



WATER QUALITY ASSESSMENT OF WELL WATER IN NILDOH VILLAGE, HINGNA REGION (M.S.) INDIA

Wadjikar B. and Masram A.

L.A.D. and Smt. R.P. College for Women, Nagpur (M.S) India

Email: amg123321@gmail.com

Abstract: The present investigation was carried out to study the physicochemical parameters of ground water and its suitability for domestic purpose from Nildoh village, MIDC Hingna. The study area is situated between 21.10° N 78.98° E and 9km west of Nagpur city. Samples were collected from ground water resource i.e. Dug wells from three different locations and in different seasons during the year 2014-2015. The parameters studied were pH, Electrical conductance, Turbidity, Total Dissolved solids, Total Hardness, Magnesium, Total Alkalinity, Chloride, Sulphate, Fluoride, Iron. Most of the physicochemical characters were within ISI permissible limit except the high concentration of Total Dissolved Solids and Total Hardness of water which loses its potability and reduces the solubility of oxygen in water. Measures to be taken in terms of groundwater quality management are required.

Keywords: Physicochemical parameters, Ground water, ISI, Nildoh

Introduction:

The drinking water of most countries, communities and municipalities is obtained from boreholes (NYSC, 1990/91 report). About 97.2% of water on earth is salty and only 2.8% is present of fresh water which about 20% constitutes groundwater. Groundwater is highly valued because of certain properties not possessed by surface water (Goel, 2000). Peoples around the world have used groundwater as a source of drinking water and even today more than half the world's population depends on groundwater for survival (UNESCO, 1992). Assessment of water quality is very important for knowing the suitability for various purposes (Ramkrishnaiah, *et al.*, 1991). Water Quality Index (WQI) is required as one of most effective way to communicate water quality (Rajankar *et al.*, 2009).

In our country 70% of the water is seriously polluted and 75% illness and 80% of the child mortality is attributed to water pollution (Zoeteman, 1980). The healthy nature of underground water has also altered (Dasgupta and Purohit, 2001). The industrial pollutants associated with organic matter, inorganic dissolved solids and other unwanted chemicals cause serious ground water problems (Tyagi *et al.*, 2000). During the past decade, widespread reports of ground water contamination have increased public concern about drinking water quality (Yanggen and Born, 1990).

The periodic monitoring of groundwater quality is necessary to safeguard its long-term sustainability, and water quality index is an indicator revealing the composite influence of a number of water quality parameter which are significant for specific beneficial uses (Nair *et al.*, 2006). The present study was undertaken to evaluate the quality of well waters in Nildoh Village, MIDC, Hingna of Nagpur City.

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 Nildoh, MIDC are of Hingna, according to the record of Grampanchayat Nildoh, there are five common dug wells which have been constructed by the Grampanchayat. At present the Grampanchayat Nildoh supplying the Vena river water through the pipe line by Sanyukta Pani Puravatha Yojana to Nildoh and Digdoh 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 Nildoh and other villages of MIDC area of Hingna is scanty. Hence the present work determining suitability of ground water for drinking and other purpose of MIDC area is

taken up. The present study also strengthens the national and local water quality data base.

Materials and methods: The well water selected for the present study is from Nildoh Village which is situated between 21.10° N

78.98° E and 9km of west of Nagpur City. The population of village is about five hundred. It shares its boundary with the village Digdoh which is adjacent to MIDC area, Hingna (Figure1).

