal of untreated wastes from various resources have posed an alarming threat to our environment due to metal pollution. These wastes generally containing in addition to Arsenic, several other poisonous metals such as Mercury, Lead, Chromium etc. highly injurious to health are finally discharged to ground water. In the present investigation quality of water with regard to arsenic pollution has been tried to know in various populated areas of Pakur town of Jharkhand.*
Key words: *Arsenic, Ground Water, Metal Pollution, Protoplasmic poison.*

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I. Introduction

Pollution in water is taken into account not only in terms of public health but also in terms of preservation of environment and beauty of nature. It brings about changes in water with regard to its colour, odour, density, taste, turbidity and thermal properties etc. The chemical pollution of water causes changes in acidity, alkalinity and dissolved oxygen which are brought about mainly by organic/inorganic pollutants.

Water pollution is presently a major global problem, and is the leading worldwide cause of so many ominous diseases including deaths. Heavy metal pollution is a serious threat to our present day environment. Water pollution with metals especially with Arsenic brings about catastrophe to living bodies in several ways. Hence, the present work was undertaken to study the amount of Arsenic present in the drinking water of Pakur municipal area of Jharkhand focusing over well and tube-well water which is frequently used by human beings for their different activities. With the use of water polluted with arsenic and other metals, many diseases are spread out among the people living in the vicinity of this area.

Area of investigation: Pakur situated in the Northeastern part of Jharkhand state came into existence as a district on 28th of January, 1994. Its boundaries are shared by sahibganj distric in north, Birbhoom distric of Bengal in south, Murshidabad and a part of Birbhoom districts in east, and parts of Dumka and Godda districts in west. It exists in north latitude between 23^{o}40’ to 25^{o}18’ having east longitudes ranging between 86^{o}28’ and 87^{o}57’. The distric embodies as many as six blocks namely Littipara, Hiranpur and Pakur (Sadar Block) in north, Amrapara and Maheshpur in central Pakur, and Pakuria in south.

The river Ganga passes at some distance along the North-eastern boundary of the distric. Other rivers flowing through the district are Gumani, Torai, Bansloi and Brahmini. All the rivers flow from west to east direction except Gumani which flows from south-west to North-east direction. These rivers are tributaries of river Ganges and are seasonal in nature.

Experimental :

Site Selection & Methodology

The present investigation was carried out for a period of two years (from January 2017 to December 2018). Samples were collected from ten different sites mentioned in table of Pakur Municipal area seasonally in all the three season namely winter, summer and rainy season. These sampling stations were symbolized as S_1 to S_{10}. The months of January, May and August were chosen as the representative months of winter, summer and rainy season respectively.

From all these spots water samples were collected and brought to laboratory for the physico-chemical analyses. Some parameters such as Air temperature, Water temperature, pH, DO and BOD were carried out at the spots itself. Standard methods of APHA were followed for the analysis of Physico-Chemical characteristics. Heavy metal composition was determined using atomic absorption spectrophotometer.

Table 1 : Name of sites with sources of water where samples were collected from.

Sample Sites	Name of Sties	Sources of water
S_1	Nimtalla	Tube well
S_2	Nimtalla	Well
S_3	Rajapara	Tube well
S_4	Rajapara	Well
S_5	Railway Station	Tube well
S_6	Railway Station	Well
S_7	Kurapara	Tube well
S_8	Kurapara	Well
S_9	Baliharpur	Tube well
S_{10}	Batiharpur	Well

All the chemicals used were of AR grade. Triple distilled water was used for trace element analysis. The water from well and Tubewell were collected in plastic bottles and preserved by adding 1.5ml of AR Conc. HNO_3 per litre of water. The samples were analysed for trace elements namely Fe, Pb, Cd, Se, As, F and Cr etc.

Arsenic present in the sample was reduced to A_SH_3 (Arsene) which is directly aspirated into Ar-H_2 flame and measured in an atomic absorption spectrophotometer at 193.7 nm. The experimental data obtained in the case of Arsenic in different seasons namely winter, summer and rainy seasons for the year 2017 are shown in Table:2 whereas the same for the year 2018 are being furnished in Table:3 below.

Table:2 – Amount of Arsenic (in ppm) present in various water samples in winter, summer and rainy seasons in 2017.

