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Assessment of Ground Water Quality status in and around Dhamangaon Rly of Amravati District, Maharashrta, India

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ABSTRACT

The objective of present study was to analyze the physicochemical characteristics of ground water samples in and around Dhamangaon Rly of Amravati district (Maharashtra) studied for one year during Oct.2010 to Sept.2011.The physicochemical parameters which were analyzed are pH, Calcium hardness, Magnesium hardness, Total hardness, Total alkalinity, Nitrate, Ammonia and Sulphate. The values obtained were compared with BIS standards (2004). The study revealed that various physicochemical parameters viz, calcium, magnesium, total alkalinity and Total hardness were beyond the desirable limits as recommended by BIS (2004) indicating that Ground water sources are polluted. It may be concluded that of Ground water sources in and around Dhamangaon Rly of Amravati district failed to qualify prescribed limits recommended by BIS in physicochemical aspects. This pollution is due to mostly human activities like discharge of untreated domestic sewage or effluent, use of fertilizer, pesticides in agricultural soil. Due to increasing population, urbanization and overutilization of ground waters, the available groundwater is rapidly getting polluted. Therefore, it is recommended that groundwater sources in this area should not be used for domestic purposes without treatment.

KEYWORDS Water quality status, Ground Water Quality, Dhamangaon Rly.

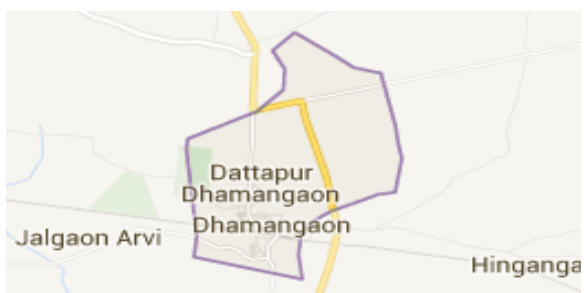
INTRODUCTION:-

Water is great gift of nature "No life without water" is possible **(Gupta and Gupta 1997).** Ground water is a good source of fresh water available on the earth. It is the important renewable resource having several inherent advantages over surface water **(Kotadiya *et* al.,2013).** Water is a major natural resource, a basic human need and precious natural asset, which should be conserved for future uses in a balanced manner. About 85 % of rural population in India is solely depended on ground water, which is depleting at a faster rate **(Gajendran *et* al, 2014).** Ground water is the major source of drinking water in both urban and rural areas. The domestic sewage and industrial waste are the leading causes of ground water pollution **(Garg *et al., 1999,* Mohd Nafees, 2015).** Ground water gets polluted drastically because of increased human activities **(Elizabeth and Naik, 2005, Singh 2006, Mishra and Bhatt, 2008).** Due to the growth of population, and man-made activities, the quality of water is deteriorating everywhere **(Bhadja *et al.,*2013).** Presently the quality and quantity of water is the important alarming environmental problems on at global and national levels. Thus, water quality and its management have received much attention in developing countries. Ground water is generally used for drinking, domestic and agricultural purposes in this area. Massive uses and inappropriate management of ground water are causing serious threat to the availability and quality of water **(Nath *et* al., 2015, Mohd Nafees, 2015).** Hence, it is very important to assess the ground water quality not only for its present use but also from the view point of a potential source of water for future consumption **(Bhadja *et al.,*2013).**

The present paper discusses account on physicochemical studies of water quality status of ground water samples in and around Dhamangaon Rly of Amravati district from Maharashtra studied for one year during Oct.2010 to Sept. 2011. The analyzed data were compared with standard values recommended by BIS (1998).

STUDY AREA AND GEOGRAPHICAL LOCATION:-

Dhamangaon Railway is a tehsil place and municipal council of Amravati district in the state of Maharashtra. Dhamangaon Railway lies between 2046′ 00′ N to / 2076′67″ N latitude and 7810′ 00′ E to 78.1667″E / 20.7667; 78.1667 longitude. It is situated at an average elevation of 291 metres. The main water sources of Dhamangaon railway are river water, well or hand pump and dug well waters.



