

## PHYSICO-CHEMICAL CHARACTERISTICS OF AMBA NALLHA AND NEIGHBORING GROUNDWATER SOURCES IN AMRAVATI CITY

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### ABSTRACT

*The physico chemical parameters of the water of Amba Nallha and neighboring ground water sources were studied during the rainy season (July to September 2012). The result of the present study revealed that the discharge of domestic waste, drainage and untreated municipal and hospital effluents in to the Amba Nallha have contributed considerable pollution in the surface & ground water in its vicinal areas. The ground water of neighboring open wells bore wells and tube wells are polluted due to the percolation through soil in its natural way. The quality parameters were compared with the drinking water standards said by APHA (1998); WHO (1991); ICMA (1976). It is significant to note that the significant variations in chemical parameters were observed at different bore wells of neighboring areas of Amba Nallha. It has been observed that the quality of ground water bore wells, tube wells & open wells is not acceptable for drinking purpose and domestic use. However the surface water of Amba Nallha have been so much polluted and hence not potable for drinking purpose and domestic use. It is harmful and cause water borne diseases to the citizens of Amravati city. The possible remedies are also proposed.*

*Key Words: Physico- chemical, Amba Nallah, Ground Water.*

### Introduction

Amravati city is located on the Mumbai- Calcutta National Highway number six. The city lies between East longitude  $76.37^{\circ}$  to  $78.37^{\circ}$  and  $20.32^{\circ}$  to  $21.37^{\circ}$  North latitude. The climate of the city is subtropical with hot and dry summer followed by rainy season.

The purpose of research work is to find out the evils of filthy and dirty water that runs in the form of Amba Nallha from the centre of the city. It has been observed that the water regularly used in the city from the surrounding nearby wells, tube wells and hand pumps is polluted due to percolation through soil in its natural way. It is not potable and may cause some water borne diseases to the citizens of Amravati city.

Ground water has been considered as reliable and safe source of water, protected by surface contamination by geological filters that remove pollutants from water which percolate through soil. Still ground water is not absolutely free from these pollutants (Tiwari & Bose, 1986; Mohan, 1995). The ground water is used for drinking as well as for domestic use. However, it may contain the soluble detergents, fertilizers, harmful chemical degradable as well as non degradable hospital waste, drainage and municipal wastes, which may creates some health problems and diseases to the human beings.

A large variety of micro-organisms may remain present in ground water / surface water. Coli is the most important and is used as an index of fecal

contamination and is related to sanitary quality of water (Cody, 1961; Clark, 1969). The most common water borne diseases are dysentery, diarrhea, hepatitis etc. Therefore, the present study has been undertaken to evaluate the quality of ground water of surrounding area of Amba Nallha.

### **Material and Methods**

Water sample are collected from the following sampling stations (Plate No. 1).

- I) Amba Nallha (A, B & C)
- II) Open wells
- III) Tube wells / Hand pumps
- IV) Bore wells

Water samples were collected in a plastic cans and bottles between the period of 10am to 2pm. from the selected sites neighboring Amba Nallha and were taken to laboratory immediately during monsoon season (July – September 2012). The water samples were stored in refrigerator at 4<sup>0</sup>C till the analysis was over and some parameters like pH, temperature, color, odour and dissolved oxygen were analysed on the spot at the time of sample collection using portable battery operated water analysis kit equipped with digital thermometer & pH meter.

The chemical parameters like free CO<sub>2</sub>, total dissolved solids (TDS), total hardness, calcium, magnesium, nitrates within four hours on the same day by using the methods as recommended by WHO (1997), ISI (1991), ICMR (1975), APHA (1998).

### **Result and Discussion**

The physico-chemical properties of water samples of Amba Nallha and

surrounding ground water sources are presented in Table-1.

#### **Temperature**

No significant changes have been noticed in the water temperature of various water samples.

#### **Odour and Colour**

Water samples of open wells, tube wells and bore wells were odourless and colourless while water samples of Amba Nallha had a very foul odour and grey brown/ greenish brown in colour.