Sample Nos.	Winter 2017		Summer 2017		Rainy Season 2017	
	Tempt.	Amount of Arsenic (ppm)	Tempt.	Amount of Arsenic (ppm)	Tempt.	Amount of Arsenic (ppm)
WS_1	19°C	0.012	28°C	0.012	24.5°C	0.010
WS_2	19°C	0.012	28°C	0.012	24.5°C	0.012
WS_3	19°C	0.012	28°C	0.013	24.5°C	0.015
WS_4	19°C	0.026	28°C	0.025	24.5°C	0.025
WS_5	19°C	0.012	28°C	0.010	24.5°C	0.012
WS_6	19°C	0.026	28°C	0.010	24.5°C	0.025
WS_7	19°C	0.010	28°C	0.012	24.5°C	0.012
WS_8	19°C	0.010	28°C	0.015	24.5°C	0.015
WS_9	19°C	0.012	28°C	0.015	24.5°C	0.015
WS_{10}	19°C	0.012	28°C	0.015	24.5°C	0.016

Where W stands for water, and S1, S2 ……. represents the sites already mentioned in Table-1

Table:3 – Amount of Arsenic (in ppm) present in various water samples in winter, summer and rainy seasons in 2018.

Sample Nos.	Winter 2018		Summer 2018		Rainy Season 2018	
	Tempt.	Amount of Arsenic (ppm)	Tempt.	Amount of Arsenic (ppm)	Tempt.	Amount of Arsenic (ppm)
WS_1	18.5°C	0.012	28.6°C	0.012	25°C	0.010
WS_2	18.5°C	0.012	28.6°C	0.013	25°C	0.010
WS_3	18.5°C	0.012	28.6°C	0.013	25°C	0.010
WS_4	18.5°C	0.028	28.6°C	0.026	25°C	0.025
WS_5	18.5°C	0.012	28.6°C	0.012	25°C	0.010
WS_6	18.5°C	0.026	28.6°C	0.020	25°C	0.025
WS_7	18.5°C	0.027	28.6°C	0.020	25°C	0.010
WS_8	18.5°C	0.012	28.6°C	0.015	25°C	0.010
WS_9	18.5°C	0.012	28.6°C	0.015	25°C	0.010
WS_{10}	18.5°C	0.012	28.6°C	0.018	25°C	0.010

Where W stands for water, and S1, S2 ……. represents the sites mentioned in Table-1

Seasonal variations of Arsenic of various samples collected from different sites in 2017 may be depicted in the following graph as represented through figure 1

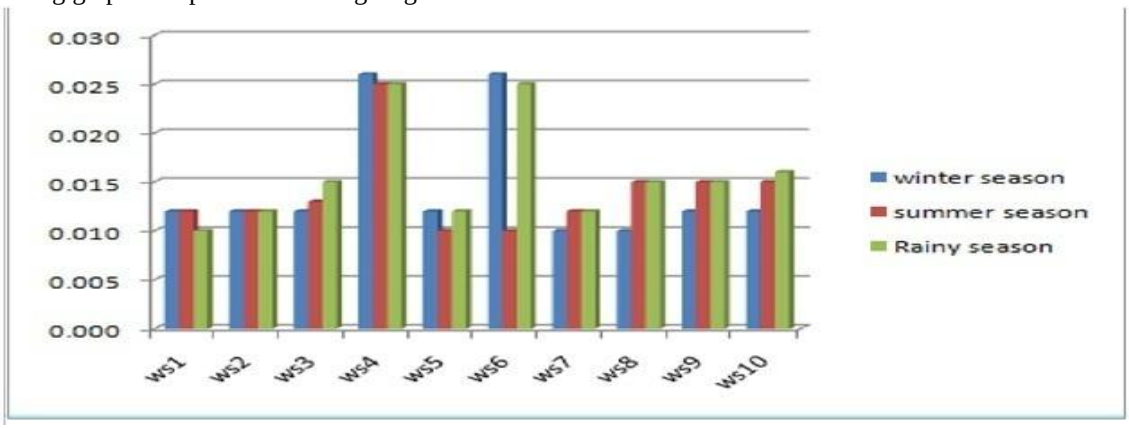

Figure 1 : Seasonal variation of Arsenic present in different samples collected from various sites in 2017.

And for the year 2018 the same has been presented in the form of graph through figure 2 as shown below.

