Life Science Bulletin, **Vol. 8(2) 2011 : 231-234** ISSN : 0973 5453

NITRATE AND FLUORIDE IN GROUND WATER OF TOWN DEEG (BHARATPUR) RAJASTHAN : AN ASSESSMENT RELATED TO SEASONAL CHANGES

B. K. GUPTA[1] and SUNDER SINGH[2]

[1]Department of Zoology, M.A.J. Govt.College, Deeg Bharatpur (Rajasthan)
[2]Department of Zoology, M.S.J. Govt. (PG) College, Bharatpur (Rajasthan)

ABSTRACT : Fresh water resources are degrading through population increase, pollution, regional and global change in climate and industrialization. The present investigation deals with the evaluation of seasonal changes (pre-monsoon, monsoon and post-monsoon) in the concentration of Nitrate and Fluoride in town Deeg (Bharatpur). A comparison with ISI standard showed that all the samples of ground water (hand pump and well) exhibit nitrate content very much higher in all seasons. However, an alarming position with regards to nitrate value (376.97 ppm) has been noted in the hand pump water of Kaman road as compared to other samples during monsoon season. This may pose serious health problems if used for drinking purpose. Seasonal variation in the levels of nitrate is evident i.e. minimum in post-monsoon some what higher in pre-monsoon and highest in monsoon season. The seasonal variation in fluoride content indicates that during monsoon the levels of fluoride are less than pre and post monsoon seasons. Well water contains more fluoride than hand pump in the present study. Removal of nitrate by boiling the water is not recommended. This will only concentrate the nitrate making levels even higher. Seeds of yellow mustard is effective for the removal of nitrate.

Key words : *Nitrage, Fluoride, Ground water.*

INTRODUCTION

Ground water has become indispensable to full fill the requirement of water for agriculture and domestic uses. (Sampat, 2000). Ground water is equally essential to ecosystems and species across the world. Rivers and streams depend on ground water for base flow or cool water inputs, also many wetlands and most lakes are directly connected to ground water (Brown *et al.*,2007). Ground water contamination and extraction have been recognized as a crucial danger to the environment and biodiversity around the world (Eamus *et al.*,2006). Groundwater is also often withdrawn for agricultural, municipal and industrial uses by constructing and operating extraction wells.In many parts, the demand for ground water already exceeds supply. In addition surface water supplies are fully allocated for use, thus water users are turning to ground water to meet further water need (Gannett *et al.*,2007). Furthermore, ground water fails to meet drinking water standards. Ground water contamination by nutrients or chemicals from agriculture, waste disposal and industrial operation is prevalent. Waste materials which are subjected to reaction with percolating rain water and reach the aquifer system hence degrade the ground water quality (Tyagi *et al.*,2002). Consequently, ground water depletion and contamination pose a looming and widespread threat to aquatic ecosystem and suitability for agricultural, industrial and domestic uses. Safe drinking water is the basic need and the residents of town Deeg (Bharatpur) Rajasthan do not totally depend on PHED water supply scheme, but they use it only for bathing and washing of clothes. For drinking purpose they fetch untreated water from the wells and hand pumps at some places situated sometimes at far off places from their residences. Water borne diseases such as of asthma, skeletal deformities and arthritis etc. are prevalent in the residents of town Deeg. Water quality studies were carried out by several workers *i.e.* Gupta & Verma (2007), Deviprasad *et al.* (2009), Shivakar *et al.* (2009), Gupta & Sharma (2009), Reza & Singh (2009) and Gupta & Singh (2009,2010). Therefore, the present study is aimed to evaluate seasonal changes (pre-monsoon,monsoon and post monsoon) in the concentration of Nitrate and fluoride in town Deeg (Bharatpur).

MATERIAL AND METHODS

The town Deeg is located on the north of Bharatpur city and lie in between 27°20' N latitudes and 77°15' E longitudes. Four different areas - the Jal Mahal, Goverdhan road, Kaman road and Nagar road and their nearby places of town Deeg were selected for sampling of water. The approximate distance between the four areas was one and a half kilometer. Samples were taken from all the four areas including four samples each from hand pump and well water every fortnightly during pre-monsoon,monsoon and postmonsoon season from January to December,2008. Samples were taken in clean sterilized polythene bags. Water samples were analysed to find out Nitrate (NO_3) by Phenol disulfonic acid (rubbing) and Fluoride (F) by SPADNS method as given by APHA (2005) and Trivedy and Goyal (1986).

