Assessment of Groundwater Quality Around Ahmednagar City and MIDC Area

Sheetal Bijwe[2], Manisha N.Wahale[1] Shweta R Akre[3], R.K.Singh[1], D.S.Ramteke[4]

[1]Reserch Scholar, RTMNU, Nagpur, [2]Field officer,MPCB, [3]ReserchScholar,NEERI,Nagpur,[4]Scientist , NEERI,Nagpur

mwahale@gmail.com, sheetalbijve@gmail.com, shwet.akre@gmail.com

Abstract

Water with unique property of dissolving and carrying in suspension a huge variety of chemical. It may get easily contaminated. Water the basic and primary need for vital life processes on this planet; it is also the resource adversely affects both qualitatively and quantitatively by all kind of human activity. Infections, diseases caused by pathogenic bacteria, virsuses, and protozoa or parasitic agents are the most typical and wide spread health risk, factors associated with drinking water (Sastri; 1993). The cause of groundwater pollution is due to the industrial area and also due to the seepage from the drainage system and waste generated from the nearby areas (Jain, *et al.*; 1996). Ahmednagar district included 18 Big industries, 189 Medium industries and about 5782small scale industries. A MIDC area of Ahmednagar shows the sugar factories, iron and steel industry, pharmaceutical industry, paper mill and also dairy industry.On the basis of physico-chemical studies it was found that some groundwater samples shows very high concentration of sulphates, total hardness and chloride, sodium in the MIDC area as compared to western part of Ahmednagar city(Jain, et al; 1997,2000). Due to high concentration of sulphate it may induce dieseases such as diarrhea. The higher concentration of total hardness in groundwater may induce gastrointestinal effect (Rao, *et al.*; 1996) (Sharma, *et al.*;2004).This paper deals with comparison of Physico Chemical analysis for Ahmednagar city and MIDC Industrial area .It was concluded that groundwater in Ahmednagar city area is comparatively good and it is fit for the drinking purposes. Whereas in the MIDC area it is in alarming stage.

Keywords: Physico chemical Parameters, Groundwater, Sulphate, diseases.

Introduction:

The role of water in nature is unique not only from the point of human consideration, but numerous of those organisms which make the aquatic medium abode. Water with the unique chemicals having properties of dissolving and carrying in suspension a huge variety of chemical, it may get contaminant easily (Das,2000) (Elango, *et al.*; 1992). Water the basic and primary need for vital life processes on this planet, it also the resource adversely affects both qualitatively and quantitatively by all kind of human activity**(**Dasgupta and Purohit ;2001) (Jain; 1996). Of the five elements of human existence, water is indispensable because man can not survive without water. Water is abundant globally but scares locally. The total quantity of water on our planet is nearly constant, and it keeps circulating through water or hydrological cycle **(**Hasan; 2003) **(**Edet; 1993).

Due to rapid growth of population, abundant use of fertilizers in agriculture as well as untreated sewage industrial proliferation, urbanization,etc., makes the water bodies dust bin causing seller water pollution(Kellar, 1979) **(**Kotaiah and Reedy ;2003).

In view of increasing demand of water for various purposes like agriculture domestic and industrial etc. greater emphasis is being laid for a planned and optimal utilization of water resources(Kannan.K.,1991) (Kedar and Patil ,2002). The utilizable water resources of India are estimated to be 112 million hector meters (mham) out which 69 million hector meters (mham) is surface water resources and 43 million hector meters (mham) is groundwater resources.There are different sources of water : Surface water, Groundwater .

The rate of water in transmitting a number of intestinal diseases (enteric fever, Paratyphoid, dysentery, cholera, viral hepatitis and other, rare, diseases) have been proven by long term research over a century **(**Sinclair and Fairley ;2000). Infections, diseases caused by pathogenic bacteria, virsuses, and protozoa or parasitic agents are the most typical and wide spread health risk, factors associated with drinking water (Guidelines, 1993) (Kumar and Kakrani ,2000) (Meenakumari and Hosmani ,1998).

The fact that some people are affected by this parasite is normally considered a sure sign of the presence in drinking water (Be'er 1996).