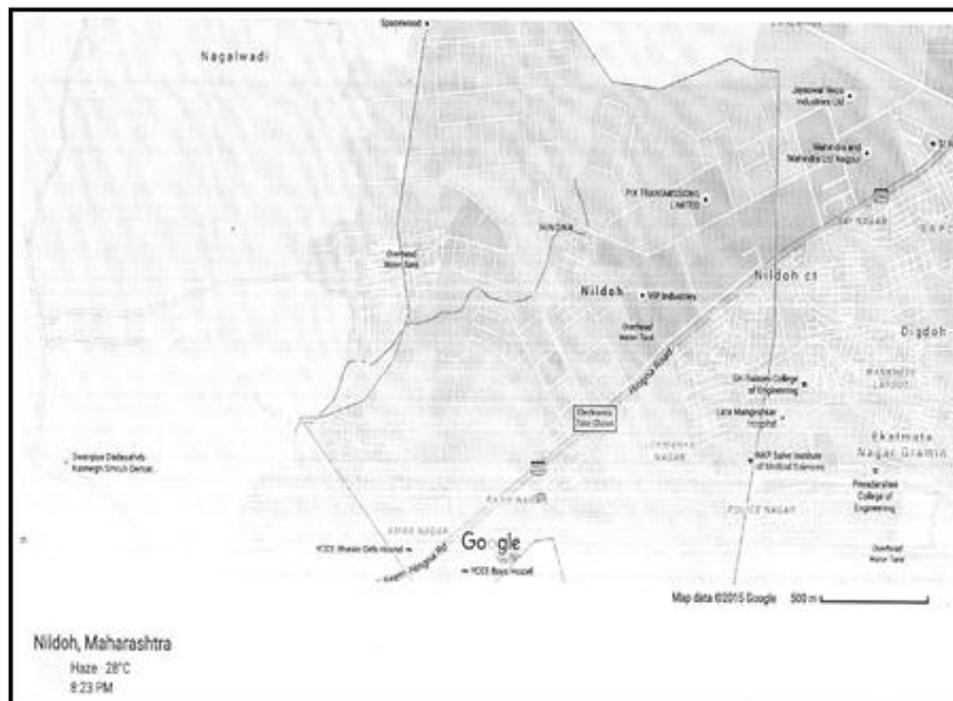


Fig. 1 : Map of Nildoh Village

There are total 5 wells in the village. For the present study three observational well water samples were collected for physicochemical analysis from three different sites of Nildoh Village during the year 2014-2015 samples were collected in sterilized plastic containers (PVC 1000ml). The samples were analysed for physicochemical parameters such as pH, EC, Turbidity, TDS, Total hardness, Mg, Ca, Total Alkalinity, Sulphate, Fluoride, Iron. The pH of water was determined by systronics digital pH meter standardized with buffer tablets. Electrical conductivity (E.C.) was determined by 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 (SO₄) were estimated with standard methods prescribed by Goltman *et al.*, (1978), Trivedi and Goel (1986) and APHA (1998).

Results and Discussion: The various physicochemical parameters of the samples collected from Nildoh village were analyzed and the results are tabulated in Table 1. The effect of the various constituents of water and their range on the potential health of living beings are tabulated in Table 2.

Table 1 : Physico-chemical parameters of well water of Nildoh village

Physicochemical Parameters	Site 1			Site 2			Site 3		
	Monsoon	Winter	Summer	Monsoon	Winter	Summer	Monsoon	Winter	Summer
pH	7.70	7.7	7.2	7.6	7.7	7.0	7.8	7.3	7.0
E.C.(ms/cm.)	2.2	2.2	2.3	1.5	1.6	1.6	2.1	2.00	2.1
T.D.S. (mg/lit.)	1132	1247	1032	1200	1137	1047	1250	1100	1110
Total Hardness	649	650	672	672	666	649	635	640	640
Mg(mg/lit.)	78	75	75	74	73	78	78	78	78
Total alkalinity(278	274	275	270	272	252	259	255	250
Chloride(mg/lit.)	195	195	180	190	192	190	197	195	197
Sulphate(mg/lit.)	60	62	63	65	64	65	67	65	67
Fluoride(mg/lit.)	0.35	0.32	0.30	0.35	0.30	0.32	0.33	0.35	0.35
Iron(mg/lit.)	0.16	0.9	0.10	0.12	0.13	0.10	0.12	0.10	0.10
Turbidity	1.02	1.10	1.00	1.5	1.2	1.3	1.5	1.2	1.3

