P: ISSN No. 0976-8602 RNI No.UPENG/2012/426228 VOL.-IV, ISSUE-I, January-2015
E: ISSN No. 2349 - 9443
Asian Resonance

A Physico-Chemical Study of Ground Water Quality, with Special Reference to Fluorosis in Rural Population of village - Bamor, District Shivpuri

D.K. Sharma
Assistant Professor
Department of Zoology
Govt. P.G. College, Shivpuri, M.P.

Anand Kumar Mishra
Assistant Professor
Department of Zoology
Govt. P.G. College, Shivpuri, M.P.

Abstract

The present work is aimed at assessing the water for the groundwater of Bamor village district Shivpuri. This has been determined by collecting groundwater samples and subjecting them to a comprehensive physicochemical analysis. The following parameters pH, TS, TDS, TSS, EC, total alkalinity, magnesium, calcium, total hardness, chloride, sulphate, and nitrate were considered. The high value was found to be mainly due to higher values of iron, nitrate, total dissolved solids, hardness, fluorides, bicarbonate and manganese in the groundwater. The results of analyses have been used to suggest models for predicting water quality. The analysis reveals that the groundwater of the area needs some degree of treatment before consumption, and it also needs to be protected from the perils of contamination.

Keywords: Water, Water quality, Human health, Shivpuri, fluoride.

Introduction

Water is the most precious natural resource and an essential component for all living beings. It is also the soul of all economic activity and development around the world. A large amount of water is being used in drinking, bathing, washing, agriculture industries and aquaculture. The pollution of air, water and land due to urbanization, industrialization and increasing human population has contaminated the water at many places. Drinking water for human consumption requires a certain level of purification and must be free from any toxic and bacterial infection.

Material and methods

Selection of parameters has great importance. Physicochemical parameters, namely pH, TS, TDS, TSS, EC, total alkalinity, magnesium, calcium, total hardness, chloride, sulphate, fluoride and nitrate were used to calculate on the basis of the calculation, the water quality of various areas was determined. For all the calculations standard values of BIS (1993) were taken in to consideration. The physico-chemical parameters were analyzed as per the procedures given in APHA**(**1986)and Trivedy and Goel (1986).

Study Area-

Bamor is a small village under Shivpuri District, Madhya Pradesh. The Bamor village is situated on Agra - Mumbai National Highway No.-3 and 18 Kilometers away from Shivpuri headquarters. The present study gives base line information on the drinking water quality.

Result and discussion

The result obtained for different drinking water samples taken from Bamor Village of Shivpuri distt. are given in Table No. 1, 2 and 3 in different seasons. (W = Winter Season, S=Summer Seasion, R = Rainy Season)

P: ISSN No. 0976-8602 RNI No.UPENG/2012/426228 VOL.-IV, ISSUE-I, January-2015
E: ISSN No. 2349 - 9443
Asian Resonance

Sources	No.	Temperature [^{0}C]			[Turbidity (NTU)			[Conductivity (micro.mohs/cm)]		
		W.	S.	R.	W.	S.	R.	W.	S.	R.
HP	1.	26	32	28	3	3	4	1360	1365	1360
WP	2.	25	30	28	4	3	4	1365	1365	1360
W	3.	28	33	29	4	4	5	1360	1360	1365
W	4.	26	32	28	3	3	4	1370	1365	1370
W	5.	25	32	28	3	3	3	1365	1370	1370
W	6.	27	30	29	3	3	4	1375	1380	1390
W	7.	28	32	29	3	2	6	1365	1365	1370
W	8.	26	32	28	4	4	5	1365	1370	1370
TW	9.	23	35	30	4	3	3	1380	1480	1470
TW	10.	22	36	31	5	5	4	1375	1385	1470
TW	11.	22	34	30	5	4	4	1370	1385	1465
TW	12.	21	34	30	3	4	7	1375	1380	1475
TW	13.	23	33	29	4	4	5	1370	1380	1400
TW	14.	20	34	30	5	5	7	1365	1380	1400
TW	15.	22	33	29	3	3	5	1375	1395	1395
TW	16.	22	34	29	3	5	5	1370	1395	1395
TW	17.	23	34	29	5	5	7	1380	1375	1470
TW	18.	21	36	31	5	4	6	1370	1390	1465
TW	19.	21	34	31	4	4	6	1375	1480	1490
TW	20.	22	34	30	5	4	7	1375	1410	1390
TW	21.	22	36	29	3	4	7	1365	1375	1375
TW	22.	22	36	29	4	4	5	1365	1380	1410
TW	23.	23	36	28	4	3	5	1380	1395	1465
TW	24.	24	34	28	5	5	6	1380	1395	1470
TW	25.	21	34	28	4	5	6	1370	1390	1400