*Author for correspondence (email : bk_gupta60@yahoo.co.in) Received 11.04.2011 Accepted 30.06.2011

RESULTS AND DISCUSSION

The fluoride content of all areas (except hand pump of Goverdhan road and Jal mahal) exceeds far from prescribed limits which may be due to natural phenomenon, influenced by the local and regional geological setting and hydrogeological conditions. Further, aridity of climate, dissolution of F bearing minerals, ion exchange and evaporative concentrations may locally reasoned for high fluoride in groundwater (Saxena & Ahmed,2003 and Narsirnha *et al.*,2009). High fluoride contents in groundwater have also been reported by Madhnure *et al.* (2007) and Narsirnha *et al.* (2009). Presence of fluoride above permissible limit in most of the sources of drinking water is the concern of public health and has serious health consequences (WHO,2008). In the surveyed area it is evident that children and older people are affected by teeth coloring and skeletal problem, , urine trouble, abnormal behavior, reduction of IQ etc. (Sarkar,2004; Emmanuel *et al.*,2008 and Roy,2007) in the area by taking fluoride contaminated water. Lower level of fluoride in monsoon as compared to pre and post-monsoon may be attributed to the aridity of climate in the present study. During monsoon season because of rainfall, the aridity of climate decreases thereby the rate of evaporation decreases which may result in the lower levels of fluoride during monsoon season (Saxena and Ahmad,2001). Ground water of town Deeg because of having high level of fluoride is not fit for drinking purpose.

Table. 1 Seasonal variation of nitrate and fluoride in town Deeg (Bharatpur).

Area	Type of water	Pre-monsoon		Monsoon		Post-monsoon	
		Nitrate	Fluoride	Nitrate	Fluoride	Nitrate	Fluoride
Nagar	Hand pump	219.00±0.06	1.56±0.005	246.00±0.99	4.57±0.047	125.5±0,98	3.56±0.05
Road	Well	209.00±0.02	8.75±0.02	233.00±0.98	4.55±0.028	142.65±0.07	6.96±0.04
Goverdhan	Hand Pump	211.00±0.04	1.49±0.04	241.00±98	1.33±0.017	115.25±0.38	1.20±0.018
Road	Well	210.06±0.05	8.69±0.06	233.00±0.88	2.34±0.16	82.67±0.07	7.69±0.01
Jal	Hand pump	209.00±0.04	1.00±0.02	225.00±0.14	0.00±0.00	115.25±0.04	0.76±0.04
Mahal	Well	217.00±0.04	8.99±0.06	248.00±0.98	4.36±0.72	125.25±0.38	7.96±0.035
Kaman	Hand pump	220.00±0.04	1.90±0.62	376.97±0.08	3.03±0.028	325.75±0.48	2.60±0.043
Road	Well	212.02±0.04	8.02±0.72	247.00±0.38	8.92±0.046	142.65± 0.07	8.61±0.054

The Nitrate concentration in all areas is higher than the permissible limits which may be attributed to the percolating nitrate from decaying plants and animal material, agricultural fertilizer, industrial and sewage waste into dug wells during rainfall and plantation of leguminosae crops whose roots (nodules) fix atmospheric nitrogen in the form of nitrate. This may create serious health problems such as methamoglobinemia (blue baby) in infants and pregnant women, gastric cancer, acute respiratory tract infection due to the formation of carcinogenic nitrosamine and nitrosarcosine (Bush & Meyer,1982 and Uba & Aghogho,2001) if used for drinking purpose. The reason being nitrite (NO_2) in the human intestine combines with haemoglobin making it ineffective to absorb oxygen. The high concentration of Nitrate (NO_3) in ground water has also been reported by Kannan *et al.* (2005), Prakash & Somashekar (2006), Kumar *et al.* (2008) and Batheja *et al.* (2009). Maximum concentration of nitrate has been recorded during monsoon season which may be due to high leaching of waste disposed from fertilizers and pharmaceutical industries, domestic and municipal sewage, washing of stagnant effluents and agricultural discharges along with rain runoffs (Lakshmann *et al.*,1987). The elevated levels of nitrate in ground water have also been reported by Chandrashekar *et al.* (2003), Kaushik *et al.* (2004), Kannan *et al.* (2005), Singh & Chandel (2006a,b), Kumar *et al.* (2007), Tatwat & Chandel (2007), Prasad *et al.* (2007), Garg *et al.* (2008), Kumar *et al.* (2008) and Gupta & Singh (2009,2010). The decreased value of nitrate in pre and post-monsoon may be attributed to the biological utilization and absorption of nitrate into the sediment. The ground water of town Deeg contains very high amount of nitrate which renders the water unsuitable for drinking purpose.

