

Physico-Chemical and Microbiological Analysis of Drinking Water at Banda City (U.P.) India

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Abstract— Water is one of the most important of all natural resources known on earth. It is important to all living organisms, most ecological systems, human health, food production and economic development. Analysis of Physicochemical and Microbiological parameters viz. colour, odour turbidity, pH, total alkalinity, total hardness, TDS, D.O., Fe, F, river water and tube well water were determined in winter season in 2014. The safety of drinking water is important for the health. The safety of drinking water is affected by various contaminants which included chemical and microbiological. Such contaminants cause serious health problems. Due to these contaminants quality of the Drinking Water becomes poor. Sometimes such poor quality water causes many diseases in the humans so that quality of the water must be tested for both the chemical as well as for the microbial contaminants. During the study it was found that maximum number of physical and chemical parameters were within the desirable limit, as suggested by WHO and BIS. The objective of the present research is to provide information on the physico-chemical and Microbiological characteristics of Drinking water in order to discuss its suitability for human consumption. Physicochemical and bio-chemical aspects of the water have been investigated to assess the quality of water.

Key words: Physico-chemical and microbiological parameter, River & Tube wells, ISI/W.H.O, Drinking Water.

I. INTRODUCTION

Aqua is the base of all life and an abundant compound on the earth's surface. Fortunately 71% of the earth surface is covered by surface water. But unfortunately only 3% of fresh water is available as drinking and other purposes. Water is one of the most important compounds that profoundly influence life. The quality of water usually described according to its physical, chemical and biological characteristics. Rapid industrialization and indiscriminate use of chemical fertilizers and pesticides in agriculture are causing heavy and varied pollution in aquatic environment leading to deterioration of water quality and depletion of aquatic biota. Due to use of contaminated water, human population suffers from water born diseases. It is therefore to check the water quality at regular interval of time. The present investigation involves the analysis of water quality in relation to physicochemical and microbiological parameters.

The Government of India launched the National Rural Drinking Water Quality Monitoring and Surveillance Programme in February 2006. This envisages institutionalization of community participation for monitoring and surveillance of drinking water sources at the grassroots level by gram panchayats and Village Water and Sanitation Committees, followed by checking the positively tested samples at the district and state level laboratories. One major problem when it comes to addressing the

problems related to water is that the provisions for water are distributed across various ministries and institutions. With several institutions involved in water supply, intersectoral coordination becomes critical for the success of any programme.

A report of world health organization (2002) says that around 700000 Indians die each year from diarrhoea. In foreign countries like U.S. polluted water is filtered in various stages to make it fit for drinking purpose.

Whereas in India this advanced technology is not being done. Here only a very simple process for a minor purification water is adopted in which polluted water is purified by using disinfectants such as Chlorine, Bleaching powder.

The contaminated Drinking water is hazardous for human beings. It may be fatal also. The untreated water may cause defects in nervous system, organ damage reproductive effects and cancer like fatal diseases water with nitrates at sufficiently high levels, can result in potentially fatal alternations in the haemoglobin of infants and very young children called blue baby syndrome.

According to the Central Pollution Control Board (2000), 90% of the water supplied in Indian towns and cities are polluted out of which only 1.6% gets treated.

Bundelkhand region is already facing surface water crisis along with ground water which can be used for various needs but it is already lower water table than other places. Besides draught in last 12 years and this year too has caused more deeper strata of the ground water due to lack of percolation of less rain water.

Banda city situated in south central part of U.P. and north part of Bundelkhand region surrounding Vindhya range. The city of Banda is the H.Q. of Chitrakoot Dham Mandal.

The Drinking water supply in Banda city is through River Ken and tubewells. The surface water supply is river Ken is located on western side of the city. The supply is from upstream. As regards the underground water are tubewells, the water strata is very deep due to rock strata. The water in supply system is treated with chlorine and also filtered as per the water works norms.

Besides shortage of water in this area Drinking water is also contaminated which causes various water born-diseases viz – Diarrhoea, Cholera, Typhoid, hepatitis, colic dysentery etc. As no physico-chemical and microbiological analysis has been done yet in this Block. So this important work was carried out scientifically to find out the pollution problems along with the suggestions for proper management on the drinking water. By taking all scientific parameters under the above heads along with meteorological conditions. All the measures for fulfilling the deficiencies were chalked out, by which the drinking water might be suitable for healthy life.

Having inview unpotability of water assessment of Drinking water is taken for the present study at Banda city (U.P.) India. This is a burning problem for the human life.