HP = Hand Pump, W = Wells, TW = Tape Water

P: ISSN No. 0976-8602 RNI No.UPENG/2012/426228 VOL.-IV, ISSUE-I, January-2015
E: ISSN No. 2349 - 9443
Asian Resonance

Table No.-2

Source	No.	pH			Chloride mg./lit.			Hardness mg./lit.			Fluoride mg./lit.		
		W.	S.	R.	W.	S.	R.	W.	S.	R.	W.	S.	R.
HP	1.	6.5	6.5	6.5	200	210	190	110	120	150	.38	.40	.40
WP	2.	6.0	6.7	6.5	180	170	200	120	130	150	.30	.35	.30
W	3.	7.5	6.2	6.5	220	180	230	125	105	140	.36	.30	.40
W	4.	6.7	6.2	6.5	200	200	210	140	120	150	.35	.38	.35
W	5.	6.5	6.7	7.8	190	180	230	140	100	110	.38	.40	.35
W	6.	6.2	7.9	7.5	210	175	225	145	100	110	.50	.40	.38
W	7.	7.4	6.5	7.8	240	220	250	140	135	110	.30	.39	.40
W	8.	6.2	6.5	6.5	200	170	200	140	160	170	.40	.35	.42
TW	9.	6.2	6.2	6.5	200	190	210	160	145	130	.35	.25	.28
TW	10.	6.0	7.2	8.0	180	180	250	150	140	120	.39	.30	.40
TW	11.	8.5	6.5	7.5	190	210	220	150	140	130	.40	.35	.45
TW	12.	6.5	7.5	7.5	210	200	240	160	150	130	.40	.25	.43
TW	13.	6.5	8.0	8.2	240	220	200	160	140	170	.40	.29	.35
TW	14.	8.5	8.0	8.2	200	220	180	150	150	150	.35	.36	.30
TW	15.	8.3	6.5	6.5	190	200	190	150	140	140	.30	.30	.30
TW	16.	8.5	8.0	8.0	240	210	200	140	150	170	.50	.35	.30
TW	17.	8.5	8.0	8.0	240	220	250	150	150	130	.50	.20	.40
TW	18.	8.0	7.5	8.0	190	180	250	160	150	130	.40	.39	.45
TW	19.	8.0	8.0	8.0	190	190	240	160	140	140	.50	.40	.40
TW	20.	8.5	6.7	7.5	180	220	210	150	150	160	.50	.35	.30
TW	21.	8.0	7.5	6.5	190	220	210	160	150	150	.50	.45	.40
TW	22.	8.3	7.9	6.5	195	200	220	160	150	160	.45	.40	.30
TW	23.	7.9	7.9	7.9	180	190	250	150	160	160	.45	.40	.40
TW	24.	8.2	8.2	8.0	240	220	250	160	160	170	.50	.45	.45
TW	25.	7.6	8.0	7.5	240	220	230	160	150	170	.40	.40	.40

HP = Hand Pump, W = Wells, TW = Tape Water

P: ISSN No. 0976-8602 RNI No.UPENG/2012/426228 VOL.-IV, ISSUE-I, January-2015
E: ISSN No. 2349 - 9443
Asian Resonance

