

The Impact of Drinking water on Human Health due to Contamination of Fluoride –A case Study of Bhagalpur Municipal Corporation Area, Bhagalpur, Bihar

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ABSTRACT.

Groundwater degradation occurs when its quality parameters are changed beyond their natural variations by the introduction or removal of certain substances (Ramesh, 2001; Todd, 2001). About 80% OF The Disease in the world are due to the poor quality of drinking water and the Fluoride contamination of drinking water is responsible for 65% of endemic fluorosis around the globe. [Felsenfeld and Robert 1991] India is fast moving towards a crisis of ground water overuse and contamination (Himansu *et al.*, 2014). The occurrence of F⁻ in groundwater has drawn worldwide attention because it has considerable impact on human health. A variety of geochemical studies have been carried out on various aspects of F⁻ in groundwater particularly on the relationship between F⁻ concentration and water-rock interaction in aquifers in different geological settings (Gaciri and Davies, 1993; Ghosh and Bandyopadhyay, 1980; Handa, 1983; Nordstrom and Jenne, 1977; Saxena and Ahmed, 2003).). All the living creatures depend upon water in one way or the other but there are instances that civilizations have disappeared due to shortage of fresh water or due to water borne diseases (Shanthi *et al.* 2014; Kumar *et al.* 2016). Problems with water quality often serve as problems with water availability

Keywords: Fluorosis, aquifers, WHO, BMC.

INTRODUCTION

Groundwater is considered as purest and majorly available source of water and is used to fulfill the 50% urban and 80% rural water demand of India besides irrigation (Sahu and Sikdar, 2008). Groundwater is also used to irrigate around two fifth of India's total agricultural land (Yogendera and Puttaiah, 2007). The present study is supposed to generate awareness among the people of the study area about fluoride related problems due to drinking fluoride contaminated water. In view of the above facts, the present study was conceptualized. The present study is aimed to assess the ground water quality with focus on mapping of fluoride contents in the ground water sources from portability point of view in the 51 wards of Bhagalpur Municipal Corporation area (BMC). The study is mainly meant to test the suitability of these ground water sources, mainly for cooking and drinking purposes.

Due to the increasing population in the country, the national per capita annual availability of water has reduced from 1,816 cubic meter in 2001 to 1,544 cubic meter in 2011 (Water and Related Statistics, April, 2011). This is a reduction of 15% (Table 1).

Table 1: Statistic regarding water resources in India

Parameters	Unit (Billion Cubic Meter /Year)
Annual water availability	1869
Usable water	1123
Surface water	690
Ground water	433

Sources: Water and Related Statistics April, 2015, Central Water Commission

Ground water development is a ratio of the annual ground water extraction to the net annual ground water availability. It indicates the quantity of ground water available for use. Table-2 below compares the level of ground water development in the country over the past two decades.

Table 2: comparative status of level of ground water development in India in the past 20 years

Level of ground water development	Explanation	% of districts in 1995	% of districts in 2004	% of districts in 2009	% of districts in 2011
0-70% (Safe)	Area Which have ground water development is recommended	92	73	72	71
70-90% (Semi critical)	Area where cautious ground water development is recommended	4	9	10	10
90-100% (Critical)	Area which need intensive monitoring and evaluation for ground water development	1	4	4	4
>100% (Over- exploited)	Area where future ground water development is linked with water conservation measures	3	14	14	15

Sources: Central Ground Water Board

The improper management of water system may cause serious problems in availability in quality of water in near future (Kendaragama 2000; FAO 2003). Therefore it is essential to study the quality of groundwater.

STUDY AREA

The district Bhagalpur is located in the eastern part of the state and extend between the north latitude of 25°03'4" and 25°30'00" and east longitude of 86°30'00" and 87°29'45" falling in the surve of India toposheet no. 72 K and O.