Ahmednagar is Maharashtra's most advanced district in many ways. It has the maximum number of sugar factories. The population of the Ahmednagar is 40,088077 as per 2001 census. Ahmednagar district included 18 Big industries, medium 189 industries and small scale industries about 5782. A MIDC area of Ahmednagar shows the sugar factories, iron and steel industry, pharmaceutical industry, paper mill and also dairy industry. The water criteria for the Ahmednagar city and the MIDC area comes from the Mula Dam and also Groundwater is only source for drinking and agricultural purposes. Sinha river flows from the Ahmednagar city.The cause of groundwater pollution is due to the industrial

area and also due to the seepage from the drainage system and waste generated from the nearby areas (Jain and Sharma;2000) (Purandara, et al 2003).

Therefore, present study is carried out to assess the groundwater with respect to physico-chemical and bacteriological parameters and quality index of water around city area of Ahmednagar **(**Kuashik, *et al.*;2002**)** (Yazdandoost and Katdare ,2000).

Material and Methods:

All Glasswares were properly leached and rinsed with double distilled water.The chemical required for analysis were all AR grade and it procured from merck supplier.

Physico-chemical Parameters, their Methods of Analysis: The Physico-chemical analysis of water samples was carried out by estimating parameters of significance. The parameters are usually classified as (1) physical parameters, (2) Inorganic parameters, (3) organic parameters, (4) Nutrient parameters and (5) heavy metals (Kaul and Gaytam; 2002).

Physical Parameters: Temperature, pH, Turbidity, Total solids (T.S),Total Dissolved Solids (T.D.S),Total Suspended Solids (T.S.S), Conductivity.

Inorganic Parameter: Alkalinity, Chloride, Hardness, Sulphate, Sodium and Potassium, Fluoride Organic Parameters:Biochemical Oxygen Demand (BOD), Dissolved Oxygen (DO)

Experimental Procedures:

Sample Collection:

In all 19 samples were collected, in which 1 sample was from dugwell and 18 samples were from bore wells and tube wells. The samples were taken from MIDC industries (2 Nos.), 8 samples were taken opposite to MIDC area and 9 samples were from Savedi Area. The samples collected were well preserved and analyzed for physico-chemical parameters. While collecting a sample from the tube wells or hand pump, the nozzle was examined to see that it appears clean and water was allowed to run to remove initial impurities adhere with the well of the pump/ nozzle before filling the bottle. While collecting the sample from the dug well, a bucket was tied with a rope, and bucket was rinsed two or three times before being filled with sample. The WQI concept is based on the comparison of the water quality parameters with respective regulatory standards (Khan et.al., 2003) (Yazdandoost and Katdare ,2000).

Samples collected from dugwells, tubewells and handpumps were brought to the laboratory at National Environmental Engineering Research Institute (NEERI), Nagpur for analysis of the following parameters. The analysis was carried out as per the standard methods given below :

Physico-chemical Parameters:

Physico-chemical Parameters:

Sr.No.	Parameter	Method of Analysis
Physical Parameters		
1	pH	Electrometric method
2	Temperature	Thermometric method
3	Turbidity	Turbidity metric method
4	Total suspended solids	Gravimetric method
5	Total dissolved solids	Gravimetric method
6	Conductivity	Conductivity meter
Inorganic Parameters		
1	Total alkalinity	Titrimetric Method
2	Total hardness	Complexo metric method (EDTA 3titrimetric method)
3	Calcium hardness	Complexo metric method (EDTA titrimetric method)
4	Chloride	Argentometric method
5	Sulphate	Spectrophotometric method
6	Sodium	Flame Photometeric method
7	Potassium	Flame Photometeric method
8	Fluoride	Ion selective electrode method

Sr. No.	Sampling location	Location Type
1	Jathe	Dug Well
2	Dharmadhikari Mala	Bore Well
3	Fulari Mala	
4	Near ESSAR Petrol Pump	
5	Tathe Mala	
6	Sai Nagar	
7	Nagapur	
8	Sai Nagar	
9	MIDC	
10	MIDC	
11	Vanrai Coloy	
12	Varad Colony	Hand Pump
13	Deep Complex	
14	Nar Mahalaxmi Garden	
15	Surabhi Colony	
16	Manorama Colony	
17	Gajanan Colony	
18	Vanarai Colony	

Table 5.1Water Sampling Locations within the Study Area

Results and Discussion:

On the basis of physico-chemical studies it was found that some groundwater samples shows very high concentration of sulphates, total hardness and chloride,

sodium in the MIDC as compared western part of Ahmednagar city (Dadhich, *et al.*;2001) (Pandey, *et al.*;2002).

