Assessment of water quality of selected tube wells in Amalner town of Jalgaon district, Maharashtra

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ABSTRACT

The paper deals with analysis of physico-chemical characteristics of bore well and municipal water of Amalner town. Three different ground water samples (bore well) and Municipal water sample from bus stand area were collected during November'2006-January'2007 and analyzed. The values obtained were compared with standards prescribed by WHO and ISI 10500-91. In the present study, three water samples were within the limit. One water sample showed high TDS, TH, Chloride, TA and low DO values indicating poor water quality. The significance of the results is further discussed.

Key words: Drinking water, ground water pollution, physicochemical parameters.

INTRODUCTION

Water, one of the precious commodities is extremely essential for the survival of all living organism. The ground water is believed to be comparatively much clear and free from pollution than surface water. But prolonged discharge of industrial effluents, domestic sewage and solid waste dump possesses the ground water to become polluted and create health problems. The problems of ground water quality are much more acute in the areas which are densely populated and thickly industrialized. The rapid growth of urban areas has further affected the ground water quality due to overexploitation of resources and improper waste disposal practices[1-2].

Industrial waste and the municipal solid waste is one of the leading causes of pollution of surface and ground water. The available water becomes non potable because of presence of iron, nitrate, arsenic or heavy metals in excess. Contamination of water resources available for household and drinking purposes with heavy elements, metal ions and harmful microorganisms is one of the serious health problems.[3]

Ingestion of polluted water can result various serious health problems. Disposal of sewage water into fresh water aquifers is the main cause of ground water pollution water soluble impurities percolate into the earth contaminating the ground water.

Considering the above aspects of ground water contamination, the present study was undertaken to investigate the possible impact of the ground water quality of some selected tube wells in Amalner town of Jalgaon district of North Maharashtra region.

Study area

Amalner town is in Jalgaon district and located on the bank of Bori River. The town lies at northern region of Maharashtra state. The people are using bore well water as well as municipal water

for their daily need. Due to acute summer, there is always a shortage of water in Amalner town. The Municipal Corporation of Amalner has constructed tube wells in various parts of the town. Large amount of water is used from these tube wells by people for their daily need. The literature survey indicates that no ground water studies are made in this region so far. Hence the present study was planned and undertaken. The present investigation was carried out by selecting four different sites from Amalner town.

MATERIAL AND METHODS

Water samples were collected from four sampling points of different locality in Amalner town during a period of three months (November, 2006 to January, 2007). The sampling points and places are given in Table-1.

Water samples were collected in plastic canes of 3 litre capacity as per standard procedure. The physicochemical parameters such as pH, Temperature, Electrical conductivity (EC), Total dissolved Solids (TDS), Turbidity , Dissolved Oxygen (DO), Total Alkalinity (TA), Total Hardness (TH), Calcium (Ca^{2+}), Magnesium (Mg^{2+}), Sodium (Na^+),Potassium (K^+) , Chloride (Cl^-), Sulphate (SO_4^{2-}), Nitrate (No_3^-), were determined using standard method. [4-6] Reagents used for the present investigation were AR grade and Double Distilled Water was used for preparing various solutions.

RESULTS AND DISCUSSION

The average values of physicochemical parameters during November 2006 - January 2007 are presented in Table-3. The pH is a measure of

Table 1: Sampling Points and Places

Sampling Point	Place
A	Shivaji Nagar (Tube well)
B	Shirud Naka (Tube Well)
C	Shivaji Garden (Tube Well)
D	Bus Stand (Municipal Water)

the intensity of acidity or alkalinity and gives the concentration of hydrogen ions in water. It has no direct adverse effect on health, but a low value below 4.0 gives sour taste and higher value above 8.5 shows alkaline taste[7]. In the present study, the pH values of water samples varies between 6.7 to 7.7 and were within the limit prescribed by WHO.

Electrical conductivity (EC) value signifies the amount of total dissolved salts. EC values varies from 466 to 2914 μmho/cm which reveals that EC values for all tube well samples were greater than the prescribed limit. The EC value for sample D (Municipal water) was found within the limit

Total dissolved solids (TDS) indicate the general nature of water quality or salinity. Water containing more than 500 mg/l of TDS is not considered desirable for drinking water supplies, but in unavoidable cases 1500 mg/l is also allowed[8]. In the present investigation, TDS values varied from 160 to 1080 mg/l. It shows that samples A and B have higher values than the prescribed limit given by ISI 10500-91. The highest TDS value in sample B may be due to sewage along with a pond near the sampling point.