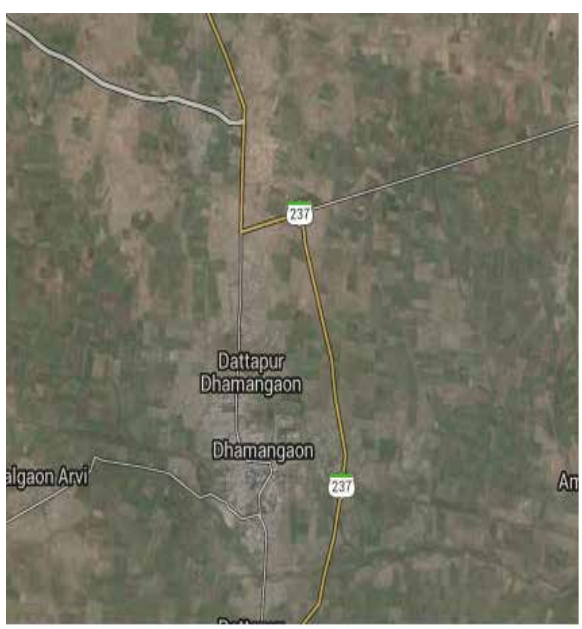


Figure 1: Location Map of the Study Area

MATERIALS AND METHODS:-

The ground water samples were collected from ground wa-

ter sources like dugwells, borewells and Hand pumps in and around Dhamangaon Rly. All the representative ground water samples were collected in clean, phosphate free polyethylene bottles that have been pre washed with dilute acid followed by distilled water using standard procedures (NEERI Manual 1988) during Oct.2010 to Sept.2011.

Various physicochemical parameters viz pH, Total Alkalinity, Calcium hardness, Magnesium hardness, Total hardness, Ammonia, Nitrate and Sulphate were determined using standard procedures (APHA (1995), ICMR Manual (1977), Trivedy and Goel (1986).

The pH of water sample was measured with a pH meter preciously calibrated with buffer solutions. Alkalinity was determined by titrating a known volume of water sample with 0.02 M HCl. Total hardness was determined by titrating with EDTA using Eriochrome black T as indicator. Remaining physicochemical parameters were determined by using standard procedures (APHA (1995), ICMR Manual (1977),Trivedy and Goel (1986).

Table 1-Sampling locations for present study

Sampling stations Stations No.	Locality
Source Dugwells	
S_{22}	Hirapur
S_{23}	Mataji Mandir Premises
S_{24}	Durgwada
Source Borewells Handpumps Handpumps	
S_{25}	Pushkarnanagar, Dhamangaon Rly
S_{26}	Kotharinagar, Dhamangaon Rly
S_{27}	Kaundyannapur, Dhamangaon Rly
S_{28}	Cinema chowk, Dhamangaon Rly
S_{29}	Shastri chowk, Dhamangaon Rly
S_{30}	Anjansingi

Table 2 - Physicochemical parameters of Ground water sources (Dugwells, Borewells and Handpumps) during Winter Season (Oct.2010-Jan.2011)

Sr. No	Source	Sampling stations	pH	T.ALK (mg/L)	Ca (mg/L)	Mg (mg/L)	TH (mg/L)	NO_3 (mg/L)	NH_4 (mg/L)	SO_4 (mg/L)
1	Dugwells	S_{22}	8.3	392	60.9	39.2	276	14.53	0.06	22.9
2		S_{23}	8.4	387	58.2	33.7	271	11.21	0.05	20.7
3		S_{24}	8.6	356	62.7	41.6	284	17.41	0.07	24.8
	Average		8.433	378.33	60.6	38.16	277	14.38	0.06	22.8
4	Borewells and Handpumps	S_{25}	8.5	321	93.6	68.8	413	31.73	0.06	30.3
5		S_{26}	8.3	328	91.4	69.6	408	30.92	0.045	29.8
6		S_{27}	8.6	341	97.2	71.3	421	33.51	0.07	31.7
7		S_{28}	8.5	431	84.3	61.7	487	44.21	0.03	33.6
8		S_{29}	8.4	440	89.8	63.8	492	48.42	0.04	35.3
9		S_{30}	8.7	447	92.7	71.9	503	51.12	0.05	39.2
	Average		8.5	439.33	88.93	65.8	494	47.91	0.04	36.03

Table 3- Physicochemical parameters of Ground water sources (Dugwells,Borewells and Handpumps) during Summer Season (Feb.2011- May 2011)

Sr. No	Source	Sampling stations	pH	T.ALK (mg/L)	Ca (mg/L)	Mg (mg/L)	TH (mg/L)	NO_3 (mg/L)	NH_4 (mg/L)	SO_4 (mg/L)
1	Dugwells	S_{22}	8.2	389	58.9	37.7	271	13.67	0.05	23.4
2		S_{23}	8.3	383	56.4	34.6	274	10.29	0.06	21.3
3		S_{24}	8.5	351	61.8	40.8	281	16.47	0.04	25.2
	Average		8.333	374.33	59.03	37.7	275.33	13.47	0.05	23.3

4	Borewells and Handpumps	S_{25}	8.4	325	92.3	72.3	507	52.17	0.06	30.7
5		S_{26}	8.2	316	91.7	67.8	411	30.76	0.06	30.9
6		S_{27}	8.5	324	90.6	70.3	401	29.97	0.05	32.3
7		S_{28}	8.5	336	96.4	72.7	412	31.67	0.06	34.1
8		S_{29}	8.3	426	82.6	62.3	481	43.31	0.03	35.6
9		S_{30}	8.5	434	88.2	64.6	491	47.47	0.04	39.8
	Average		8.4	379.5	90.36	68.33	449.5	38.88	0.05	33.91