Table No.-3

Sources	No.	[Nitrate mg./lit.]			[Alkalify (mg./lit.)]			[E.Col. (MPN)]		
		W.	S.	R.	W.	S.	R.	W.	S.	R.
HP	1.	25	20	40	100	110	130	2	10	4
WP	2.	25	25	40	100	100	125	-	-	-
W	3.	30	28	40	140	110	130	-	-	-
W	4.	28	20	35	100	100	120	-	-	-
W	5.	25	30	30	100	100	140	-	-	-
W	6.	29	30	30	120	140	140	-	-	-
W	7.	32	28	35	140	150	160	-	-	-
W	8.	30	35	40	140	170	150	3	6	3
TW	9.	25	30	45	130	110	130	-	-	-
TW	10.	40	30	45	120	180	150	-	8	-
TW	11.	30	34	40	100	170	150	3	-	-
TW	12.	30	28	40	180	160	150	-	-	-
TW	13.	25	32	40	180	180	170	2	10	3
TW	14.	28	40	45	100	180	140	2	10	3
TW	15.	30	38	44	180	160	170	-	-	-
TW	16.	27	35	44	90	160	100	-	8	4
TW	17.	40	40	45	100	150	140	2	10	4
TW	18.	30	34	40	170	180	160	-	-	-
TW	19.	40	25	44	90	150	160	-	-	-
TW	20.	35	30	44	100	140	160	-	5	4
TW	21.	38	32	40	150	140	140	-	2	5
TW	22.	35	38	45	150	130	125	-	-	-
TW	23.	40	40	45	160	120	130	3	8	5
TW	24.	40	45	45	130	180	170	-	-	-
TW	25.	38	40	45	150	160	170	5	5	10

HP = Hand Pump, W = Wells, TW = Tape Water

Conductivity

Conductivity is a capacity of water to carry on electrical current and varies both with the number and types of ions the solution contains. This in turn is related to the concentration of ionized substance in the water. Most dissolved inorganic substance in water are in the ionized from and hence contribute to conductance.

The value of conductivity in the drinking water sample varied from 1360 micro mhos/cm to 1470 micro.mhos/cm. During winter micro.mhos/cm to 1380 micro mhos/cm. In summer season conductivity range slightly above in Tap-Water sample No. 15, 17, 18, 23 and 24. The range of conductivity in rainy season in varied from 1380 micro.mhos/cm to 1470 micro.mhos/cm and the maximum range was found in this season in sample 9, 12, 19, 23 and 24.

Turbidity

Suspension of particles in water interfering with passage of light is called turbidity Turbid waters are undesirable from aesthetic point of view in drinking water supplies and may also affect products in industries. Turbidity values if high in rainy season. Its range from 4 NTU to 7 NTU and maximum value were recorded in tap-water samples. Average value of turbidity is found 5.0 NTU.

Temperature

It is essential to record the temperature of water at all the site, source, from where water sample is collected.Temperature of water of DO, CO2, alkalinity and salinity. It is recorded with the help of Thermometer. In present study the temperature of water is higher than comparison to rainy and winter seasons. Its average value in rainy (20^0C-28^0C) summer (30^0C - 36^0C) & winter season is value from 28^0C to 31^0C

Taste

Taste is a parameter which cannot be quantified. Test vary from person to person and hence the criteria laid for potable water is that should not none and objectionable test. In present study the test of drinking water is not objectionable.

Analysis of Chemical Parameters

Chemicals analysis has the advantage of great precision and clarifies the value of analysis stands and falls with the representatives of samples. In present study the most parameter which analyzed about the portability of water their relevance are discussed below.

pH Value

pH is measure of Hydrogen concentration and is given by the expression.

Acidic Neutral Alkaline 1 2 3 4 5 6 7 8 9 10 11 12 1314

pH Scale

Knowledge of pH of water used for public water supplies is important. Low pH makes the water corrosive. The pH of domestic water supply should not be lower than 6.5 and higher than 9.2. The pH value in the study areas of various water sources snowed higher level than the permissible limit during season. During rainy season the ground water was found to slightly acidic to slightly alkaline range. In the winter season showed very slight variation in pH was shown and water was mostly alkaline. The pH value in winter season 6.0 to 8.5, summer season 6.2 to 8.2 and rainy season 6.5 to 8.2. The maximum pH value were recorded in water sources of Hand Pump. The total picture sohowed that there was not much variation beyond the permissible limit.