Due to high concentration of sulphate it may induce diarrhea. The higher concentration of total hardness in groundwater may induce gastrointestinal effect (Bharathi and Ramanibai,2002).

The chloride content in some groundwaters was found high which clearly shows that quality of groundwater contaminated due to the seepage from the wastewater being discharged on land or due to leaching effect and getting percolated in to the groundwater and responsible for groundwater pollution (Talebi, *et al.*;1994) (Tripathy, 2003).

Due to this pollution the groundwater samples may get contaminated bacteriologically and also corrosion effects of pipes shows the higher concentration of Pb, Mn and Fe (Jain, *et al.*;1999) (Panda and Sahu, 2000).

However on the basis of water quality index, the groundwater quality of the western (Sawedi) part of Ahmednagar city area and MIDC area was found to be good quality of water. The medium quality of groundwater found in opposite to MIDC Area in Nagapur and Vanarai Colony. This indicates the alarming situation as far as the groundwater quality is concerned (Azni. Bin, *et al.*;2000).

Hence, it is concluded that groundwater in Ahmednagar city area is good quality water and it is fit for the drinking purposes. Whereas in the MIDC area it is in alarming stage (Patel, *et al.*;2003).

Acknowledgement:

The author would like to thank Dr.D.S.Ramteke HOD,EIRA Division,NEERI Nagpur, Dr. S. R. Wate, Director, NEERI, Nagpur for his constant encouragement in carrying out the above work and permission to publish the paper.

References:

Azni Bin I., Abdullah Ai M., Mohd. Amin M., and Wan Noor W., (2000), Review of Water Quality Standards and Practices in Malaysia, Poll. Res., Vol.22 (2), 145-155

Bharathi D and Ramanibai R., (2002), Investigation on Hydrobiological Profile of Kolavoillake - Chingleput District, India, Indian J. Environ & Ecoplan, Vol. 6(1), 147-150

Dadhich A., Khasim S. and Kavitha G., (2001), An Assessment of the Groundwater Quality : A Case Study Done in Adarsh Nagar Area of Vishakhapatnam, Water Pollution, Arvind Kumar, pp 41-45

Das K., Saha S., Dasmahapatra G and Pal T., (2000), Wastewater Treatment of a Pharmaceutical Manufacturing Unit by a Batch Package Activated Sludge Plant- A Case Study, Journal IAEM, Vol. 27, 255-259

Dasgupta A. and Purohit K., (2001), Status of Surface and Groundwater Quality of Mandiakudar Part 1: Physico-chemical Parameters, Poll. Res., Vol. 20(1), 103-110

Edet A E., (1993), Groundwater Quality Assessment in Parts at Eastern Niger Delta, Nigeria, Environ Geol., Vol. 22, 41-46.

Elango L., Ramachandran S and Chowdary Y., (1992), Groundwater Quality in Coastal Regions of South Madras, Indian. J. Environ, HLTH., Vol. 28, 481-487.

Garg S. S, Water Quality of Well & Bore Well of Ten Selected Locations of Chitrakoot Region, Water pollution, Arvind Kumar, pp 239-251.

Hasan. S. (2003), Groundwater Exploitation and Hydrogeological Research : A Chronology of Histrorical Developments, J. Current Scicence, Vol. 2(2), 299-304.

Jain C and Sharma M., (2000), Regression Analysis of Groundwater Quality data of Sagar District, Madhya Pradesh, Indian. J. Environ. HLTH., Vol. 42 (4), 159-168.