It is evident that fluoride is minimum in monsoon season compared to other seasons. well water contains more fluoride than hand pump water. Nitrate concentration is very high than the permissible limits in all samples however, the nitrate values show highest concentration in monsoon than other seasons.

Suggestive remedies :

1. The untreated sewage and sewerage flowing in various open drains are one of the causes of ground water quality deterioration. Proper under ground sewerage system must be laid in all inhabited areas and the untreated sewage and industrial wastes should not be allowed to flow in open drains.
2. Monitoring of Groundwater quality should be done in the areas where water was found contaminated.

3. Collection & treatment of wastewater and collection & disposal of municipal solid waste must be executed.
4. The de-fluoridation treatment (domestic level) should be undertaken if the water is having high fluoride.
5. The use of potable water with high fluoride concentration should be discouraged. Food rich in calcium and phosphorus, adoption of an activated alumina adsorption technique, recharging the underground aquifer by harvesting, are recommended as these decreases the fluoride accumulation in human body (Madhnure *et al.*,2007 and Alagumuthu & Rajan,2008)
6. Treatment option for nitrate should be undertaken in ground water drawn from sources exceeding the permissible limit of 50 mg/l.16. Nitrates must not be removed by boiling as this will concentrate the nitrates making levels high. Seeds of ellow mustard is effective for the removal of nitrate (Batheja *et al.*,2009).
7. Use of canned milk and food to children should be banned in the areas with high nitrate.Vitamin-C with food should be provided because it develops immunity to nitrates (Kumar *et al.*,2008).
8. Environmental awareness through education is highly recommended as this is very important to conserve water resources and equally to maintain health.

REFERENCES

Alagumuthu, G. and M. Rajan (2008). *Rasayan J. Chem.*, **1(4)** : 757-765.

APHA (2005). *Standard methods for the examination of water and waste water*. American Public Health Association, Washington D.C., USA.

Batheja, K.; A. K. Sinha and G. Seth (2009). *Asian J. Exp. Science*, **23(1)** : 61-66.

Brown, J.; L. Bach; A. Aldous and A. Wyers (2007). Overcoming data shortfalls to locate ground water dependent ecosystems and assess threats to ground water quantity and quality. In : *Proceedings of the 35th IAH Congress International Association of hydrogeologists groundwater and ecosystems*. (eds. L. Ribiero; A. Chambel and M. T. Condesso de Melo). Lisbon, p. 461.

Chandrashekar, J. S.; K. L. Babu and R. K. Somashekar (2003). *J. Environ. Biol.*, **24(3)** : 223-227.

Bush, D. and M. Meyer (1982). *J. Environ. Health*, pp. 310-311.

Deviprasad, A. G.; G. V. Venkataramana and M. Thomas (2009). *J. Environ. Biol.*, **30(5)** : 713-718.

Eamus, D.; R. Froend, R. Loomes, G. Hose and B. Murray (2006). *Australian Journal of Botany*, **54** : 97-114.

Emmanuel, K. A.; K. A. Ramaraju, G. Rambabu, A. Veerabhadra Rao (2008). *Rasayan J. Chem.*, **1(4)** : 802-818.

Gannett, M. W.; K. E. Lite Jr.; J. L. La Marche, B. J. Fisher and D. J. Polette (2007). *Groundwater hydrology of the upper Klamath Basin, Oregon and California*. U.S.G.S., Scientific Investigations Report 2007-5050, p. 98.

Garg, D.; R. Kaur, D. Chand, S. K. Mehala and R. V. Singh (2008). *Rasayan J. Chem.*, **1(4)** : 743-750.

