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DRINKING WATER QUALITY ANALYSIS OF SOME BORE-WELLS WATER OF CHIKHLI TOWN, MAHARASHTRA

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ABSTRACT

The present paper deals with the drinking water quality analysis of some Bore-wells of Ward No. 17 of Chikhli town. The various parameters studied are colour, taste, odour, pH, turbidity, total dissolved solids, total suspended solids, total hardness, calcium hardness, magnesium hardness, copper, iron, chlorides, sulphates, nitrates and fluorides. The samples were collected during the month of June 2003. The results were compared with WHO (World Health Organization), ICMR (Indian Council of Medical Research), ISI (Indian Standards Institute)
Standards.

INTRODUCTION

Water is essential for the survival of any forms of life. Water accounts for about 70% of the weight of a human body. About 80% of the earth's surface is covered by water. Out of the total quantity of water present on the earth, about 97% of the earths water resources are locked up in the oceans and seas, which is too saline to drink and for the direct use for agriculture and industrial purpose and about 2.4% is trapped in giant glaciers and polar icecaps. Thus not even 1% quantity of water is available for drinking, agriculture, domestic and industrial consumption. Due to increasing industrialization on one hand and exploding population on the other, the demand of water supply have been increasing tremendously. But considerable part of this limited quantity of water is polluted by sewage, industrial wastes and wide verities of synthetic

chemicals. Thus, the quantity as well as quality of clean water supply is of vital significance for the welfare of mankind.

Water supplied to consumer should not have any impurities which cause taste, odour, colour, toxicity and injuries to human health. The different impurities in water which cause undesirable effects may be classified into physical, chemical, bacteriological and radiological .

In the present study, the water quality parameters prescribed for drinking water by different authorities are estimated.

TABLE - 1
Standards for drinking water

	ISI		ICMR		WHO	
Parameter	P	E	P	E	P	E
PHYSICAL						
Colour	10	50	5	25	5	25
Taste and odour	Unobject	-	Unobject	-	Unobject	-
Turbidity	10	25	5	25	5	25
CHEMICAL						
pH	6.5-8.5	6.5-9.2	7-8.5	6.5-9.2	7-8.5	6.5-9.2
TDS	-	-	-	-	500	1500
Total Hardness	300	600	300	600	-	-
Calcium	75	200	75	200	75	200
Magnesium	30	100	50	150	50	150
Copper	0.05	1.5	1.0	3.0	1.0	1.5
Iron	0.3	1.0	-.3	1.0	0.3	1.0
Manganese	0.1	0.5	0.1	0.5	0.1	0.5
Chlorides	250	1000	250	1000	200	600
Sulphates	150	400	200	400	200	400
Nitrates	45	-	20	50	-	100
Fluorides	0.6-1.2	-	1.0	2.0	0.5	1.0-1.5
Phenolic Substances	0.001	0.002	0.001	0.002	0.001	0.002
TOXIC						
Arsenic	0.05	-	-	0.2	-	0.2
Cadmium	0.05	-	-	0.05	-	0.05
Cyanide	0.05	-	-	0.01	-	0.05
Lead	0.1	-	-	0.1	-	0.1
Selenium	0.01	-	-	0.05	-	0.01
Zinc	5	10	-	-	-	-
Mercury	0.01	-	-	-	-	-

P = Permissible limit
E = Excessive limit
Note - All units except pH are in mg/L, otherwise stated.
* - Now BIS

TABLE - 2
Physico-chemical analysis data of bore- wells of ward no. 17

PARAMETER	BW-I	BW-II	BW-III	BW-IV	BW-V	BW-VI	BW-VII	BW-VIII	BW-IX	BW-X
PHYSICAL										
Colour	12	10	10	08	20	18	16	20	16	12
Taste and odour	UO	UO	UO	UO	UO	UO	UO	UO	UO	UO
Turbidity	11	09	08	06	13	15	14	17	14	10
CHEMICAL										
PH	7.2	6.2	8.3	8.4	7.8	7.8	6.9	6.3	7.5	8.5
TDS	200	180	220	170	180	130	270	210	160	150
Total Hardness	250	200	230	180	130	165	170	185	192	205
Calcium	36	20	40	55	60	48	52	56	63	68
Copper	15	22	27	28	30	25	18	16	20	28
Iron	0.4	0.3	0.3	0.4	0.3	0.3	0.2	0.4	0.2	0.2
DO	06	08	07	06	6.5	7.8	08	7.8	6.9	7.5
Manganese	0.01	0.04	0.05	0.06	0.03	0.02	0.08	0.09	0.02	0.01
Chlorides	210	180	200	220	235	177	180	160	175	227
Sulphates	180	120	90	110	173	145	126	138	160	155
Nitrates	20	22	27	35	28	40	35	32	24	28
Fluorides	0.2	0.3	0.5	0.3	0.4	0.35	0.015	0.019	0.18	0.25

UO- Unobjectionable.

MATERIAL AND METHODS

The study area cover the Ward no. 17 of Chikhli town of Buldana district, Maharashtra (India). The water samples were collected in the month of June-2003. The water samples were collected in sterile glass bottles of 100 to 1000 ml capacity. APHA (1985) was used for all analytical procedures.

RESULTS AND DISCUSSION

The analysis data of Bore-wells water ofWard No. 17 of Chikhli town is presented in Table 2.

From the results, it is evident that, the pH is well within permissible limit. pH (6.5 to 8.5) has no direct adverse effects on health, however a lower value below 4 will produce sour taste and higher value above 8.5 bitter taste. Higher value of pH also reduces the germicidal potential of chlorine. High pH induces the formation of trihalomethanes which are causing cancers in human beings. The pH was determined with the help of digital pH meter with electrodes model No. 335, by standard methods.