Jain C., Bhatia K., and Kumar S., (1999), Groundwater Quality in Greater Guwahati, Assam with Reference to Trace Elements, Technical Report, CS(AR) 8/ 98-99, National Institute of Hydrology, Roorkee.

Jain C., Bhatia K and Sharmam M., (1997), Ground Quality Evaluation in Doon Valley, Dehradum, Technical Report, CS(AR) 10/ 96-97, National Institute of Hydrology Roorkee.

Jain C., Kumar C. and Sharma M., (2003), Groundwater Quality of Ghataprabha Command Area, Karnataka, Indian. J. Enviran. & Ecoplan, Vol.7(2), 251-262.

Jain C., Kumar Sudir K and Bhatia S., (1996), Groundwater Quality in Western Uttar Pradesh, Indian Environ, Hlth, Vol. 38 (2), 105-112.

Jain C., Ram D and Bhatia K., (1996), Groundwater Quality Monitoring and Evaluation in District Hardwar, U. P., Technology Report, CS (AR) 198, National Institute of Hydrology, Roorkee.

Jain S., Sharma M and Thakur R., (1996), Seasonal Variations in Physico-chemical Parameters of Halai Reservoir of Vidisha District, India. J. Ecobiol., Vol. 8(3), 181-188

Kannan K., (1991), Fundamentals of Environmental Pollution, S. Chand and Company Ltd., New Delhi, 189.

Kaul S and Gaytam A., (2002), Water and Wastewater Analysis

Kedar G. and Patil G.,(2002), Studies on the Biodiversity and Physico-chemical Status of Rishi Lake, Karanja, Thesis Amravati University, Amravati.

Kellar A W., (1979), Environmental Geology, Charles. E. Merrill Publishing Co., Ohio, 548

Kotaiah B and Reedy S., (2003), Groundwater Quality of Block V, Srisailm Right Branch Cannal Command Area, Kurnool District, AP, Indian .J, Env and Ecoplan, Vol. 7, 43-46

Kuashik A., Kanchan T and Sharma. H., (2002), Water Quality Index and Suitability Assessment of Urban Groundwater of Hisar and Panipat in Haryana, J. Environ. Biol., Vol. 23(3), 325-333.

Kumar and Kakrani., (2000), Water Environment and Pollution

Langenegger O., (1990), Groundwater Quality in Rural Area of Western Africa UNDP Project, INT /81/ 026,10.

Meenakumari H and Hosmani S., (1998), Physico-chemical and Biological Quality of Groundwater in Mysore City, Water Pollution, Arvind Kumar, pp 109-113.

Panda D S and Sahu R K., (2002), Heavy Metal Pollution in a Tropical Lagoon, Chilika Lake, Indian. J. Environ. & Ecoplan., Vol. 6(1), 39-43.

Pandey A., Dutta S and Sharma K., (2002), Physico-Chemical Characteristics of Homor Pond of Kishangarh, Ajmer (Rajasthan), Indian. J. Environ & Ecoplan., Vol.6(1), 167-169.

Patel K., Pandya R., Maliwal G., Patel K and Ramani V., (2003), Suitability of Industrial Effluents for Irrigation around Bharuch and Ankleshwar Industrial zone in Gujarat, Poll. Res. Vol. 22(2), 241-245.

Prakash K., Nandini N and Somashekar R., (2004), Fluoride Contamination in Groundwater of Anekal Taluk of Bagalore Urban District, India, Eco. Env & Cons., Vol. 10(2), 123-126.

Purandara B., Varadarajan N and Jayashree K., (2003), Impact of Sewage on Groundwater Quality : A Case Study, Poll. Res., Vol. 22(2), 189-197.

Rao K.S., Thathaian K., Muralikrishna U., Rao M. and Mohana Rao N., (1986), Quality of Groundwater of Nuzid Town (A.P.), Indian. J. Environ. HLTH., Vol. 28(4), 3490-351.

Sastri M N., (1993), Introduction to Environment, First edition

Sharma A., Iyengar L. and Sankararamakrishnan N., (2004), Groundwater Quality in Kanpur District along the Gangetic Plain, Pollution in Urban Industrial Environment by Das S N, Swamy Y V, Rao K K and Mishra V N, 95-99.