Table 2 : Effect of the various constituents of water and their range on the potential health of living beings

Parameters of water analysis	BIS guideline values (Max. Allowable)	Potential health effects
pH	6.5-8.5	Affects mucous membrane; bitter taste; corrosion
Total Alkalinity	600mg/l	Boiled rice turns yellowish
Total Hardness	600mg/l	Poor lathering with soap; deterioration of the quality of clothes; scale forming
Chloride	1000mg/l	Taste affected; corrosion
Sulphate	400mg/l	Taste affected; gastro-intestinal irritation
Fluoride	1.5mg/l	Dental and skeletal fluorosis; non-skeletal manifestations
Total Dissolved Solids	200mg/l	Undesirable taste; gastro-intestinal irritation; corrosion or incrustation

pH :

The seasonal variations of physicochemical characteristics of dug well are tabulated in the above table for Monsoon, Winter and Summer seasons. 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). The normal range of pH in well water was between 6.5 and 8.5 (BIS, 2010) and EPA (2009) recommends this range of pH as a good guide for individual well owners. In the present study the values of pH of well water were in the range of 7.0 to 7.8 The least value was recorded to be 7.0 at the site-2 in the summer season while maximum value was recorded to be 7.8 at the site-3 in rainy season. The reason for the increase in pH

range may be due to mixing up of the alkaline chemicals, soap and detergents etc. Produced due to industrial and residential activities (Radhakrishnan *et al.*,2007). Our values were positively correlated by the pH of ground water in municipal area of Bijapur (Hiremath, 2011) and dug wells of the Digodh village (Masram, 2014) on an average pH of all samples was in desirable limit as prescribed for drinking water standard. This shows that pH of water sample was slightly alkaline might be due to high temperature that reduces the solubility of carbon dioxide.

Total suspended solids :

The total suspended solids are composed of carbonates, bicarbonates, chlorides, phosphates and nitrates of calcium,

magnesium, sodium, potassium, manganese, organic matter, salt and other particles. The total suspended solids of dug well water was minimum 1.00mg/lit in site-1 in summer and maximum 1.5mg/lit in site-2 and site-3 in monsoon. The effect of presence of total suspended solids is the turbidity due to slit and organic matter. The higher the concentration of total suspended solid in scp is an index that it is more polluted (mahananda *et al.*,2010). Higher in monsoon compared to winter and summer season, it is evident that the discharge variations are commensurate with weather condition and seasonal variations. High turbidity in wells could be because of soil disturbance and resuspension within the well during water withdrawal. High turbidity can stimulate the bacterial growth, which indicates problems with treatment processes (WHO,2004).

Electrical conductance (E.C.) :

The Electrical Conductance was recorded in the range of 1.5 to 2.2ms/cm. for all the samples from all the sites. There are no prescribed standred 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 seasons.

Total dissolved solids :

TDS of well water ranged from 1032 to 1250 mg/liter. TDS was minimum 1032 mg/lit. site -1 in summer season and maximum 1250 mg/lit. in siter -3 in monsoon. TDS is a measure of the combined content of all inorganic and organic substances contained in a liquid in molecular, ionized or micro granular suspended form. The permistible limit of drinking water is 500mg/lit. (WHO,2004). A high value of TDS reduces water quality for drinking; irrigagation and agriculture purposes (WHO, 1996). The higher TDS in well sources may be attributed to the percolation of effluents into these aquifers from various automobile and small scale industries located in the study area. TDS is a measure of the combined content of all inorganic and organic substances contained in a liquid in a molecular, ionized or microgranular suspended form. The permissible limit of

drinking water is 500 mg/lit. (WHO 2004). These results were positively correlated with the pitamahal dam reservoir water in summer, winter and rainy season (patel 1999). According to Trivedy and Goel (1984) an excess amount of TDS in water tends to disturb the ecological balance due to suffocation in aquatic fauna even in the presence of fair amount of dissolved oxygen.