Gupta, B. K. and Anjali Sharma (2009). *Poll. Res.*, **28(4)** : In press.

Gupta, B. K. and B. P. Jatav (2009). Physicochemical characteristics of water of Juggar Dam, Hindaun city in Karauli district Rajasthan. In : *Proceedings of National Conference on Environmental Health Hazards*. JDB Girls College, Kota (Rajasthan), pp. 293-294.

Gupta, B. K. and S. S. Verma (2007). Physicochemical studies of drinking water quality of town Deeg (Bharatpur) Rajasthan during pre-monsoon season. In : *Proceedings of National Symposium of Limnology*. Udaipur, pp. 224-226.

Gupta, B. K. and Sunder Singh (2009). Ground Water Quality of Town Deeg in District Bharatpur, Rajasthan, India : A physicochemical analysis. In : *Proceedings of National Conference on Environmental Health Hazards*, JDB Girls College, Kota (Rajasthan), pp. 296-297.

Gupta, B. K. and Sunder Singh (2010). *Life Sciences Bulletin*, **07(01)** : 155-157.

Kaushik, A.; K. Kumar, I. S. Sharma and H. R. Sharma (2004). *J. Environ. Biol.*, **25(2)** : 173-180.

Kannan, V.; R. Ramesh and C. Sasi Kumar (2005). *J. Environ. Biol.*, **26(2)** : 269-272.

Kumar, S.; R. K. Gupta and A. C. Goyal (2008). *Asian J. Exp Science*, **22(1)** : 161-164.

Kumar, T. S.; V. Sudarshan and G. Kalpana (2007). *Poll. Res.*, **26(4)** : 785-800.

Lakshmann, P. T.; C. S. Shynamma, A. N. Balchand and P. N. K. Nambisa (1987). *Ind. J. Mar. Sci.*, **16** : 99-102.

Madhnure, P.; D. Y. Sirsikar, A. N. Tiwari, B. Ranjan and D. B. Malpe (2007). *Curr. Sci.*, **92(5)** : 675-679.

Narsirnha, A.; M. Ramana. Kumar, A. Ravi Kumar and B. Srinivas (2009). *Poll. Res.*, **28(3)** : 485-488.

Prasad, M.; M. Swami and R. V. Singh (2007). *Int. J. Chem. Sci.*, **5(5)** : 2353-2358.

Prakash, K. L. and R. K. Somashekar (2006). *Indian J. Environ. Biol.*, **4(27)** : 633-637.

Reza, R. and G. Singh (2009). *J. of American Sci.*, **5(5)** : 53-58.

Roy, S. K. (2007). *J. Environ. Sociobiol.*, **4** : 31-36.

Sampat, P. (2000). *Deep trouble : The hidden threat of groundwater pollution*. World Watch Paper # 154. World Watch Institute, p. 28.

Sarkar, M. (2004). *Fluorosis. Science Reporter*, p. 28.

Saxena, V. K. and S. Ahmad (2001). *Environ. Gest.*, **40** : 1084-1087.

Saxena, V. K. and S. Ahmed (2003). *Environ. Geol.*, **43** : 731-736.

Shivakar, M. M.; C. L. Patil and Varsha Waikole (2009). *Poll. Res.*, **28(2)** : 301-304.

Singh, V. and C. P. S. Chandel (2006a). *Res. J. Chem. Environ.*, **10(1)** : 30-33.

Singh, V. and C. P. S. Chandel (2006b). *Res. J. Chem. Environ.*, **13(3&4)** : 307-314.

Tatwat, R. K. and C. P. S. Chandel (2007). *Poll. Res.*, **26(4)** : 681-685.

Trivedy, R. K. and P. K. Goyal (1986). *Chemical and biological methods for water pollutions studies.* Environ. Publication, Karad.

Tyagi, P.; D. Buddhi, R. Chaudhary and R. L. Sawhney (2002). *Ind. J. Environ. Protcct.*, **20** : 174-181.

Uba, B. N. and Aghogho (2001). *Institute Public Analyst of Nigeria News*, **2** : 11-14.

WHO (2008). *Guidelines for Drinking Water Quality.* Recommendation, World Health Organization, Genewa, **1** : 130-135.