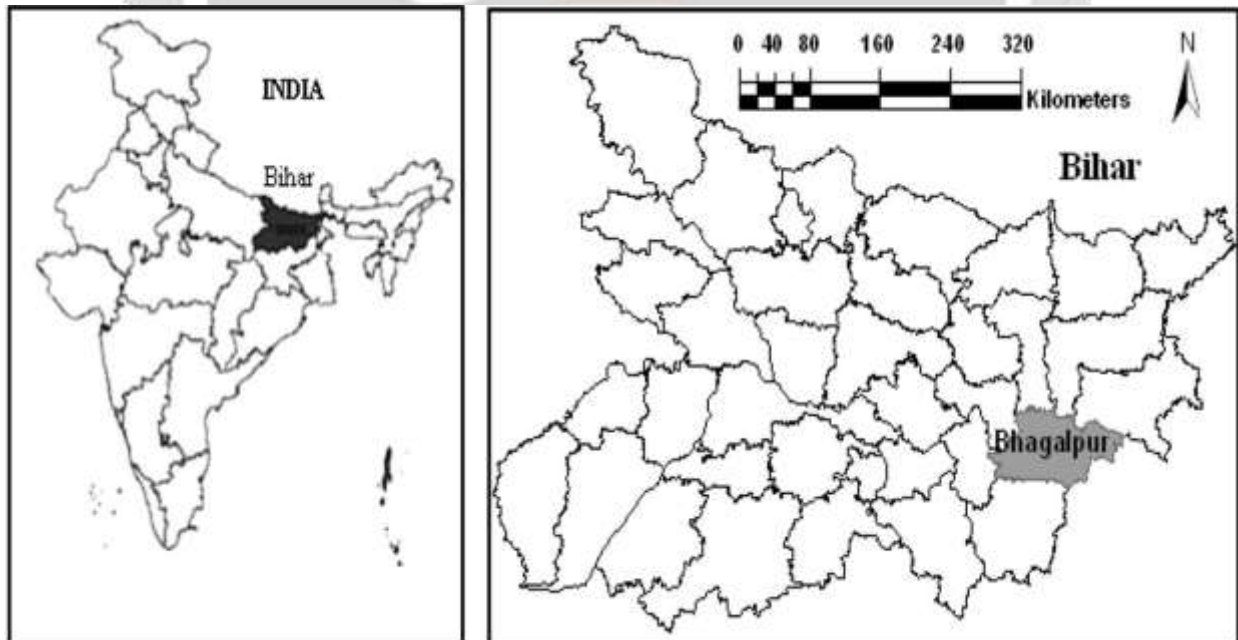
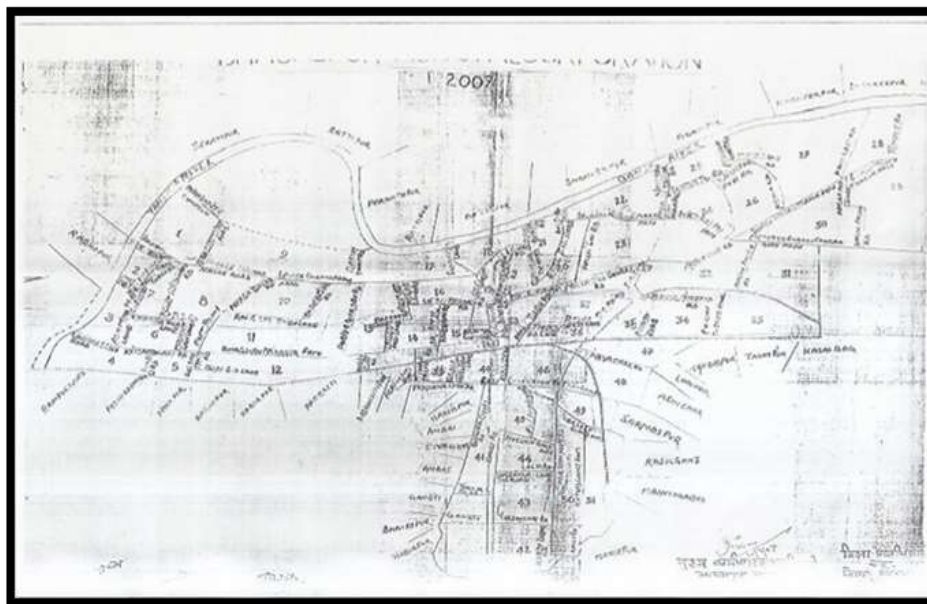