Chloride

Chloride occurs in widely varying concentration in all natural waters. The human body wastes contain 5 to 9 gm. of chloride a day and this amount of chloride boosts up the chloride ion concentration of sewage by about 15 mg/lit. In this way chloride is the pollution indicator.

The levels of chloride content are ground water ranged from 180 to 250 mg/lit. The maximum valued was recorded in Rainy season in sample no. 7, 10, 17, 18, 23 and 24 much variation in chloride content was recorded in this season. In the present study on drinking water sources none of the sources exceed.

Hardness

Water is said to be hard when it does not from lather with soap. Hardness is water is caused by dissolve calcium, magnesium, Iron and Zink Ions. Hardness is estimated by titration with EDTA. Since hard water is unsuitable for domestic uses like laundering, cooking and for industries like paper, textile dyeing etc.

Levels calcium hardness in ground water samples varied from 110 mg./lit. to 170 mg./lit.) highest values were recorded in the maximum samples of tap-water in summer and Rainy season. A limit 200 mg./litof calcium hardness (as CaCo3) has been suggested a standard limit of drinking water. During rainy season total hardness exhibited higher variation as compared to summer and winter seasons and ranged from a lowest of 110 mg./lit. to the highest value of 170 mg./lit. During winter season hardness was found to vary from 110 mg/.lit. to 160 mg./lit. These findings make it clear that the water is quite suitable for drinking purpose after normal treatment.

Nitrate

Nitrate represents the final stage of nitrogenous organic matter (such as dead green plants and animals and the excremental wastes from man and animals) as such higher value of nitrate in the water may be indicative of sewage pollution. It is health related water quality parameter and when its concentration in exceeds 45 mg./lit. It becomes severally harmful to infants and babies, this disease is called cyanosis or blue babies or methemoglobunima.

On the basis of the present study the author has not able to identify and disease which has positive correlation with nitrate content. The levels of nitrate during rainy season were high as compared to summer and winter seasons, this ranged from 30 mg./lit. to 45 mg./lit. The highest level of nitrate snowed in maximum sample in rainy season. A study of the topography of this location showed that this area is at a lower level, there by accumulation of

organic matter becomes the source of high nitrate level. The range of nitrate in winter season is varied from 25 mg./lit. to 40 mg./lit. The lowest rang showed is sample No. 1, 2, 5 and 13 and highest rang in sample No. 10, 17, 19, 23, 24 winter season. In summer season the value of Nitrate in 20 ml/lit. to 40 mg/lit. The lowest values were recorded in sample No. 1 and 4 in this season.

Alkalinity

The alkalinity of water used for water supplies is important because it affects the amount of chemicals that need to be added for coagulation, softening and control by corrosion in distribution system. Alkalinity is the sum total of components in the water that tend to elevate the pH of water. It is measured by titration with standardized acid.

The level of alkalinity in the water samples varied from 100 mg./lit. To 180 mg./lit. During rainy and summer season alkalinity rang slightly above in this season's most of the samples it very from 150 mg./lit. To 180 mg./lit. The minimum range was found in sample No. 7, 11 and 19 in summer and winter season. Thus none of the sources of drinking water alkalinity is exceeded the permissible limit.

Bacteriology of Water

Water circulating in the distribution system should not contain any organism. The presence of coli form group should be considered an indication of recent and remote fecal pollution and the presence of Escherichia coli should considered definite indication of recent fecal pollution.

In the present study the studied water sources showed highest bacterial count in the summer season which was followed by rainy and winter season respectively. In summer the No. of 12 water sample witnessed the bacterial count above 10 MPN. In winter season the 24 hours test showed 5 MPN to 7 MPN. In winter season the 24 hours test showed variation from 2 MPN to 3 MPN No. of Ten samples snowed the range on higher side is 10 MPN. It may be because of the location of side near the mullah white is contamination source with four small in this area.