The value of turbidity and total solids are also well within permissible limits. The colloidal material which exerts turbidity provides adsorption sites for chemicals that may be harmful or cause undesirable tastes and odours and for biological organisms that may be harmful. Disinfection of turbid waters is difficult because of the adsorptive characteristics of some colloids and because the solid may partially shield organisms from disinfectant. In natural water bodies, turbidity may impart a brown colour to water and may interfere with light penetration and photosynthetic reaction in streams and lakes. Total solids determination is used to assess the suitability of potential supply of water for various uses.

According to ISI, ICMR and WHO who have published the standards for the total hardness, that is, 300 mg/L (Permissible) and 500 mg/L (Excessive). The values of total hardness for able water samples fall within permissible limit. Hardness of water is important in determining the suitability of a water for domestic and industrial uses. Absolutely soft waters are tasteless. On the other hand, hardness up to 500 mg/L can be relished if got acclimatized to. More cases of cardiovascular diseases are reported in soft waters area. Hard water is useful for the growth of children's due to presence of Calcium. Magnesium hardness, particularly associated with sulphate ions has a laxative effects on persons unaccustomed to it. It makes food tasteless. It is also precipitate protein of meat and make tasteless.

The standards published for chlorides are 250 mg/L (Permissible) and 1000 mg/L (Excessive). Chlorides associated with sodium exerts salty taste, when its concentration is more than 250 mg/L. Although chlorides are not harmful as such, their concentration over 250 mg/L imparts a peculiar taste to the water, thus rendering the water unacceptable for drinking purposes from aesthetic point of view. The values of present study lies within limit. This was determined by standard chemical method.

Prescribed limit of sulphates in natural water is ranging from 200 mg/L to 400 mg/L. Excess Na_2SO_4 and $MgSO_4$ should not be present in drinking water as they cause cathartic action. This was determine by standard chemical method. Higher concentration of sodium sulphate in water can cause misfunctioning of the alimentary canal. So the recommended upper limit is 250 mg/L in waters intended for human consumption. In the present study, the values fall within limit.

Phosphates are not toxic and do not represent a direct health threat to human health or other organism. The also do not represent a serious indirect threat to water quality. Small quantity of phosphorous in surface waters is necessary for biological life, but excess of phosphorous promotes the abundant growth the nuisance algae (Eutrophication). The vales of phosphates are NIL for above water samples. This was determine with the help of spectrophotometer (Digital) systronic make (340 μm- 960 μm) Type 106 (sr. No. 3165), by standard chemical method.

A few minerals contribute nitrates to ground water. The most important source of nitrated is biological oxidation of nitrogenous substances which come in sewage, industrial wastes, chemical fertilizers, decayed vegetables, animal feedlots, leaches from refuse dumps, septic tank effluent, etc. This was determine with the help of spectrophotometer (Digital) Systronic make (340 μm- 960 μm) Type 106 (Sr. No. 3165), by standard chemical method.

Many ground water have significant quantities of nitrates due to leaching of the nitrate with percolating water. Ground water can also be contaminated by sewage, septic tank effluents and other waste rich in nitrate. High mount of nitrates in ground water is the indication of pollution of domestic waste water. Nitrate poisoning to infants, animals including humans can cause serious health hazards and even death. Apparently low acidity in an infants intestinal tract permits the growth of nitrate reducing bacteria that convert the nitrate to nitrite which is then absorbed in the blood stream. Nitrite has great affinity for hemoglobin than dose oxygen and this replaces oxygen in the blood complex. The body is denied essential oxygen and in extreme cases, the victim suffocates. The skin of infants is converted into blue colour due to absence of oxygen. Therfore, nitrate poisoning has been referred to as "BLUE BABY". The scientific word is 'methemoglobenemia'. This disease occurs in infants only when the concentration of nitrates exceeds 45 mg/L in drinking water.

The ISI, ICMR and WHO is an important in determining the suitability of water for domestic and industrial uses. Presence of large amount of fluoride is associated with dental and skeletal fluorsis (> 1.5 mg/L). This was determine with the help of spectrophotometer (Digital) Systronic make (340 μm-960 μm) Type 106 (sr. No. 3165), by standard chemical method.

Excess presence of iron in drinking water supplies is objectionable for a number of reasons :

Although iron has got little concern as a health hazard but is still considered as

a nuisance in excessive quantities. Long time consumption of drinking water with a high concentration of iron can lead to liver diseases (hemosiderosis).

Iron rich water exposed to the air, become turbid and highly unacceptable from the aesthetic view point due to oxidation of soluble iron to insoluble ferric oxide which settles out as rust coloured salt. Such water often tastes unpalatable even at low concentration (0.3 mg/L).

Water with high concentration of iron when used in the penetration of tea and coffee, then reaction with tannin gives a black inky appearance with metallic taste. Coffee may even become unpalatable at concentration of iron more than 1.0 mg/L.

The ISI, ICMR and WHO standards are 0.3 mg/L to 1.0 mg/L for drinking water and above water samples iron content is found well within limit.

The drinking water should be rich in dissolved oxygen (DO) for good taste and the values of DO are well within limit and found suitable for appropriate taste.

Oily and greasy material reported as NIL in all above water samples.

CONCLUSION

The water quality parameters were estimated through physico-chemical study. Physico-chemical study states that all drinking water quality parameters were found well within limit for all studied water samples prescribed by ISI, ICMR, & WHO.

From the results, it is evident that, the chemical parameters such as colour, taste, odour and turbidity and chemical parameters are well within suitable limits. Therefore the water from all Bore-wells is suitable for drinking as per specifications.

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