II. MATERIAL AND METHODS

Total 7 (Seven) samples were collected in winter season 2014(Sep.2014 to Dec.2014), from different locations in Banda city. Selections of seven different stations were identified and seven water samples were collected at sites and assigned as S1, S2, S3, S4, S5, S6, and S7. Sample sites are described in Table 1. Samples were collected from the sites in between 10:00 a.m. to 11:30 a.m. Sample for the analysis of dissolved oxygen was collected in BOD bottle (250 ml), by Winkler’s ‘A’ and Winkler’s ‘B’ solution at site.

The parameters like Temperature and Turbidity was recorded at the site. For the analysis of other chemical and microbiological parameters, the samples were collected in plastic can and carried to the laboratory on same day.

Sampling Code	Source	Location
S1	Ground Water	Gyatri Nagar
S2	Ground Water	Civil line
S3	Ground Water	Aliganj
S4	River water	Katra
S5	River water	Swaraj colony
S6	River Water	Indranagar
S7	River Water	Banda Railway station

Table 1: Description of water sampling sites

S.No	Parameter Studied	Site S1	Site S2	Site S3	Site S4	Site S5	Site S6	Site S7
1	pH	7.4	8.1	7.9	8.3	8.2	7.6	7.5
2	ALKALINITY (mg/l)	536	554	443	558	540	463	502
3	COD (mg/l)	4.26	4.32	4.48	4.58	5.56	5.12	5.23
4	DO (mg/l)	5.58	4.85	5.2	4.5	4.9	4.12	5.6
5	CHLORIDE S (mg/l)	129	138	142	156	162	177	162
6	FLOURIDES (mg/l)	0.63	0.59	0.67	0.42	0.45	0.62	0.59
7	T.H (mg/l)	226	338	256	324	356	358	386
8	T.D.S(mg/l)	266	256	227	336	315	346	321
9	TURBIDITY (NTU)	1.9	1.8	1.6	1.4	1.9	2	2.2
10	IRON (mg/l)	0.48	0.65	0.52	0.43	0.43	0.53	0.58
11	TASTE/ ODOUR	Unsatisfactory	Unsatisfactory	Satisfactory	Satisfactory	Satisfactory	satisfactory	Unsatisfactory

Table 2: Values of Physico-Chemical parameters

Total coliform Bacteria	662	668	725	856	788	725	764
E.Coli	495	502	562	559	605	702	565

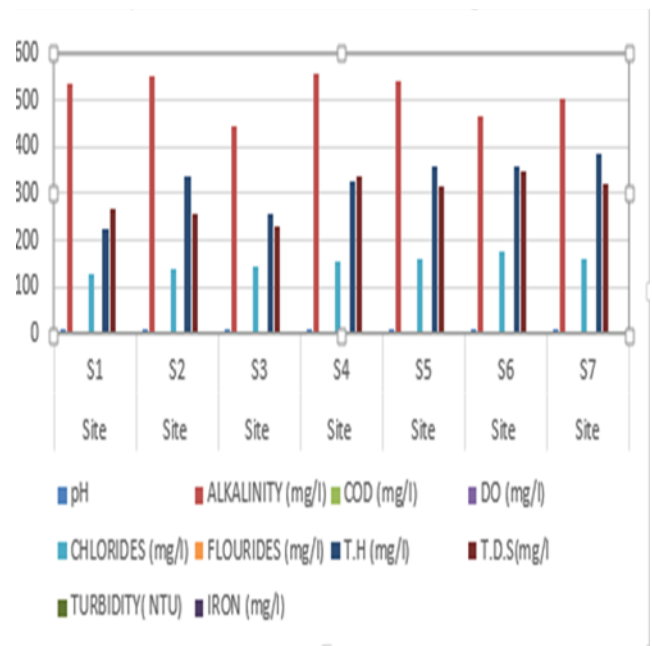


Fig. 1: Physico-Chemical Factors of Drinking Water

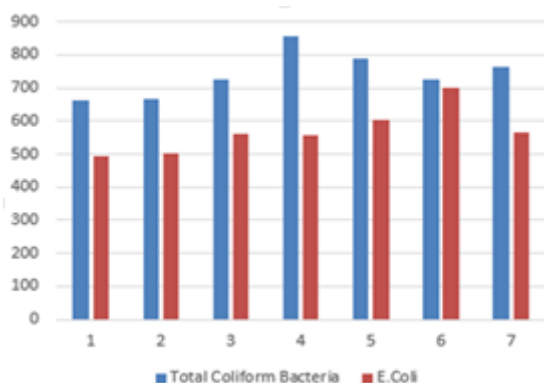


Fig. 2:

The Physico-chemical parameters along with micro-organism viz.– MPN/SPC of Coliform bacteria will be analysed as per the standard methods given in American Public Health Association (APHA), American Water Works Association (AWWA) and Water Environment Federation (WEF) 21st 2005.