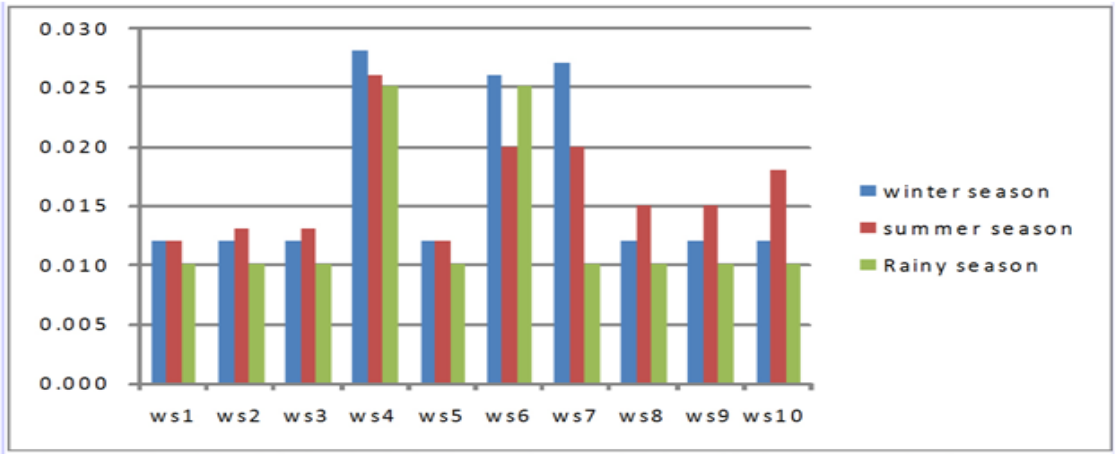

Figure 2 : Seasonal variation of Arsenic present in different samples collected from various sites in 2018.

II. Results and Discussion

Arsenic is a metalloid which is widely distributed in biosphere. Arsenic is another chalcopyrite element and hence it is naturally found in sulphid minerals such as pyrites. Aqueous arsenic in the form of arsenite, arsenate and organic arsenicals may result from mineral dissolution, industrial discharge or during application of agricultural chemicals such as weed killers, fungicides, insecticides and rat poisons. The toxicity of arsenic depends on its chemical form. Arsenite is many times more toxic than arsenate. For the protection of aquatic life, the average concentration of As^{3+} in water should not exceed 72 mg/L and the maximum concentration should not exceed 140 mg/L. Because of arsenic poisoning lakhs of people of west Bengal, the adjoining state of Pakur are suffering from various diseases caused by arsenic. They are using well and tubewell water containing 1.5 ppm.

Arsenic is a protoplasmic poison and affects all systems in the body. Arsene (A_SH_3) combines with haemoglobin and is oxidized to haemolytic compounds. High arsenic levels in men are usually found in hair, nails and skin. When arsenic is inhaled, it is retained in the lung tissues for long. Non-allergic contact dermatitis and conjuctivities are frequently suffered by workers exposed to dusts containing arsenic. Arsenicals are known to be carcinogenic to lungs in humans. They may also lead to skin cancer through the initial skin lesions.

The **present research findings** reveal that in water samples of Pakur municipal area, the concentration of arsenic ranged from 0.010 ppm to 0.026 ppm in winter season, 0.010 to 0.025 ppm in summer season, and 0.010 ppm to 0.025 ppm in rainy season in 2017 as is obvious from table 2, whereas in 2018 its value ranged between 0.012 ppm to 0.028 ppm in winter, 0.012 ppm to 0.026 ppm in summer and 0.010 ppm to 0.025 ppm in rainy season respectively which may be seen in table 3. It is to be noted here that as per WHO, the maximum permissible limit of arsenic in drinking water is 0.05 ppm. It may be noticed that little seasonal variation in arsenic content is to be found in water sample.

It is also to be mentioned here that water temperature governs the composition and activities of biological species to a considerable extent. It may be seen in the table that water temperatures in the areas of investigation ranged from 12.5^{o}C to 28.6^{o}C in 2017-18. Of course, higher temperature was recorded in summer.

The average abundance of arsenic in the earth crust is 1.8 ppm; in soil it ranges from 5.5 to 13 ppm; in streams it is less than 2 mg/L; and in Ground water it is generally less than 100 mg/L. Arsenic occurs in water as said earlier through dissolution of minerals and ores, and through erosions.

Remedies & Suggestions.

Seeing the poisonous effects of arsenic, it is suggested that constant monitoring of these waterbodies is unavoidable to protect and maintain the eco-balance. To check further pollution, proper sewage system and specific treatment plants should be installed in township; and discharge of effluents without proper management should be completely banned. Arsenic is found in high concentration in the underground water of nearby districts of Bengal. Hence, such an investigation is must for the safety of this area from the possible threat of arsenic. Finally, public awareness should also be made properly in this regard.

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