Total hardness :

It is an indicator of hydrogeology and aesthetic quality of water.Total hardness was found in the sample water ranges from 635 to 672 mg/liter which shows that water is not safe for drinking purpose. The minimum value of total hardness was found to be 635 mg/lit. in site-3 in monsoon and maximum 672 mg/lit in site-1 in summer and site-2 in monsoon. However, maximum permissible level prescribed by WHO for drinking water is 500mg/liter. These results are correlated with the total hardness of the water samples collected from Ambatlur industrial area, Tamilnadu, India (Saravanakumar *et al.*, 2011). The high level of total hardness is due to presence of high concentration of carbonates and bicarbonates. Similar results were also observed by lendhe and yeragi (2004). Water total hardness is imparted mainly by the calcium and magnesium ions, which apart from sulphate, chloride and nitrates are found in combination with carbonates. The permanent hardness is mainly caused by chlorides and sulphates (Roy and kumar 2002). Meshram (2005) reported that calcium hardness is essential for normal growth and development for many aquatic ecosystems.

Total alkalinity :

Alkalinity of a water in terms of caco3 varied from 250 to 278 mg/lit.

The permissible limit of alkaliity in the water sample is 600 mg/lit (ISI). In the present investigation it was found to be minimum 250 mg/lit. in site-3 in summer season while maximum 278 mg/lit. in site-1 in monsoon season which were within the permissible level. These results was positively correlated with groundwater sample of Bairagart district, Orrisa (Mahananda *et al.*, 2010). This result was positively correlated with borewell water of

chirala town at prakasam district, which was in the range of 110 to 850 mg/lit. (shrinivasa rao and venkateswarlu,1999). Greater the total alkalinity may be due to consequent washing of excreta near by well water and wastewater discharge from industries. Decrease in temperature bringing down the rate of decomposition of salts to a minimum there by increase the alkalinity. Increased alkalinity may be due to increase photosynthetic activity of phytoplankton. The water for domestic use having alkalinity less than 100 mg/lit. is safe.

Chloride :

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). According to WHO, maximum permissible limit for chlorid is 500mg/liter. The value observed in present study was minimum 180 mg/lit. in site -1 in summer and maximum 197 mg/liter in site-3 in the monsoon. The value observed in the present study is in the range of permissible limit (Ravisankar and Poogothai, 2008). The high concentration of chloride is due to dissolution of salts, soil erosion and discharge effluents into water sources. Chloride increases with the increasing degree of eutrophication.

Fluoride :

Fluoride is level from 0.7 to 1.2 mg/lit is essential in drinking water (Anon,1977). Fluoride at a lower concentration at an average of 1mg/lit. is regarded as important constituent of drinking water (WHO,1972). The minimum value recorded 0.30 mg/lit. in site-1 in summer and site-2 in winter season while maximum 0.35 mg/lit. in site-1 and site-2 in monsoon and site-3 in winter and summer season which are within permissible limit of WHO. High fluoride concentration causes dental fluorosis (Hiremath,2011).

Sulphate :

Concentration of sulphate ions was minimum 60mg/lit.in site-1 in monsoon and maximum 67 mg/lit. in site-3 in monsoon and summer season. Concentration of sulphate has laxative effect

(Lorraine, 2000) which is enhanced when sulphate is consumed with mangesium. The sulphate values were also found to be within the permissible limits. Water containing magnesium sulphate (1000 mg/liter) acts as purgative in human adults (Hiremath *et al.*, 2011).

