# **Research Article**

# A case study of arsenic in the Koshi region of Khagaria District

Ashok Kumar Jha<sup>1</sup> and Yogesh Chandra Gupta<sup>2</sup>

<sup>1</sup>Supervisor, Bhagwant University, Ajmer, Rajsthan, India, <sup>2</sup>Research scholar,Bhagwant University,Ajmer,Rajsthan,India

### Abstract

Arsenic is a water pollutant with high toxicity and carcinogenicity. The order of toxicities are arsenite > arsenate > monomethyl arsenic acid > dimethyl arsenic acid. Ground water survey of Khagaria district, surrounded by the Burhi Gandak, the Kamla, the Ganges and the Koshi river, have been found to be arsenic contaminated whereas the Koshi river water sample did not find any detectable amount of arsenic. This area has potential aquifers and for irrigation of different crops e.g. maize, wheat and paddy grown in coloured organic rich argillaceous sediments. The Koshi river having high sediment load due to flood and interaction with ground water may be one of the reasons for accumulation of arsenic in these aquifers. One of the problem identified with this area is Iron and Nitrate too leading to gastro intestinal and blue babies disease in children. Excess nitrate in underground water is due to excessive use of fertilizers and pesticides for agricultural purposes. The result obtained by U.V. double beam spectrophotometer and AAS are in close agreement with the results given by merckoquant arsenic kits.



**Keywords:** Aquifer, arsenic, argillaceous, Blue baby disease

\*Correspondence Author: A.K. Jha Email: ashokjha39@gmail.com

### Introduction

Khagaria, a district of Bihar, is surrounded by KamlaBalan, Koshi, Kareh, Kali Koshi, Ganga and Burhi Gandak rivers (**Figure 1**). Even the District headquarter faces the flood and water logging problems. The neighbouring districts of Khagaria are Begusarai, Madhepura, Munger, Saharsa and Samastipur (**Figure 2**). The Koshi river has a catchment area of 70,409 Km<sup>2</sup> covering the territory of two countries viz. Nepal (59,570 Km<sup>2</sup>) and India (10,839 Km<sup>2</sup>) North Bihar [1]. Besides this, North Bihar has many chaurs, Dhars and wetland [1] (**Figure 3-6**).

Water is the most important resource for the human settlement from the time immemorial. Country with huge reserve of freshwater will be termed as the most precious country but water quality of water resources is deteriorating continuously due to perennial flood, excessive use of water for irrigation, use of fertilizers and pesticides in agriculture in Khagaria district surrounded by rivers, chaurs and dhars, a common features of the North Bihar region.

Under high p<sup>H</sup> conditions, arsenite is strongly bound to soil compounds than arsenate. Arsenite is more toxic than arsenate and tends to be more mobile in the environment.

Arsenic, a metalloid, naturally occurring contaminate of drinking water is mobilized through channelisation of flood water with ground water and a range of anthropogenic activities [2-6]. The contamination of drinking water with heavy metals and arsenic in particular is the greatest threat to human health. The poor population in the Koshi region has not access to safe drinking water, a cause of major concern for environmentalists, social activist and the governments. Arsenic  $(AsO_3^{3-})$  and arsenate  $(AsO_4^{3-})$  are common in natural water [7-9]. Though arsenic contamination in ground water are common in the Gangetic plain, the presence of arsenic in few ground water samples of the Koshi region has caused problem for the local population and has been able to draw the attention of the researchers in pursing research in this region.

It is established that excessive use of arsenic in ground water leads to hyper pigmentation and peripheral neuropathy as it gets bound to the tissues. [10-12].

Chronic exposure to arsenic above 100 ppb may cause vascular disorders, skin, liver and lung cancer too. [13-15].



Figure 1 Map of Khagaria District



Figure 2 Map of Khagaria District touching other Districts



Figure 3 North-Eastern Region of Kosi Basin



Figure 4 South-Western Region of Kosi Basin



Figure 5 South-Eastern Region of Kosi Basin



Figure 6 North-Western Region of Kosi Basin

Water treatment process adopted by plants adheres to maximum contaminant level for arsenic in drinking water of 10 ppb prescribed by World Health Organisation [16-17]. A large no. of data on ground water quality has been integrated to know arsenic contamination in ground water in Khagaria Koshi region so that local population might be aware of the health hazards [18-19]. With a view to assess the quality of the river water, analysis for arsenic has been done [20].

# Experimental

The samples were collected from different places of Khagaria district from Khagaria railway station as reference point in sterilized plastic bottles and analyzed by merckoquant arsenic Kit available in the laboratory. The samples were also analyzed by U.V. double beam spectrophotometer Pharo 300. The results from merkoquant arsenic kit and U.V. double beam spectrophotometer are in agreement with each other. The analysis of arsenic done by UV double beam spectro photometer matches also with the results of atomic absorption spectro photometer.