#### **pH**

Results as illustrated in Table-1 shows that water samples of open wells have the pH value from 7.6 to 8.0, whereas water samples of Amba Nallha varies from 8.5 to 11.5 may be due to high concentration of cations present in this water.

#### **Dissolved Oxygen (D.O.)**

A good water should have solubility of oxygen (7.0-7.5mg/l) at 30<sup>0</sup>C and this much oxygen saturated water have pleasant taste. D.O. of water samples of Amba Nallha and of neighboring sites were very low ranging between 3.7 to 5.75mg/l, which may be due to the presence of large amount of bacteria and hence not potable.

#### **Biological Oxygen Demand (B.O.D.)**

This is an important parameter to assess the pollution of surface water and ground water, where contamination occurred due to the disposal of domestic and municipal waste/sewage. The values of water samples of Amba Nallha were from 40 to 85 mg/l, which was more than 20mg/l (permissible value) and hence the

water of Amba Nallha and nearby groundwater sources is not suitable for drinking and other domestic use.

#### **Chemical Oxygen Demand\_(C.O.D.)**

The maximum permissible value of COD is 10mg/l for drinking water. The higher value (40 to 150 mg/l) of water samples of Amba Nallha and nearby groundwater sources indicates the pollution of water and presence municipal sewage into it. The values observed indicates that the water is not potable.

#### **Total Alkalinity (TA)**

The total alkalinity of water samples of Amba Nallha was 270 to 450 mg/l which is much higher the other water samples.

#### **Total Hardness (TH)**

The calcium and magnesium cations are responsible for total hardness of water. Similarly the sulphates, chlorides and nitrates anions are also responsible for total hardness. Total hardness of ground water samples & Amba Nallha varies from 180-450 mg/l which may be due to the high concentration of  $\text{Ca}^{++}$ ,  $\text{Mg}^{++}$ ,  $\text{Cl}^-$  &  $\text{CO}_3$  ions present in it.

In the present study the values of calcium, magnesium, chlorides, calcium carbonate were found to be higher in the water samples of Amba Nallha. However, sulphates have lower values in all the samples.

#### **Total Dissolved Solids\_(TDS)**

Total dissolved solids in case of water samples of Amba Nallha varies from 360 to 540 mg/l. Whereas, water samples of wells, tube wells and bore wells was found to be higher ranged between 550 to

930 mg/l. These values are responsible for hardness of these water samples. Our findings are well in agreement with the earlier workers Kamal K. et.al. (2008), Tiwari et.al. (1986), Mohan (1995), Chahnam (2000), Dineshkumar et.al. (2003), Goel (1997), Gupta and Gupta (1999), Prasad and Vishwanath Bhat (2011).

T.D.S. values varied between 360-930 mg/l is commonly objectionable. This is also reported by Ramachandra and Prasad (2005), Prakash and Gupta (2007), higher values of calcium and magnesium are found in ground water due to dissolving limestone. Hence the ground water of open wells, bore wells and tube wells/hand pumps of neighboring Amba Nallha is suitable for drinking purpose in term of hardness and other pollutants present in it. Coli also may remain present in water of Amba Nallha because of bad sanitary habits of surrounding localities. It may cause water borne diseases to the citizens of that area.

The present study indicates that the water samples of all the sampling sites except Amba Nallha fulfills the criteria of physical parameters such as temperature, colour, odour & taste. However, the chemical parameters like T.D.S., T.S., T.A. Ca, Cl,  $\text{NO}_3$  and  $\text{CaCO}_3$  hardness of the water samples of open wells, bore wells and tube wells/hand pumps of surrounding Amba Nallha area have shown higher concentration in comparison to the permissible limit as recommended by ICMR (1982). Hence it is not acceptable for drinking pupose as well as for domestic use.