Turbidity of water is actually the expression of an optical property (Tyndall effect) in which the light is scattered by the particles present in water. Turbidity makes the water unfit for domestic purposes, food and beverage industries and many other industrial uses. In the present study the turbidity values varies between 3.8 to 8.6 NTU and were within the limit prescribed by ISI 10500-91.

Dissolved oxygen (DO) is one of the important pollution parameters in water quality assessment and reflects the physical and biological processes prevailing in the water. The DO Values indicate the degree of pollution in water bodies. In present investigation, DO value varies between 2.7 to 8.2. The results indicate that the DO is not depleted except sample B which showed low DO value indicating heavy contamination by organic matter.

The alkalinity of water is a measure of its capacity to neutralize acids. The alkalinity in water is caused by carbonates, bicarbonates and

hydroxides. Total alkalinity values for tube well samples were found to be greater than the values prescribed by WHO.

Hardness of water mainly depends upon the amount of calcium or magnesium salts or both. Hardness of water is objectionable regarding water

Table - 2: Methods used for estimation of various physico-chemical parameters.

S. No.	Parameters	Method
1	pH	pH Metry
2	Electrical Conductivity	Conductometry
3	Total Dissolved Solids	Filtration Method
4	Turbidity	Nephelometric Method
5	Dissolved Oxygen	Iodometric Method
6	Total Alkalinity	Titration Method
7	Total Hardness	EDTA Titration
8	Calcium	EDTA Titration
9	Magnesium	EDTA Titration
10	Sodium	Flame Photometric Method
11	Potassium	Flame Photometric Method
12	Chloride	Silver Nitrate Method
13	Sulphate	Turbidimetric Method
14	Nitrate	Brucine Method

Table 3: Average values of Physico-chemical parameters with drinking water standards (November 2006 to January, 2007)

S. No.	Parameter	Sampling points				Range of results		WHO	ISI
		A	B	C	D	Min.	Max.	1993	10500-91
1	pH	6.9	6.7	7.0	7.7	6.7	7.7	6.5-8.5	7-8.5
2	EC	1831	2914	1497	466	466	2914	1400	-
3	TDS	520	1080	440	160	160	1080	1000	500
4	Turbidity	8.6	6.5	3.8	6.8	3.8	8.6	-	10
5	DO	5.9	2.7	6.7	8.2	2.7	8.2	-	5.0
6	TA	328	614	504	140	140	614	120	200
7	TH	550	923	592	168	168	923	500	300
8	Ca^{2+}	96.21	117.8	85.77	25.65	25.65	117.8	100	75
9	Mg^{2+}	75.53	153.2	92.09	25.34	25.34	153.2	150	30
10	Na^+	34	53	73	15	15	73	200	200
11	K^+	0.75	0.6	2.0	3.4	0.6	3.4	-	-
12	Cl^-	324	477.5	254.9	69.02	69.02	477.5	250	250
13	SO_4^{2-}	61.07	93.39	64.19	39.73	39.73	93.39	250	200
14	NO_3^-	0.061	0.158	0.035	0.040	0.035	0.158	45	45

(All parameters are in mg/l except pH, EC and Turbidity, EC in m mhos/cm, Turbidity in NTU)

use for laundry and domestic purpose, since it consumes a large quantity of soap. In the present study; Total Hardness (TH) value varies from 168 to 923 mg/l. The values for tube well samples were higher than the prescribed limit.

The amount of calcium varies from 25.65 to 117.8 mg/l and the magnesium content is ranging between 25.34 to 153.2 mg/l which is found within the prescribed limit except sample B. Sodium content varies between 15 to 73 mg/l and found below prescribed limit. Potassium concentration varies from 0.6 to 3.4 mg/l in which no standard values are suggested for drinking by WHO and ISI 10500-91.

Chloride imparts salty taste if present in excess (> 250mg/l). People accustomed to high chloride in water are subjected to laxative effects[9]. Chloride presence in study area ranges from 69.02 to 477.5 mg/l. Only the sample D was found within the prescribed limit. The sulphate content varies between 39.73 to 93.39 mg/l and the nitrate content varies between 0.035 to 0.158 mg/l. The sulphate and nitrate values were found within the prescribed limit.

CONCLUSION

1) Deviation is shown by tube well water from municipal drinking water and standard (WHO) indicating that tube well water is polluted. The cause of pollution appears to be sewage.

2) The quality of water in the sample (B) is inferior compared to other water samples, probably due to sewage pond is very close to hand pump. The water sample (B) is highly polluted and unfit for drinking purpose.

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