Table 4- Physicochemical parameters of Ground water sources (Dugwells, Borewells and Handpumps) during Monsoon Season (June.2011-Sept.2011)

Sr. No	Source	Sampling stations	pH	T.ALK (mg/L)	Ca (mg/L)	Mg (mg/L)	TH (mg/L)	NO_3 (mg/L)	NH_4 (mg/L)	SO_4 (mg/L)
1	Dugwells	S_{22}	8.2	389	58.9	37.7	271	13.67	0.05	22.9
2		S_{23}	8.3	383	56.4	34.6	274	10.29	0.06	20.7
3		S_{24}	8.5	351	61.8	40.8	281	16.47	0.04	24.8
	Average		8.333	374.33	59.03	37.7	275.33	13.47	0.05	22.8
4	Borewells and Handpumps	S_{25}	8.4	379.5	90.36	68.33	449.5	38.88	0.05	30.3
5		S_{26}	8.2	316	91.7	67.8	411	30.76	0.06	28.8
6		S_{27}	8.5	324	90.6	70.3	401	29.97	0.05	30.7
7		S_{28}	8.5	336	96.4	72.7	412	31.67	0.06	32.5
8		S_{29}	8.3	426	82.6	62.3	481	43.31	0.03	35.3
9		S_{30}	8.5	434	88.2	64.6	491	47.47	0.04	38.1
	Average		8.4	369.3	92.7	72.3	501	50.14	0.07	36.03

Results and discussion:-

The sampling locations and observations on physicochemical parameters of Ground water samples in and around Dhamangaon Rly of Amravati district from Maharashtra studied for one year during Oct.2010 to Sept. 2011 are presented in Fig.1 and Table 1-3.

The pH is measure of the intensity of acidity or alkalinity and the concentration of hydrogen ion concentration. pH has no direct adverse effects on health; however, higher values of pH hasten the scale formation in water heating apparatus and also reduce germicidal potential of chloride. High pH induces the formation of tri halo methane which is toxic. pH is one of the most important factors that sever as an index for the pollution. The average pH value of the Ground water samples ranged between 8.43-8.5 during winter, 8.3-8.4 during summer season and 8.3-8.4 during monsoon. It appears that pH was alkaline throughout all the seasons. Calcium forms the most abundant cation in freshwater which contributes hardness to waters (Arthi *et al.* 2011). Calcium concentration ranged from 60.9- 88.9 mg/ L during winter, 59.03 -90.36 mg/L during summer and 59.03-92.7 mg/L during monsoon. Calcium concentration is beyond the desirable limit as per the BIS standards. The total hardness of Ground water ranged from 277-494 mg/L during winter and 275.3-449.5 mg/L during summer and 275.3-501 mg/L during monsoon indicating that total hardness exceeded the desirable limit throughout all the seasons. Hard water causes incrustation in distribution systems and excessive soap consumption (Coleman 1976). According to Nayak *et* al. (1982) and Ghosh and George (1989) the higher alkalinity indicates pollution. The total alkalinity varied from 378.3-439.3 mg/L during winter, 378.3- 379.5 mg/L during summer and 369.3-374.3 mg/L during monsoon. Total alkalinity was beyond the acceptable limit throughout all the seasons. The main source of the formation of nitrate is the decomposition and biodegradation of organic matters. High nitrates would indicate pollution load. Intrusion of sewage into the natural waters increases levels of nitrate (Manson 1991). Nitrate concentration ranged from 14.38-47.91 mg/L during winter, 13.47-38.88 mg/L during summer and 13.47- 50.14 mg/L during monsoon indicating that it was within the desirable limit throughout all the seasons except monsoon as per the BIS standards. The sulphate ion is one of the important anions in natural waters and when present in higher quantity it produces catharatic effect in human beings (Srinivas *et* al. 2002). The sulphate ion concentration ranged from 22.8-36.03 mg/L during winter, 23.3-36.03 mg/L during summer and 22.8-36.03 mg/L during monsoon indicating that it was within the desirable limit throughout all the seasons as per the BIS standards (Fokmare, Musaddiq, 2001).

CONCLUSION :

The study revealed that various physicochemical parameters viz, calcium, magnesium, total alkalinity and Total hardness were beyond the desirable limits as recommended by BIS (2004) indicating that Ground water sources are polluted. It may be concluded that of Ground water sources in and around Dhamangaon Rly of Amravati district failed to qualify prescribed limits recommended by BIS in physicochemical aspects. This pollution is due to mostly human activities like discharge of untreated domestic sewage or effluent, use of fertilizer, pesticides in agricultural soil. Due to increasing population, urbanization and industrialization, the available groundwater is rapidly getting polluted. Therefore, it is recommended that groundwater sources in this area should not be used for domestic purposes without treatment

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