Physical parameters – water temperature, colour, turbidity, water current chemical factors pH, total hardness, Ca and Mg, fluorides, D.O., T.D.S, CL-, Iron etc.

III. MICROBIOLOGICAL EXAMINATION

A. Total bacterial density by Standard Plate Count (SPC) – after counting the bacterial colonies by "Quebec Colony Counter" SPC/ml will be calculated by the following formula- coloners counted

$$\text{SPC/ml} = \frac{\text{coloners counted}}{\text{Dilution Factor}}$$

Dilution Factor

B. Most Probable Number (MPN) of Coli form : It will be calculated by conducting three following tests :

- Presumptive Tests
- Confirmatory Test
- Completed Test

C. MPN of faecal Coli form – It will be calculated by MC Grandy table published in "Chemical and biological methods for water pollution studies" Trivedi and Goel (1986).

IV. RESULT AND DISCUSSION

The examined physico-chemical and bacteriological parameters showed considerable variations in different samples. The observations are depicted in table-2 and 3.

A. Water Temperature:

The atmosphere temperature was recorded between 17 oC to 26 oC. The temperature is one of the important factors in aquatic environment since it regulates physicochemical as well as biological activities (Kumar et al., 1996).

B. PH:

The effect of PH on the chemical and biological nature of water makes for determinations is very important. It is defined as-log [H+], and measured as intensity of acidity or alkalinity on a scales ranging from 0-14. The free H+ are more it is expressed acidic (i.e PH<7), while more OH- ions is expressed as alkaline (i.e PH>7). Ph value of surface and ground water ranged from 7.4 to 8.3. The acidic medium of

water is quite harmful. Whereas alkaline medium above 7 to 9.5 is suitable for fish culture and other biota.

C. Turbidity:

It shows light-transmitting properties of water and is comprised of suspended and colloidal material, which is concerned with health. This is unsafe for consumption and industrial use also. In the course of study turbidity was observed 1.4 to 2.2 N.T.U.

D. Odour/Taste:

It is felt in colored water which is unsuitable for drinking. The cause is the leaching organic materials and chemicals near water resources. As S3, S4, S5,S6 water was satisfactory, whereas S1,S2, S7 it was of unsatisfactory taste.

E. Total Hardness:

It is an important parameter in decreasing the toxic effect. During the course of study it was found to be in the range of 226-386 mg/lit. Which is within the desirable limit as compared with BIS.

F. TDS:

These are in dissolved state in solution. Water with high dissolved solids generally are of inferior potability and may induce an unfavourable physiological reaction in the transient consumer. The TDS of all the samples were in the range of 227-346 mg/lit.

G. D.O:

Dissolved oxygen (DO) ranged from 4.12 to 5.58 mg/lit. It may be present in water due to direct diffusion from air and photosynthetic activity of autotrophs in surface water. Concentration of D.O is one of the most important parameters of indicate water purity.

H. Fluoride:

Its high concentration causes dental fluorosis and lower concentration (<0.8 mg/l) causes dental carries, sources of fluoride are found in coke, glass, and ceramic, electronic, pesticide and fertilizers. Fluoride of all the samples were in range 0.42 to 0.67 mg/l.

I. Chloride:

The presence of chloride in natural waters can mainly be attributed to dissolution of salt deposits in the form of ions (Cl-). High chloride content has a deleterious effect on metallic pipes. Chloride was found to be in the range of 129 to 177 mg/l.

J. C.O.D:

Variation of COD (mg/l) of different sites in Banda city is varied from 4.26 to 5.56 mg/l (ppm).

K. Iron:

Iron is also very important to human and other organisms, as it is partially responsible for transporting oxygen through the bloodstream. Iron is easily dissolved in water and can be found naturally occurring in water bodies. Iron is an essential element for human nutrition and metabolism. But in large quantities results in toxic effect like haemochromitosis in tissues if more iron accumulation takes place. The maximum permissible limit of Fe in

drinking water is 0.3 ppm. Iron content of different sites in Banda city in the range of 0.43 to 0.65 mg/l, which is very high compared to standard values. Water sample from the sites in Banda city contain high value of Fe. The high concentration of Iron may be due to high percentage of pyrites.

