Seasonal Analysis of Physicochemical Characteristics of Well Water in rural area of Hingna, (M.S.) India.

A. S. Masram
L.A.D. and Smt. R.P. College for Women, Nagpur
Email address:amg123321@gmail.com

Abstract:

The present investigation was carried out seasonally to study the quality of water and its suitability for domestic purpose from dug wells of Digdoh village, MIDC Hingna. The study area is situated between 21.12°N 79.02°E longitude and 9.2Km. west of Nagpur city. Samples were collected from ground water resource i.e. Dug wells from different locations and in different seasons during the year 2013-14.Attempts were made to study and analyse the physicochemical parameters like pH, Electrical conductance, Total suspended solids, Total dissolved solids, Total hardness, Calcium, Magnesium, Total alkalinity, Chloride, Sulphate. Most of the physicochemical characters were within the ISI permissible level. However some parameters were outside the accepted limits. It is concluded that water from dug wells should be treated if used as drinking water.

Keywords: Physicochemical parameters, ground water, ISI.

Introduction:

Much of the current concern regards to environmental quality is focused on water because of its importance in maintaining the human health and health of the ecosystem. Fresh water is finite resource, essential for agriculture, industry and even human existence, without fresh water of adequate quantity and quality, sustainable development will not be possible (Kumar, 1997). There is an extensive literature, which stresses deterioration of water quality (Tiwari and Mishra, 1986; Tiwari and Ali, 1987; Reddy and Venkateswar, 1987; Khulab, 1989). The addition of various kinds of pollutants and nutrients through the various agencies like sewage, industrial effluents, agricultural runoff etc. into the water bodies brings about a series of changes in the quality of water, which have been the subject of several investigations (Vollenweidre, 1998; Milway, 1969; Olimax and Sikorska, 1975; Pieznska et al. 1975). Fresh water resources is becoming day-by-day at the faster rate of deterioration of the water quality is now a global problem (Mahananda et al. 2005).

Ground water is an increasingly important resource all over the world. The term ground water is usually reserved for the substance water that occurs beneath the water table in soils and geologic formation that are fully

saturated. It supports drinking water supply; livestock needs, irrigation, industrial and many commercial activities (Veslind, 1993).

Dug well water is used primarily as a source of drinking water by a vast majority of the rural population in India. Particularly in the village Digdoh, MIDC area of Hingna, according to the record of Grampanchayat Digdoh, there are seven common dug wells have been constructed by the grampanchayat. At present the grampanchayat Digdoh supplying the Vena river water through the pipe line by Sanyukta Pani Puravatha Yojana to Digdoh and Nildoh villages. But it is not sufficient for the need and hence the people of the village use the dug well water for drinking and other purposes.

In view of the above, the effective maintenance of water quality of local resources monitoring of their quality parameters and their use as supplement to river water may reduce the water crises. Also the information of water quality of Digdoh and other villages of MIDC area of Hingna is scanty. Hence the present work determining suitability of ground water for drinking and other purposes of MIDC area is taken up. The present study also strengthens the national and local water quality data base.

Material and methods:

Dighdoh village is situated between 21.12°N 79.02°E and 9.2 km of west of Nagpur City. The population of the village is about 38,193. It shares its boundary with the industrial region of MIDC, Hingna (fig.1). In the study area 4 exploratory wells, 3 observational wells are there and depth of wells varies from 6.5 to 307 meters below the ground level (mbgl), discharge litre per second (lps) is 0.5 to 21.33 IPS (Murthy and Sahoo, 1999) much information is not available on the water quality, pollution load and biotic community structure of these water sources. So keeping all these facts in minds three sampling sites were chosen for the study

Ground water samples were collected for physicochemical analysis from three different sites from different wards of Dighdoh village in all the three seasons during the year 2013-14. Samples were collected in sterilised plastic containers (PVC 1000ml), grab sampling method was followed for case wells. The containers were sealed and the samples were protected from direct sunlight during transportation and it is directly transported to laboratory for analysis. The pHof water was determined by systronics digital P^H meter standardized with buffer tablets. Electrical conductivity (E.C.) was determined using Elico digital conductometer standardized with KCl solution, Total dissolved solids(TDS) was determined by using digital TDS meter standardized with Nacl,Chloride (Cl), Sulphate(So_4) were estimated with standard methods prescribed by Goltman et al,(1978), Trivedi and Goel (1986) and APHA(1998).