Fluoride

Fluoride is a health related quality parameter. The problem of high concentration of fluoride in drinking water has become a prime cause of concern to one and all. To combat the problem effectively, it is essential to understand the hydrological control for occurrence of fluoride in ground water and take appropriate measure to meet the challenge.

The study of fluoride content have thrown light on the fact that in quantic terrain, the minerals fluorite and Fluor apatite contribute to higher concentration of fluoride with increase in contact time of ground water with these minerals in rocks. The deeper aquifers were found generally to content high concentration of fluoride as companied to shallow qualifiers. Also the wells located near surface water bodies have low fluoride content in ground water.

Fluoride intake in excess through water, food and air can cause several ailments like -Dental caries (Fluoride level below 0.5 mg/lit), Molting of teeth fluoride level 1.5 to 3.0 mg/lit) Skeletal crippling fluorosis and damages of the fetus (fluoride level 3.0 to 0.9 mg/lit.)

In the present study on ground water sources none of the sources exceeded the permissible limit of fluoride. The value of fluoride content of water ranged from .20 mg/lit. to 50 mg/lit. The highest value was recorded in sample No. 6, 21 and 24 in winter season. In the rainy season showed very slight variation of fluoride content in drinking water. As well as none of the sources exceeded the permissible limit of fluoride.

Health Spectrum Offluorosis

High fluoride (>1.5 mg/l) may cause various types of fluorosis manifestations including mottling of teeth called /dental fluorosis and skeletal fluorosis. The manifestations of non-skeletal fluorosis are often overlooked due to the misconception that fluoride affects only bones and teeth. Fluorides in excess can cause several ailments, viz. neurological, muscular, allergic, gastrointestinal complaints and flatulence in expectant and lactating mothers, hardworking young adults, urinary tract infections and headaches. Intake of high fluoride (> 3.0 mg/l) can result in skeletal fluorosis and other skeletal abnormalities and beyond 10 mg/l over a long period can result in crippling fluorosis. Population affected by skeletal fluorosis in the country is estimated as 50 lakh, which are approximately 90% of the total affected world's population.

It has been observed that the prolonged use of drugs containing sodium fluoride is known to cause skeletal fluorosis. Fluoride dust and fumes generated from certain industries may be a dangerous as consuming fluoride through food, water and drugs, and complexes the problem of water and food borne fluorosis. Infant mortality has also been observed due to calcification of blood vessels in endemic areas. While abortions, stillbirths and children born deformed are common, the adolescent age group is most vulnerable. However, fluoride toxicity, and the biological response leading to ill effects depend on several other factors apart

P: ISSN No. 0976-8602 RNI No.UPENG/2012/426228 VOL.-IV, ISSUE-I, January-2015
E: ISSN No. 2349 - 9443
Asian Resonance

Relation between concentrations Of Fluorides and Biological Effects

(Smith and hedge-1959)

Concentration of Fluoride (mg/ltr)	Medium	Effect
1.5 to 4.0	Foods and water	Mottling and staining of teeth. Bone deformity
4.0 to 7.0	Foods and water	Dental carries and minor skeletal deformation
Above 7.0	Foods and water	Acute ostio Fluorosis stiffness in Joints, Skeleton deformation thyroid changes, kidney damage
8	Foods and water	10% Osteosclerosis
50	Foods and water	Thyroid changes, stiffness in joints
100	Foods and water	Growth retardation and kidney damage

Control Strategy

There is a need for development of a broad concept to tackle excess fluoride problem and its implementation of strategy.

Survey for Delineation of Fluoride Affected Areas

The water quality analysis may be carried out in 10% of the source in the possible affected areas to delineate the area broadly. The areas identified so, could be health surveyed by observing teeth of the school children preferably above 8 years old. For this purpose, the specially trained school teachers/ health workers may be used to assess the impact on the teeth, i.e. dental fluorosis. If both data are conclusively indicating the effect of fluoride through drinking water, the area should be scanned through analysis of 100% water samples of existing sources, following the health survey to develop the strategies to tackle the problem.