**Table 1: Average of physico-chemical parameters of different sampling stations in Amravati city during Rainy Season (July to September 2012).**

Sr. No.	Parameters	Well Water	Bore Well	Tube well/ Hand pump	Amba Nallha		
					A	B	C
1	W. T. ( <sup>0</sup> C)	26.94 ±2.96	26.85 ±1.67	26.80 ±1.40	30.20 ±4.20	30.50 ±4.30	30.40 ±4.00
2	Odour	Odourless	Odourless	Odourless	Foul	Foul	Foul
3	Colour	Colourless	Colourless	Colourless	Grey Brown	Grey Brown	Grey Brown
4	pH	7.80 ±0.28	7.50 ±0.40	7.60 ±0.35	8.50 ±0.30	10.20 ±0.50	8.70 ±0.40
5	D O (mg/L)	4.75 ±0.90	4.50 ±0.40	4.40 ±0.30	3.50 ±0.20	4.00 ±0.30	5.00 ±0.40
6	BOD (mg/L)	2.50 ±0.20	1.50 ±0.10	2.00 ±0.30	40.50 ±5.20	80.20 ±15.20	85.30 ±15.30
7	COD (mg/L)	40.20 ±8.20	42.50 ±8.20	42.00 ±8.20	120.20 ±20.20	150.00 ±30.20	140.20 ±25.30
8	Total Alkalinity (mg/L)	360.50 ±18.20	280.00 ±40.00	350.20 ±50.30	210.50 ±50.20	150.30 ±20.50	250.20 ±40.30
9	Total Hardness (mg/L)	400.50 ±30.40	340.20 ±52.30	320.50 ±40.20	180.50 ±50	250.20 ±40.10	230.30 ±30.20
10	TDS(mg/L)	930.25 ±80.30	750.30 ±100.20	550.40 ±95.20	450.20 ±60.30	540.20 ±80.50	360.40 ±40.20
11	T.S. (mg/L)	800.30 ±90.20	1000.20 ±120.50	1420.30 ±160.40	700.50 ±80.20	1200.50 ±100.20	1350.30 ±150.20
12	Ca Hardness (mg/L)	70.30 ±1050	50.50 ±5.20	80.60 ±10.80	180.30 ±20.50	230.50 ±50.20	150.20 ±15.50
13	Mg (mg/L)	75.10 ±4.75	40.50 ±20.70	30.20 ±5.60	90.20 ±25.20	80.50 ±10	70.50 ±15.20
14	CaCO <sub>3</sub> Hardness (mg/L)	350.30 ±35.12	280.20 ±30.00	170.50 ±15.23	210.50 ±30.50	250.30 ±40.30	200.50 ±20.30
15	Cl (mg/L)	60.30 ±10.20	100.20 ±20.50	150.30 ±30.20	120.30 ±25.20	160.20 ±40.30	110.50 ±20.30
16	SO <sub>4</sub> (mg/L)	50.20 ±7.20	40.50 ±8.36	60.30 ±10.25	100.20 ±10.50	90.50 ±30.50	75+50 ±20.20
17	NO <sub>3</sub> (mg/L)	20.05 ±2.10	25.10 ±3.50	30.20 ±2.30	10.20 ±0.50	15.50 ±0.60	20.50 ±2.20

W. T. (<sup>0</sup>C)-Water Temperature.  
 D.O.-Dissolved Oxygen ,  
 B.O.D.-Biological Oxygen Demand ,  
 T.ALK.- Total Alkalinity,  
 T.S.- Total SOLID ,  
 Mg- Magnesium  
 SO<sub>4</sub>. Sulphates,

NO<sub>3</sub>.Nitrates ,  
 Cl-Chlorides ,  
 C.O.D.- Chemical Oxygen Demand,  
 T.D.S.- Total Dissolved Solid ,  
 Ca Hardnesss – Calcium Hardness,  
 CaCO<sub>3</sub>hardness \_ Calcium hardness ,

Plate No. 1 : Showing Different sampling Spots of Amba Nallha and Nearby Stations



Spot No.1 : Amba Nallha



Spot No.2 : Open Well



Spot No.3 : Borewell nearby Amba Nallha



Spot No.4: Hand Pump nearby Amba Nallha

Therefore, it is suggested that the domestic waste, sewage and untreated municipal waste should not be discharged into the Amba Nallha of Amravati city.

Sustained efforts should be made to bring out greater awareness among masses about the importance of good quality of drinking water.

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