Sinclair M I and Fairley C K., (2000), Drinking Water and Endemic Gastrointestinal Illness, J. Epidemiol. Community Health, Vol. 54(10).

Talebi A., Chandrashekhar M., Fazeli M., Khosravan F and Bhole A., (1994), Hydrochemistry and Quality of Groundwater in Yenne Hole Watershed, Journal IAEM, Vol. 21, 8-6.

Tripathy J K., (2003), Groundwater Hydrochemistry in and around Bhanjabihar, Ganjam District, Orissa, Poll. Res., Vol. 22(2), 185-188

Yazdandoost M and Katdare M., (2000), Water Quality Index of Major Rivers in Pune, J. of Industrial Pollution Control, Vol.16 (2), 231-238.

Tables and Graphs:

Sr. No.	Sampling location	pH	Temp. (^{0}C)	Turbidity (NTU)	TSS (mg/l)	TDS (mg/l)	EC (µS/cm)
Dug Well							
1.	Jathe	7.9	29.0	1	17	599	1090
Bore Well							
2.	Dharmadhikari Mala	7.8	29.5	<1	10	672	1130
3.	Fulari Mala	7.8	29.5	<1	14	512	868
4.	Near ESSAR Petrol Pump	8.1	29.5	<1	6	860	1400
5.	Tathe Mala	7.8	29.5	<1	16	572	936
6.	Sai Nagar	7.3	29.0	1	10	1136	1720
7.	Sai Nagar	7.1	30.0	1	11	1872	2970
8.	Nagapur	8.5	29.5	53	122	1002	1670
9.	Sai Nagar	7.8	29.5	1	10	656	1130
10.	MIDC	7.7	29.5	1	14	1846	2800
11.	MIDC	8.1	30.0	1	13	2130	3180
12.	Vanrai Coloy	7.9	29.0	1	12	1288	2080
Hand Pump							
13.	Varad Colony	8.0	29.0	2	13	1102	1130
14.	Deep Complex	8.0	29.5	2	12	756	1220
15.	Nar Mahalaxmi Garden	7.8	29.5	1	12	662	1140
16.	Surabhi Colony	7.8	29.0	2	13	818	1300
17.	Manorama Colony	8.2	29.5	2	12	596	932
18.	Gajanan Colony	7.9	29.0	2	16	904	1330
19.	Vanarai Colony	8.1	29.5	43	162	1198	1760

Table 1.1 Water Quality - Physical Parameters

Sr. No.	Sampling location	Total Alkalinity	Total Hardness	Calcium Hardness	Chloride	Sulphates	Sodium	Pota-ssium	Fluoride
		(as $CaCO_3$)							
		(mg/l)							
Dug Well									
1.	Jathe	152	290	215	135	90	76	6	0.02
Bore Well									
2.	Dharmadhikari Mala	250	347	210	116	77	75	18	0.02
3.	Fulari Mala	160	187	125	84	73	86	14	0.03
4.	Near ESSAR Petrol Pump	248	381	135	149	109	116	6	0.02
5.	Tathe Mala	150	143	22	87	73	54	16	0.02
6.	Sai Nagar	253	525	350	250	121	182	9	0.02
7.	Sai Nagar	192	593	518	512	160	305	3	0.02
8.	Nagapur	204	253	186	304	94	218	8	0.02
9.	Sai Nagar	95	269	195	162	82	61	10	0.02
10.	MIDC	350	883	605	480	193	170	6	0.03
11.	MIDC	489	848	555	606	150	304	1	0.02
12.	Vanrai Coloy	308	515	253	318	134	194	6	0.02
Hand Pump									
13.	Varad Colony	200	339	130	142	109	84	6	0.02
14.	Deep Complex	275	397	197	179	95	106	6	0.02
15.	Nar Mahalaxmi Garden	216	455	205	168	109	57	2	0.09
16.	Surabhi Colony	220	392	200	89	184	97	7	0.01
17.	Manorama Colony	243	304	216	42	31	76	6	0.006
18.	Gajanan Colony	196	341	225	170	77	50	2	0.008
19.	Vanarai Colony	258	593	235	339	132	138	3	0.010

