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Assessment of Heavy Metal Pollution of Brahmaputra River in India: A Review

Aarati Bobade[1], Santosh Rankhamb[2] and Ayesha Durrani[3]
Department of Chemistry, Late Ramesh Warpudkar College, Sonpeth, Parbhani, MS, India[1]
Department of Zoology, Late Ramesh Warpudkar ACS College, Sonpeth, Parbhani, MS, India[2]
Department of Chemistry, Dr. Rafiq Zakaria College for Women, Aurangabad, MS, India[3]
santosh.rankhamb@gmail.com

Abstract: *Heavy metals are toxic and carcinogenic. These metals are non-biodegradable and hazardous in nature. The present review focuses on investigating the toxicity of heavy metals in Brahmaputra river in Assam state. The concentration level of metals like a Fe, Cr, Pb, Cu and Cd observed in different season. This study revealed that different water station with respect to heavy metals concentration found beyond the recommended limit prescribed by BIS and WHO acceptable drinking water limit. For Iorn - (Tejpur)9.872 g/ L, Lead- (pandu) 21.480 µg/L, Copper- (Tejpur) 54. 400 µg/L, Chromium – (Tejpur) 53.100 µg/L.*

Keyword: Brahmaputra, River, Heavy Metal, Water Quality, Assam

I. Introduction

Water is life and rivers are lifeline. Water is one of the fundamental necessities of individuals without water no life is possible to sustain on this planet earth hence it is termed as 'Natural liquid gold'.

Rivers are one of the humankind's most valuable resources. River has great potential of economic change (Patil et.al. 2013). Rivers have provided water for population and industries as a navigation route for material and commerce (Neal et.al. 2006).Population growth, urbanization (Muhammed et.al.2018), industrialization (Isai et.al. 2015), mining and economic activities put immense pressure on River system (Bora and Goswami 2017). Water quality get deteriorated (Zhaoshi et.al. 2017) because of human activities related to economic development (Unde and Turkunde 2018). Heavy metal contamination in river is one of the major quality issue now a days.

Water pollution caused by the heavy metal is the major environmental as well as socio-economic problem. In fast growing cities maintenance of water quality infrastructure did not increased along with urbanization and population growth(Karbassi et.al 2007; Akoto et.al. 2008; Ahmad et.al. 2010). Brahmaputra river is the largest tropical river in India. River lies between $88^0$11' to $96^0$57 East longitudes and $24^0$44' to $30^0$3' North latitude and extend over an area of of 1, 93,252 sq. km which is nearly 5.9 % of the total geographical area of the country. The river originates in the north from Kailash ranges of Himalaya. In India river flow for 916 km (Ministry of Jalshakti 2019) . The aim of this study is to assess the quality of water with respect to heavy metalsFe, Cu, Cr, Cd and Pb contaminant level in Brahmaputra river.

II. Sources

Heavy metal enter into river water by variety of sources, it can be either natural or anthropogenic (Wong et. al. 2003; Adaikpoh et.al.2005). Mineralogy and the weathering are also sources of heavy metal contamination at low concentration. Main anthropogenic sources of heavy metal contamination are untreated industrial effluents, indiscriminate use of heavy metal containing fertilizers and pesticides in agricultural fields (Ammann et.al. 2002; Nouri et.al.2006, 2008). In urban area river contaminated by heavy metal due to the practice of discharge of untreated domestic and small-scale Industrial effluents discharge into water body (Rim - Rukeh et. al. 2006; Khadse et. al. 2008,

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Juang et.al. 2009; Venugopal et. al. 2009; Sekabira et.al. 2010). The concentration level of Fe in water increases due to transportation, industrial effluent, acid mine drainage, sewage and landfill leachate (Kotasa and Stasicka 2000).

Copper normally occurs in drinking water from copper pipes, disposal of municipal and industrial wastes, disposal of fly ash and from additives designed to control algal growth (Mohod and Dhote 2013). Cadmium enters into water system by industrial discharge and galvanized pipe broken down (Terry and Stone 2002),phosphate fertilizer industry (Jarup 2014),pesticides, and nuclear fission plant.

Sources of chromium includes metallurgical and chemical industries, refractories and chemical (pigment, electroplating, tanning). Lead enters in water sources due to agricultural activities, automobile emission, burning of coal and oil, smoking and mining. These metals are of serious concern because they accumulate through food chain and create environmental problems (Praveena et al. 2010; Paul and Sinha 2015)

III. Health Impact Of Heavy Metals

Now a day's heavy metal contamination is becoming very serious issue of concern around the globe. To fulfill the needs of rapidly growing population the use and processing of the heavy metal increases day by day which causes harmful health and environmental effects.

Table 1: Shows some impact of heavy metals

Heavy Metal	Health Impact
Fe	Muscles, Liver Brain, CNS (Luqueno et al., 2013), Anemia (Tsai and Evans, 1975)
Cr	Skin, Lungs, Kidneys Liver, Brain Pancreas Testes, Gastrointestinal, Reproductive
Cu	Liver, Brain, Kidneys, Cornea Gastrointestinal, Lungs Diarrhea (Bent and Bohm,1995) and Anemia (Madsen, et al.,1999)
Pb	Bones, Liver, Brain, Kidneys, Causes damage of DNA
Cd	Kidney (U.S.EPA, 1999), Bones (Webb, 1979) Cardiovascular, Lungs, Testes, Immunological

(*Source: Vhahangwele and Khathutshelo, 2018*)

IV. Results and Discussion

Central water commission under department of water resources ministry, Resources Department and Ganga Rejuvenation Ministry of Jal Shakti published book 'status of trace and toxic metal in Indian river 2019' which provide water quality scenario of different river with respect to toxic and trace heavy metals. From this Data the water collected from Brahmaputra River in three season.