Magnesium :

The desirable limit of magnesium in water is 50 mg/liter as per ISI. In the present study the minimum value of magnesium was found to be 73 mg/lit. in site-2 in winter and maximum 78 mg/lit. in site-1 in monsoon and maximum 78 mg/lit. in site-2 and site-3 during all the season were exceeded the desirable limit. This may be due to the proximity of a industrial region. This result was positively correlated with the mg content of the water samples collected from the village of Velsao at Goa, which ranged from 80 to 110 mg/lit. (Subhadradevi *et al.*, 2003). The high concentration of mg adversely affect domestic use of water.

Iron :

Iron is common in groundwater and most frequent contaminant. In the present study the minimum value was recorded 0.9 mg/lit. in site-1 in winter and maximum 0.16 mg/lit. in site-1 in monsoon in well above the permissible limit(<0.3 ppm for iron). This result is positively correlated with the value of iron concentration of well water quality in Tsunami affected regions of south west coast of kerala, India (Nair *et al.*,2013). Higher level of iron in groundwater can result in discoloured water and unpleasant metallic taste (Jamir *et al.*,2011).

Conclusion :

The present investigation has led us to conclude that the quality of water samples subjected to study was not acceptable for some of the physicochemical parameters such as total dissolved solids and total hardness and other parameters which were analysed were not at the level of pollution for ground water. Therefore the water needs to be treated before using it for domestic purposes including drinking. Drinking contaminated water can expose human body to various water borne diseases hence water treatment and improving quality of water before drinking is required. Based on

the results of analysis, it is suggested that further detailed investigation of the water purifying methods and other sources of water may be carried out in future.

References :

- Anon (1977)** National Interim Primary Drinking water regulations. Environmental Protection Agency, office of water supply EPA-570/9,76-003.
- APHA (1998)** standard methods for chemical examination of water and waste water, American public health Association 20th edition Washington D.C.
- BIS (2010)** Drinking water specification (second revision of IS 10500) Bureau of Indian standards, New Delhi.
- Chutia J. and Sarma S.(2009)** Relative content of chloride and sulphate in drinking water samples in different localities of Dhakuakhana sub division of lakhimpur district of Assam; International journal of chemical sciences7(3); 2087-2095.
- Dasgupta , A. and Purohit K.M. (2001)** status of the surface water quality of mandiakudar. Pollut. Res.20(1), 103-110.
- EPA (2009)** Drinking water contaminants. National Primary Drinking water regulations. United states Environmental protection Agency publication, 237.
- Goel P.K. (2000)** water pollution causes, Effects and control, New Age Int.(P) Ltd. New Delhi.
- Goltman H.Z., Clymo R.S. and Ohnstad M.A.M. (1978)** Methods for physical and chemical analysis of fresh water, I.B.P.H. and Book No. 8, 2nd edition Black well scientific, Oxford.
- Gupta D.P., Sunita and Saharan J.P. (2009)** Physicochemical analysis of groundwater of selected area of kaithal city (Haryana) India. Researcher.1(2),1-5.
- Hiremath S.C., Yadawe M.S., Pujeri U.S., Hiremath D.M. Pujar A.S.(2011)** Physicochemical analysis of ground water in municipal area of Bijapur (Karnataka), Current World Science; 6(2); 265-269.
- Jamir T.T., Devi W.B., Singh U.I. and Singh R.K.B.(2011)** Lead, Iron and Manganese contamination in spring pond and well water in Nagaland , one of the seven North –Eastern states of India, A future danger .J.chem.pharma . Res. 3,403-411.
- Lendhe R.S. and Yeragi S.G. (2004)** Physicochemical parameters and zooplankton diversity of phirange kharbhav lake district Thane, M.S.J.Aqua.Biol.19(1) 49-52.
- Lorraine C.B. (2000)** Assessing the acute gastro intestinal effects of ingesting naturally occurring high level of sulphate in drinking water. Crit.Rev.clin.Lab.Sci.;37,389-400.
- Mahananda M.R.,Mohanty V.R. and Behra N. (2010)** physicochemical analysis of surface and ground water of Bargarh district, Orissa India, Int.J.Res.Revi. App.Sci.,2,284-295.
- Masram A.S. (2014):** Seasonal analysis of physicochemical characteristics of well water in rural area of Digdoh, Hingna, (M.S.) India. J. Researchers in Biosciences, Agriculture and Technology ISSN No. (Online) 2347-517X, Dec. special issue, 49-56.
- Meshram C.B. (2005)** Zooplankton biodiversity in relation to pollution of lake wadali, Amravati. J. Ecotoxicol. Environ Monit,15,55-59.
- Nair G.A.,Bohjuari J.A.,AL-Mariami M.A.,Attia F.A. and El-Toumi F.F. (2006)** Grond water quality of North east Libya.J. Env. Biol.,27,695-700.
- NYSC (National youth service corp.) Handbook (1990/91) Borno state 1990/91 service year.
- Patel R.K.(1999)** Assessment of water quality of pitamahal dam.Ind.J.Environ.Protoc.,19 (6),437-439.
- Pavendan P.,Anbuselvan S. And Sebastian C., Rajasekaran (2011)** European Journal of Experimental Biology 1(1): 183-189.
- Radhakrishnan R., Dharmaraj K., Ranjithakumari B.D. (2007)** A comparative study on the physicochemical and bacterial analysis of drinking, borewell and sewage water in the three different places of sivakasi, Journal of Environmental Biology, 28(1), 105-108
- Rajankar P.N.,Gulhane S.R., Tambekar D.H.,Ramteke D.S. and Wate S.R. (2009)** water quality assessment of groundwater resources in Nagpur region (India) based on WQI ,Journal of Chemistry,6(3),905-908.
- Ramkrishnaiah S and sri.y. Babu Rao(1991)** Environmental and water quality studies in AP state - A case study.
- Ravisankar N. And Poogothai S.(2008)** A study of groundwater quality in Tsunami affected areas of sirkazhi Taluk, Nagapattinam district, Tamilnadu, India .Sci.Tsun Haz.27;47-55.
- Roy Y. And Kumar R. A. (2002),** A study of water quality of the rivers of Ranchi district. Ind. J. Environ. Protec. 21 (5), 398-402.
- Saravanakumar K. and Ranjitkumar R.(2011)** Analysis of water quality parameters of groundwater near Ambattur industrial area, Tamilnadu, India. Indian