Table 1.2 Water Quality - Inorganic Parameters

Sr. No.	Sampling location	Nitrate as N	Total Phosphates	Dissolved Oxygen	Chemical Oxygen Demand	Biochemical Oxygen Demand
		(mg/l)				
Dug Well						
1.	Jathe	9	0.02	6.0	11	<3
Bore Well						
2.	Dharmadhikari Mala	11	0.07	6.2	9	<3
3.	Fulari Mala	11	0.09	6.4	9	<3
4.	Near ESSAR Petrol Pump	22	0.15	5.9	11	<3
5.	Tathe Mala	15	0.10	4.8	10	<3
6.	Sai Nagar	11	0.20	3.2	27	<3
7.	Sai Nagar	3	0.17	3.1	26	<3
8.	Nagapur	1	0.20	2.9	57	12
9.	Sai Nagar	1	0.11	4.6	17	<3

10.	MIDC	10	0.10	5.2	09	<3
11.	MIDC	4	0.13	4.9	10	<3
12.	Vanrai Coloy	2	0.11	6.2	6	<3
Hand Pump						
13.	Varad Colony	2	0.34	3.2	9	<3
14.	Deep Complex	2	0.05	3.6	7	<3
15.	Nar Mahalaxmi Garden	3	0.03	3.4	11	<3
16.	Surabhi Colony	6	0.06	5.1	9	<3
17.	Manorama Colony	3	0.13	4.9	12	<3
18.	Gajanan Colony	3	0.12	3.2	27	<3
19.	Vanarai Colony	6	0.22	4.8	9	<3

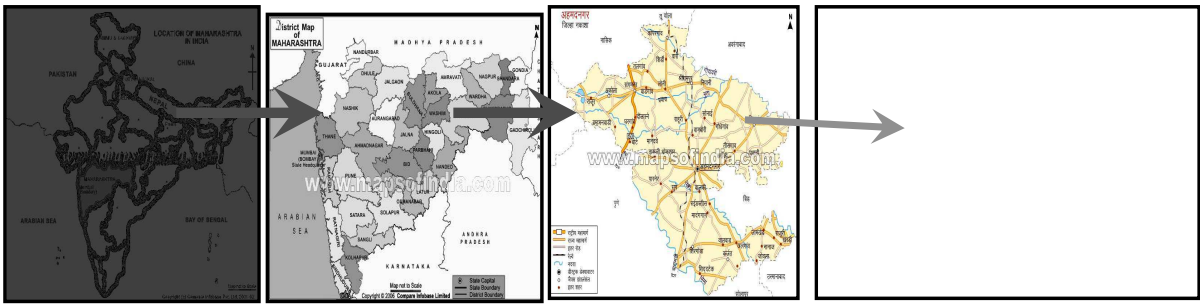
ND : Not Detectable

Table 1.3 Water Quality – Nutrient, Oxygen Demand and Organic Parameters

Sr. No.	Sampling Location	Water Quality Index	Inference
1.	Jathe	75	Good
2.	Dharmadhikari Mala	75	Good
3.	Fulari Mala	75	Good
4.	Near ESSAR Petrol Pump	71	Good
5.	Tathe Mala	74	Good
6.	Sai Nagar	75	Good
7.	Sai Nagar	81	Good
8.	Nagapur	64	Medium
9.	Sai Nagar	82	Good
10.	MIDC	75	Good
11.	MIDC	76	Good
12.	Vanrai Coloy	81	Good
13.	Varad Colony	77	Good
14.	Deep Complex	80	Good
15.	Nar Mahalaxmi Garden	81	Good
16.	Surabhi Colony	76	Good
17.	Manorama Colony	78	Good
18.	Gajanan Colony	80	Good
19.	Vanarai Colony	68	Medium

Table 1.4 Groundwater Quality Rating Based on Water Quality Index

Figures:



The location map of Ahmednagar in Maharashtra is given in **Fig. 1.1**.