Preventive Measures

Using Information, Education and Communication (IEC) activities/techniques to sensitize the public to drink only fluoride free water and routinely monitor the drinking water quality in affected area and its surroundings may be taken up. Simultaneously, the people in such areas may be advised to switchover to the diet, which can encounter the physiological effects of fluoride intake. Importance of a nutritive diet rich in calcium and vitamin- C supplements and consumption of de-fluoridated water need to be stressed to the people specially pregnant and lactating mothers in affected areas to avoid abortions, stillbirths and infant health problems. In the country, serious efforts to tackle fluorosis due to intake of excess of fluoride through drinking water had been made only after the launching of Rajiv Gandhi National Drinking Water Mission (Presently, Dept. of Drinking Water Supply) in 1986. Obviously, there is a need to develop a strategy to tackle fluorosis in the country.

Recommendation and Conclusion

Awareness should be generated among rural population regarding real cause of the disease. This can be done by regular of frequent workshops & visit at village level by health/PHE Department. There into treatment of Fluorosis, therefore rural & development department studies are funded for proper cure of Fluorosis and to a certain reversibility of florists.Although the water samples from the villages are collected and analyzed public health engineering department to update database in terms of chemical parameter content in drinking water sources.This is the most important category of personnel who need sensitization, sufficient time need to be devoted in the above activities through workshops, hand on training and group discussion. School teachers would recorded incidence of Dental fluorosis school children's from the age 08 years and above. In the present study in indicated that drinking water of village Bamor is hard but it is suitable for drinking purpose after the use of sedimentation, filtration and chlorination. The fluoride problem may be tackled by adopting a well-planned systematic approach to identify and use safe alternative sources or treat fluoride-containing waters using proven treatment technologies, if safe water is not routinely available at economical distance. The domestic de-fluoridation should be resorted to as stop gap or interim measure until permanent alternate distant safe source based water supply or community based de-fluodation system installations are commissioned. The Consumption of a nutritive diet, calcium and vitamin-C supplement and consumption of de-fluoridated water should be recommended to pregnant and lactating mothers, if abortions, still births and infant health problems are to be avoided. A strong and appropriately informed education and communication (IEC) to achieve full success should support the total programme.

References

1. APHA, AWWA, WPCF, standard methods for examination of water waste water, Washington D.C. (1995).
2. BIS - Bureau of Indian Standards (Drinking Water Specification "First Revision") New Delhi BIS: 10500 (1991).
3. Dhoble R.D. and Patel, Dr. D.R. Prevention of fluorosis by Alternative source of drinking water in fluoride affected village of Jhabua District (M.P.) IWWA 31 Annual convention Lucknow 69-75, (1999).

4. Dinesh Chand, fluoride and Human Health Cause for concern, Indian Journal Environmental prot 9(2), 81, (1999).
5. Gupta M.K. at al fluoride ground water at Agra, Indian Journal of Environmental Health NEERI (Nagpur) 36. (1994).
6. Husain M. F and Ahmad I. Variability in physic chemical, parameters of pachin river (Itanager), Indian J. Environ, Hlth 44 (4) 329-336. (2002).
7. Trivedi, R.K. and Geol, P.K. 1986. Chemical and Biological Methods for Water Pollution Studies. Environmental pubkarad. 7-251.
8. UNICEF, State of arti Report on the extant by fluoride in drinking water and the resulting infelicity in India. (1999).
9. USPHS, Drinking water standard public health service publication, Washington D.C. 333 PP (1985)
10. Wenzel W. W and Blum W. Fluoride specification and mobility in fluoride contained soil and minerals, soil science 153:357-364 (1992).
11. WHO, Guidelines for drinking water quality world health organization, Geneva, Switzerland Vol 5, P121. (1987).