L. Alkalinity:

An anionic radical such as carbonates, bicarbonates, hydroxide and phosphate contributes to increase in alkalinity. Variation of alkalinity (mg/l) of different sites in Banda city is varied from 443 to 558 mg/l (ppm).

M. Bacteriological Taste:

1) Total Coliform Bacteria:

In the present study of total coli.(MPN) in drinking water, it was counted from 662 to 856.

2) Escherichia Coli:

In the present study of Escherichia coli in water, it was counted from 495 to 702. Both the above bacteria are very harmful to human health.

V. CONCLUSION

In present study physico-chemical and microbiological factors in water at its source and consumers point areas were assessed because contaminated water may lead to the various health related Problems. The present study emphasized on the two major findings. Firstly chlorination is much to reduce the microbial load of water. Secondly Turbidity, load at consumer points areas indicates that water become contaminated when it is supplied to these areas. As per the result the water of Banda city which have excess of Iron, Fluoride and bacteria mainly on the basis of physico-chemical of bacteriological study, it should be treated to remove these following the criteria of W.H.O. and B.I.S method. So, drinking water should not be used before its prior treatment in the area of study. Because untreated water might cause water borne diseases.

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REFERENCES

- [1] AWWA, APHA, WACF (2002). Standard methods for the examination of water and waste waters (21sted).
- [2] APHA; (2005) Standard methods for the estimation of water & waste water. American Public Health Association, American waste
- [3] Water Association, water pollution control federation 21st Edn, Washington DC.
- [4] BIS IS 13428 (2005), Standard parameters of drinking water given by Government of India.
- [5] Census of India (2001), 'Tables on Houses, Household Amenities and Assets', Registrar General of India, Government of India, New Delhi.
- [6] Government of India (2002), The National Water Policy, Ministry of Water Resources, New Delhi. Implementation Manual on National Rural Water Quality Monitoring and Surveillance Programme, Department of Drinking Water Supply, Ministry of Rural Development.
- [7] Gupta Akhilesh, Mall R.K., Singh Ranjeet, Rathore L. S., Singh R. S., Water resources and climate change: An Indian Perspective; Current Science, VOL. 90, NO. 12, June 2006.
- [8] Kumar A, HP Gupta and DK Singh, 1996. Impact of sewage pollution on chemistry and primary productivity of two fresh water bodies in Santal Paragana (BIHAR) INDIA J. Ecol. 23(2): 82-86.
- [9] Milovanovic M (2007). Water quality assessment and determination of pollution sources along the Axios / Vardar River, Southeast Europe. Desalination 213: 159-173.
- [10] Mohemmad Rafik, Rmacher. T, Uma Mahesh.m. (2011). A study on chemical analysis of drinking water form some communities in Nandyal rural areas of Kurnool, Andhra Pradesh, India. Vol. 2(1).
- [11] Mohammad Musaddiq and Anil K Fokmare, 2002. Determination of water quality index of surface water source of Akola city (M.S.), J. of Aquatic Biology, 18 (2):27-28.
- [12] NEERI, 1987. A laboratory manual on water analysis.
- [13] Pandey DK, 1993. Water quality evaluation of lentic ecosystem of central Himalaya at bimonthly interval Indian J. Environ protection, 13 (1):10-14.
- [14] Patil S and JM Patwari, 2003. Ground water quality from Prarava area, district Ahmednagar (M.S.). J. Aquatic Biology, Vol. 18(2): 85-86.
- [15] Pawar SK and JS Pulle, 2005. Studies of physico-chemical parameters in Pethwadaj dam, Nanded district in Maharashtra, India. J. Aqua. Bio., 13(1&2)57-59.
- [16] Sakare and Joshi 2003. Environmental aspects of lake water and its quality management.
- [17] Saxena MM, 1978. Environmental Analysis water, soil and Air. Agro Botanical pub. India, 1-16.
- [18] Subba Rao, 1993. Fresh water molluscs of Indian Recent advances in fresh water. Anmol publications pvt. ltd. New Delhi pp. 47-52.
- [19] Trivedi, R.K. and P.K. Goel. 1984. Chemical and biological methods for water pollution studies.
- [20] Wagh S.P.; Shrivastava V.S.; IJEP (27), 2007, 165-167.
- [21] WHO (2011). Guidelines for drinking water quality, 4th ed. WHO press, P.P 564.
- [22] WHO/UNICEF/UNFPA. Maternal mortality in 1995: estimates developed by WHO, UNICEF, UNFPA. WHO/RHR01.9. Geneva, World Health Organization, 2004.