Journal of Science and Technology
Vol.4,No.5,660-662.

Shrinivasa, Rao B. And Venkateswarlu P.(1999) Evaluation of groundwater quality in chirala town (Prakasam district) Ind. J. Environ.Protect. 20(3)161-164.

Subhadradevi G., Barbuddhe S.B.,Hazel D. And Dolly C.(2003) Physicochemical characteristics of drinking water at Velsco.(Goa). J. Ecotoxical.Environ. Monit.,13 (3),203-209.

Trivedi R.K. and Goel P.K. (1984) Chemical and Biological methods for water pollution studies, Environmental publication ,Karad, India.

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

Tyagi P. Buddi D. Chowdary R. And Sawhney R. (2000) physicochemical quality of ground water in industrial areas of India. Pollut. Res.19,443-445.

UNESCO, (1992) Ground water UNESCO Environmental and development briefs no. 2,14.

WHO (1996) guidelines for drinking water quality ,2nd ed.vol.2.p.132-367.WHO, Geneva, Switzerland.

WHO (2004) guidelines for drinking water quality ,2nd edition.WHO, Geneva,231-233.

WHO (2004) International Standards of drinking water. World Health organization, Geneva, 55-79.

WHO, (1972) Guidelines for drinking water quality.

Yanggen, D.A. and Born S.M.(1990) Protecting ground water quality by managing local land use J.soil water conser.,45(2),207-210.

Zoeteman, B.C.G. (1980) sensory assessment of water quality, Oxford pergaman press, U.K.