Results and discussion:

The results for dug well water quality of Digdoh village ,MIDC, Hingana are tabulated in the following table. The seasonal variations of physicochemical characteristics of Dug well are tabulated in above table for the monsoon, winter and summer season. Climatic factors such as rainfall, temperature pressure and humidity etc. play an important role in the geology as well as territorial environment. A sound knowledge of these factors help in understanding the complex processes of interaction between the climatic and biological processes in water bodies (Hiremath et al. 2011).

pH is the scale of intensity of acidity and alkalinity of water and measures the concentration of hydrogen ions. In the present study the values of pH of well water were in the range of 7.2 to 8.2. The least value was recorded to be 7.2 in the month of January for site-1 while maximum was recorded to be 8.2 in May for the sample Site-2. pH is an important parameter in water body since most of the aquatic organisms are adapted to an average pH and do not withstand abrupt changes. pH is most important in determining the corrosive nature of water. Lower the pH value higher is the corrosive nature of water (Gupta et al., 2009). In the present study the pH values of all the well water samples show that slightly alkaline nature and all the samples were within the permissible limit prescribed by ISI standard. This was positively correlated by the pH of ground water in municipal area of Bijapur (Hiremath, 2011).

The electrical conductance was recorded in the range of 1.5 to 1.6 ms/cm. for all the samples from all the sites. There are no prescribed standards suggested by ISI for parameter electrical conductance for drinking purpose. So no comparison can be made from observed value. No significant variation of conductance was recorded in all the seasons.

The total suspended solids of dug wells water varied from 10-15 mg/lit. There is no significant variation was observed except in the site-1 in summer season where it was observed 15mg/lit. might be due to presence of several suspended particles, Solid garbage dump and other wastage. The higher the concentration of total suspended solid in SCP is an index that it is more polluted (Mahananda et al. 2010).

Total dissolved solids of well water ranged from a minimum 1332 to 1432 mg/lit. In water, total dissolved solids are composed mainly of carbonates, bicarbonates, chlorides, potassium and manganese, organic matter, salt and other particles.All recorded values from all sampling station in all the three seasons were within the highest desirable permissible limit set by WHO standards. A high value of TDS reduces water quality for drinking, irrigation and agriculture purposes (WHO, 1996). Increase in TDS

is mainly due to sea water intrusion and increase in salts (Mittal et al. 1994). These results were positively correlated with the Pitmahal Dam reservoir water in summer, winter and rainy seasons (Patel, 1999). The total hardness (TH) represents the concentration of calcium and magnesium. The desirable limit of total hardness is 200mg/lit. in water as per ISI, TH of the well water of all the three sites were not within the permissible limit. It was in the range of 544 to 666 mg/lit. The calcium hardness was recorded between the range of 178 to 196 mg/lit. and the magnesium hardness was between 46 to 58 mg/lit. These results are positively correlated with the total hardness of the water samples collected from Bijapur (Hiremath,2011), Chirala Town at Prakasan district (Srinivasaet al., 1996). These findings suggests that the water body is moderately hard and high medium productive during present stage were also observed.

The permissible limit of alkalinity in the water sample is 600mg/lit (ISI). In the present investigation it was found to be in the range of 274-315 mg/lit. which were within the permissible level. These results was positively correlated with ground water samples of Bairagarh district, Orissa (Mahananda et al., 2010). The reason for the high amount of alkalinity in the water is due to the wastewater discharge from industries, low water table and lower temperature bringing down the rate of decomposition of salts to a minimum thereby increasing the alkalinity (Radhakrishnan et al. 2007, Mahananda et al. 2010).

Chloride is the indicator of contamination with animal and human waste. Chloride is a common constituent of all natural water and is generally not classified as harmful constituents (Chutia and Sarma, 2009). The chloride contents varied from 163 to 122 mg/lit. maximum in summer from all sites and minimum in monsoon from all sites and results are within the permissible limit suggested by ISI. The present findings are positively correlated with groundwater in municipal area of Bijapur (Hiremath et al. 2011).

The concentration of sulphate recorded was between the range of 97 (Monsoon) to 103 mg/lit(Summer). Sulphate concentration is within the desirable limit of WHO.Concentration of sulphate has laxative effect (Lorraine, 2000) which is enhanced when sulphate is consumed with magnesium. Water containing magnesium sulphate (1000mg/lit) acts as purgative in human adults (Hiremath et al. 2011).