#### **Results and Discussion**

**Table 1** clearly shows that S1, S2 and S3 samples contain arsenic concentration of 0.02 ppm whereas S28, S29 and S32 samples have been found to contain arsenic more than permissible limit of 0.05 ppm. Koshi river samples S10 to S19 have no trace of arsenic. It is clear that the Koshi river water is not arsenic contaminated whereas some ground water samples are arsenic contaminated. This has opened a vast scope of probe in the koshi region of Khagaria district. It is important to mention that ground water is contaminated with arsenic at a depth of 70 to 80 feet. The ground water samples of Dhamaraha ghat near a place Bangalia village is arsenic contaminated revealed by our analytical tests.

Table I Details of ground water sample				
Sample	Place	Depth in Ft.	Distance from Khagaria	As in ppm
			<b>Railway Junction</b>	
$S_1$	Khairi	70	7 Km (approx)	0.02
$S_2$	Khairi	80	7 Km	0.02
<b>S</b> <sub>3</sub>	Khairi	80	7 Km	0.02
$S_4$	Khairi	70	7 Km	0.02
$S_5$	Khutaha	70	9 Km	0.01
$S_6$	Khutaha	70	9 Km	0.01
$S_7$	Balour	80	8 Km	No trace
$S_8$	Balour	80	8 Km	No trace
<b>S</b> <sub>9</sub>	Balour	80	8 Km	No trace

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Sample	Depth in	Place	Distance from	As in
	Ft.		Khagaria	ppm
			<b>Railway Junction</b>	
$S_{10}$	3	Near Khairi	9 Km	No trace
<b>S</b> <sub>11</sub>	3	Near Khairi	9 Km	No trace
S <sub>12</sub>	5	Near Khairi	9 Km	No trace
S <sub>13</sub>	5	Near Khairi	9 Km	No trace
S <sub>14</sub>	4	Near	10 Km	No trace
		Khutaha		
<b>S</b> <sub>15</sub>	4	Near	10 Km	No trace
		Khutaha		
S <sub>16</sub>	3	Near Balour	10 Km	No trace
S <sub>17</sub>	3	Near Balour	10 Km	No trace
S <sub>18</sub>	2	Near Balour	10 Km	No trace
<b>S</b> <sub>19</sub>	2	Near Balour	10 Km	No trace

Sample	Depth in Ft.	Place	Distance from Dhamara Railway Station	As in ppm
S <sub>20</sub>	2.5	Koshi river near Dhamara Ghat railway station	1 Km	0.02
$S_{21}$	80	Tubewell Vill- Bangalia near Dhamaraghat railway station	1.5 Km	0.02
<b>S</b> <sub>22</sub>	1.5	Koshi river near Dhamara Ghat railway station	1 Km	0.05 to 0.02
<b>S</b> <sub>23</sub>	1.5	Koshi river near Dhamara Ghat railway station	1 Km	0.00
<b>S</b> <sub>24</sub>	1.5	Koshi river near Dhamara Ghat railway station	1 Km	0.02
S <sub>25</sub>	1.5	Koshi river near Dhamara Ghat railway station	1 Km	0.02
S <sub>26</sub>	1.5	Koshi river near Dhamara Ghat railway station	1 Km	0.02
<b>S</b> <sub>27</sub>	80	Tubewell Vill- Bangalia near Dhamaraghat railway station	1.5 Km	0.00
S <sub>28</sub>	70	Tubewell Vill- Bangalia near Dhamaraghat railway station	1.5 Km	0.06
S <sub>29</sub>	70	Tubewell Vill- Bangalia near Dhamaraghat railway station	1.5 Km	0.07
S <sub>30</sub>	2.5	Koshi river near Dhamara Ghat railway station	1.5 Km	0.00
<b>S</b> <sub>31</sub>	80	Tubewell Vill- Bangalia near Dhamaraghat railway station	1.5 Km	0.00
<b>S</b> <sub>32</sub>	2.5	Koshi river near Dhamara Ghat railway station	1.5 Km	0.05

### Conclusion

Some of the studied water sample of the Kosi region has been found to be arsenic contaminated. Some visible symptoms of arsenicosis have also been detected in Bangalia village near Dhamaraha ghat railway station. Kosi river samples are free from arsenic contamination where as ground water sample is arsenic contaminated. This may be due to the channelization of flood water with ground water. The aquifer is not free from arsenic at a depth of 70-80 feet.

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