- **Monsoon** - August 2016, August 2017.
- **Summer**- May 2014, April 2016, April 2017, April 2018.
- **Winter** - November 2014, February 2015, December 2015, December 2016, December 2017.

Seasonal average value of heavy metals for different water stations with acceptable limits as prescribed by the Bureau of Indian standards (BIS – 10500- 2012) for Brahmaputra river is given in Table II. The given data show following results for heavy metal concentration from Brahmaputra river water. Ferrous- Maximum acceptable drinking water limit recommended by BIS is (0.3 mg/L) at Tejpur water station in Assam state shows highest iron concentration is 9.872mg/L. Copper- according to BIS the acceptable limit is(50 µg/L)in drinking water Tejpur water quality station shows 54.00 µg/L concentration level. Lead- acceptable drinking water limit is (10 µg/L)at Pandu water station shows 21.480 µg/L concentration level in water which is highest among all water stations observed for Pb, for Chromium - Acceptable drinking water limit for chromium is (50 µg/L) among all observed water station Tejpur water station shows highest concentration for Cr is 53.100 µg/L. Cadmium-it is real natural element BIS proposed maximum acceptable drinking water limit for cadmium metal is (3 µg/L) Cd metal not show any toxicity in river water. The water stations on Brahmaputra river are mostly contaminated with Ferrous and Lead at Tejpur water station.

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Table 2: Seasonal average value of heavy metals for different water stations

Sr No	Metal	Study Period	Quality Site	Metal in µg/l				
				Average			Min.	Max.
				Total	Non Monsoon	Monsoon		
1	Fe 0.3mg/l – 0.3 mg/l	Dec 2015, April 2016, Aug. 2016, April 2017, Aug. 2017, Dec. 2017.	Bhomoraguri	1.583	1.184	3.376	0.008	6.147
			Dhubri	1.861	1.861	--	0.254	3.467
			Dibrugarh	1.365	0.623	4.702	0.020	5.801
			Naematighat	1.187	0.715	3.315	0.010	5.075
			Pancharatna	0.279	0.238	0.462	0.039	0.720
			Pandu	0.352	0.375	0.246	0.020	1.649
			Tejpur	2.347	1.306	7.031	0.027	9.872
2	Cu 50 µg/l – 50 µg/l	April 2017	Bhomoraguri	9.675	10.424	6.305	0.530	45.710
			Dhubri	3.345	3.345	--	3.1	3.590
			Dibrugarh	4.894	4.941	4.680	0.380	13.150
			Pancharatna	6.304	7.452	1.135	0.120	46.050
			Pandu	4.626	5.336	1.435	0.020	11.740
			Tejpur	9.535	9.866	8.065	0.230	54.000
3	Pb 10 µg/l – 10 µg/l	Aug 2016	Bhomoraguri	2.153	2.158	2.130	0.053	7.060
			Dhubri	1.727	1.727	--	1.380	2.073
			Dibrugarh	3.678	2.455	9.185	0.582	14.250
			Pancharatna	2.798	1.514	8.575	0.400	15.810
			Pandu	3.418	1.325	12.840	0.020	21.480
			Tejpur	2.362	2.188	3.145	0.210	8.630
4	Cr 50 µg/l – 50 µg/l	Aug. 2016	Bhomoraguri	7.335	4.189	21.490	0.700	40.970
			Dhubri	10.975	10.975	--	1.850	20.100
			Dibrugarh	3.382	3.708	1.915	0.040	15.090
			Naematighat	1.862	1.932	1.545	0.560	5.990
			Pancharatna	3.418	3.334	3.795	0.120	10.700
			Pandu	4.137	4.684	1.675	0.370	17.300
			Tejpur	11.301	7.441	28.670	0.170	53.100
5	Cd 3 µg/l – 3 µg/l	Aug. 2016	Bhomoraguri	0.072	0.074	0.063	0.002	0.252
			Dhubri	0.056	0.056	--	0.049	0.062
			Dibrugarh	0.132	0.141	0.093	0.005	0.846
			Naematighat	0.065	0.071	0.036	0.006	0.846
			Pancharatna	0.303	0.354	0.076	0.008	1.314
			Pandu	0.129	0.134	0.103	0.04	0.528
			Tejpur	0.132	0.149	0.053	0.002	0.759

(*Source : Ministry of Jalshakti 2019*)

V. CONCLUSION

The study reveals that there is a considerable variation in the concentration of heavy metals in water of Brahmaputra River at various sites. Domestic wastes, Industrial wastes and fertilizers are main cause of heavy metal contamination in Brahmaputra River. Due to carcinogenic nature the heavy metals causes certain lethal diseases and create hazardous effect on environment. We must be aware of the adverse influence of polluted water may have on us. Water is a scare

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and precious National resources to be planned, developed, conserved and managed because socio economic development of any nation depends on availability of water. So at present we cannot prevent water being polluted cent percent but minimization is a very much needed. For that concern of community need to be taken into account for water resource development and management. There is need for continuous monitoring and treatment process if water is to be used for domestic, agricultural and drinking purpose.

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