Table. 1- Seasonal analysis of the well water from Digdoh,

Physicochemical parameters	Site-1			Site-2			Site-3		
	M	W	S	M	W	S	M	W	S
pH	7.5	7.2	7.8	7.8	7.3	8.2	7.6	7.7	7.7
Electrical conductance MS/Cm)	1.6	1.5	1.5	1.6	1.6	1.5	1.5	1.6	1.6
Total Suspended Solid (mg/lit)	10	10	15	10	10	10	10	10	10
Total dissolved solids (mg/lit)	1404	1400	1395	1432	1400	1402	1365	1300	1332
Total Hardness (mg/lit)	660	660	666	552	550	544	635	630	630
Calcium (mg/lit)	78	180	186	192	190	196	180	180	180
Magnesium	48	45	46	58	58	54	46	48	48
Total alkalinity	314	300	315	315	300	315	297	280	274
Chloride	121	123	124	156	145	163	123	123	123
Sulphate	97	97	100	98	102	102	97	100	103

M- monsoon, W- winter, S- summer

Figure 1: Map of Digdoh village

Conclusion:

In the present investigation it was found that, maximum parameters were not at the level of pollution except few parameters like Total hardness at sampling site -1in the summer season. The recorded value of Total dissolved solid was found to be higher than permissible limit which is not suitable for drinking purpose. The effective maintenance of water quality of local resources through appropriate control measures, continuous monitoring of their quality parameters and their use as a supplement to river water will reduce the water crises of the village.

References:

APHA (1998). Standard methods for chemical examination of water and waste water, American public Health Association 20thedn, Washington D.C.

Chutia J. and Sarma S. P., (2009). Relative content of chloride and sulphate in drinking water samples in different localities of Dhakuakhana sub division of lakhimpur district of Assam : Int. J. Chem.Sci.;7 (3);2087-2095.

Gupta A. K., (2003). Impact of domestic waste on water quality and human health in case of river Ganga. Plant Archives 3(2),237-241

Hiremath S. C., Yadawe M. S. Pujeri U. S., Hiremath D. M. , Pujar A. S., (2011). Physico chemical analysis of ground warter inMuniciple area of Bijapur (Karnataka) ,Current World Science; 6(2);265-269.

Khulab R. D., (1989). Prospective in aquatic biology, Papyrus Pub. House, New Delhi.

Kumar N., (1997).A view on freshwater environment J Ecol. EnvandCons.3 (3-4).

Mahananda M. R., Mohanty B. P. and Behera N. R., (2010). Physicochemical analysis of surface and ground water of Bargarh district, Orissa,India. IJRRAS 2(3):284-293

Mahananda H. B., Mahananda M. R. and Mohanty B. P. (2005). Studies on physicochemical and biological parameters of a fresh water pond ecosystem as an indicator of water pollution. Ecol. Env. and Cons. 11 (3-4), 537-541.

Millaway C. P., (1969). "Educational in large lakes and impoundments."Proc. UpplasaleSymp.DECD Paris.

Mittal S. K., Rao A. L., Singh and Kumar R., (1994). Ground water quality of some areas of Patiyala city. Ind. J. Environ.Health,36:51-53

Murthy K. N. and Sahoo K. B. (2000). A report on groundwater resources and development potential of Nagpur District, MS.

Olimax T. and Sikorska U., (1975). Field Experiment on the effect of Municipal sewage on macrophytes and epifauna in the lake Littoral, Bull. Acad. Pol. Sc. Clii. 23, 445-447.

Patel R. K., (1999). Assesment of water quality of Pitamahaldam.Ind.J. Environ. Protec.,19 (6),437-439

Piecznska E. Usikorna and Olimak T., (1975). The influence of domestic sewage on the littoral zone of lakes, Pol. Arch. Hydrobiol. 22, 141-156.

Radhakrishnan R., Dharmaraj K., Ranjithakumari B. D., (2007). A comparative study on the physic chemical and bacterial analysis of drinking, borewell and sewage water in the three different places of Sivakasi, J. Env. Biol. 28(1)105-108.

Reddy P. M. and Venkateshwar V., (1987). Assessment of water quality in the river Tungabhadra near Kurnol, A.P.J. Environ. Biol. 8, 109-119

Srinivasa Rao B. and Venkateswaralu P., (1987). An assessment of water quality of of river Ganga at Garmukeshwar.Ind.J.Ecol.14(20),278-287

Tiwari T. N. and Ali M., (1987). River pollution in Kathmandu valley variation in water quality index, JEP I, 347-351.

Tiwari T. N. and Mishra M., (1986) . Pollution in the river Ganga at Varanashi. Life Science Advances 5, 130-137.

Trivedi R.K. and Goel P.K., (1986). Chemical and Biological methods for water and soil pollution studies, Environmental publication, India (1986).

Veslind T. J., (1993). National geographic senior writer, National Geographic, Vol. 183 no. 5.

Vollenweidre R. A., (1998). Water management research.Scientific Fundamental of the eutrophicationof lakes and flowing waters with particular reference to nitrogen and phosphorous, as factorin eutrophication, 45-72.

WHO, (1996). Guidelines for drinking water quality 2 (WHO, Geneva), 231