Fig : location of map in the sampling sites areas of BMC, Bhagalpur district, Bihar, India.



The city has a population of 410,210 (Census of India 2011) with a metro population of around 0.41 million and is the fourth largest city in Bihar in terms of urban population. The average population density of the city is 113 person per hectare.

The shallow aquifers consisting of fine to medium sand with clay silt and kankars are the main source of groundwater in the marginal alluvial tract in the south Bhagalpur. The deeper aquifers mainly consist of sand, gravel and calcareous nodules with alternating layers of clay.

A survey of 51 wards of Bhagalpur Municipal Corporation was made and groundwater sources used for drinking and other domestic purposes were identified in each ward.

MATERIAL AND METHODS

Table: Methods of estimation of different physico-chemical parameters of groundwater

Parameters analyzed	Methods used
Temperature	Centigrade mercury thermometer
pH	pH paper / Digital pH Meter
Conductivity	Conductivity-TDS Meter
TDS	Conductivity-TDS Meter
Bicarbonate	Methyl-orange indicator's method
Total hardness	EDTA titrimetric method
Chloride	Argenometric Method (APHA,2005)

Phosphate-phosphorus	Stannous chloride method (Wilde et al. 1972)
Nitrate-nitrogen	Phenol disulphonic acid method (NEERI, 1986)
Fluoride	Spectroquant Colorimeter Picco by Merk

RESULT AND DISCUSSION

The property of groundwater is constant in most of the cases but if get changed its very difficult to identify and understand the fate. It is equally challenging and difficult to resolve or retrieve the purity of groundwater in most of the cases once it gets polluted. The growing population and rapid urbanization raising the gap of adequate and safe drinking water supply sharply. The urban areas have started to face the inadequate supply of safe drinking water to the households, periurban and slums. The regular changes in these non-deterministic components may originate from randomness of overexploitation or improper use of these resources. Due to lack of proper information and awareness and carelessness in behaviour in new era may raise mammoths' of drinking water problems with uncertainty. WHO has reported that the developing countries like India 80% of the disease in human and about 30% of infant mortality occurs due to water pollution in (Chakroborty, 1999). Keeping these facts in mind the present study was aimed to revealed the facts of fluoride contents in groundwater of Bhagalpur Municipal Corporation (BMC). The problem of groundwater quality are more acute in areas that are densely populated and thickly industrialized and have shallow groundwater tube wells (Gupta, 1999; Dhoble and Patel, 1999)

CONCLUSION

Finally it is concluded that the present study of physico-chemical analysis of groundwater sources (drinking water sources) of the 13 wards under Bhagalpur Municipal Corporation suggest that all the physico-chemical parameters are within safe limits except that of fluoride which is above permissible limit as prescribed by WHO/BIS for drinking water. The excess fluoride concentration in the study area (Wards 39-51) may be attributed to the geological formation in the area. The weathering of rocks and leaching of fluoride bearing minerals might be the major reasons which may have contributed to the elevated concentration of fluoride in groundwater sources of Bhagalpur Municipal Corporation. Therefore, the present study indicates that groundwater sources in wards 39 – 51 of Bhagalpur Municipal Corporation are not fit for drinking purpose. The authors also witnessed some youths less than twenty years of age in southern wards of BMC who complained of sever backache and difficulty in folding their knees. Awareness to be created among the people, about the fluorosis.

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