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Studies on Dissolved Minerals in Municipal Tap Water of Some Selected Areas of Tiptur Town,Tumkur District

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Abstract

Water is one of the most important of all natural resources known on the earth. 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. The Physico-Chemical analysis of drinking water quality of Tiptur town were studied by taking parameter like Temperature, P^H, Total dissolved solids, Salinity, Electrical Conductance, Total alkalinity, Total hardness, Calcium, Magnesium, Chloride, Dissolved Oxygen, Nitrate, Phosphate, Sulphate and Iron. The work was carried out during the period of one year from October 2014 to September 2015 in order to assess water quality. The results were compared with standards prescribed by BIS standard. The study revealed that parameters approach maximum limits of Standards.

Keywords: *Physico-Chemical parameters, Municipal tap water, Tiptur town, Drinking water quality.*

Introduction

The quality of water is vital concern for mankind since it is directly linked with human welfare. The present investigations involve the analysis of Physico-Chemical parameters of drinking water supply to the residents of Tiptur town and evaluate its suitability for drinking with respect to BIS guide lines. Unsafe drinking water accounts for mortality and susceptibility to water borne microbial infectious diseases due to improper management and environmental degradation. Poor quality of water effects badly the plant growth and human health (SubbaRao, 2005, WHO 1992, Karanth1997).

Water quality is a critical factor affecting human health and welfare. Water meant for drinking must therefore meet quality standards. Water quality is essentially described according to its Physical, Chemical and biological characteristics (Rafiullah Khan *et al.*, 2012). To assess that monitoring of these parameters is essential to identify magnitude and source of any pollution load.

The main aim of this study was to carryout different Physico-Chemical parameters of water samples collected from different locations of Tiptur town and to recommend whether it is suitable for drinking and domestic purpose.

Study Area

Tiptur town is about 75km from Tumkur district. It covers an area of 785sq km having $13^{o,}16'$ north latitude 76^{o},29' east longitude and an altitude of 850.30 meter above sea level. The average temperature ranges 11^{o} in winter and 38^{o} during summer. The average rain fall of Tiptur town is 503mm (Basavaraddi *et al.*, 2012).

Material and Methods

Water samples from fifteen sampling locations in Tiptur town were collected in two liter cleaned and dried polythene bottles regularly for every month with necessary precautions. All the chemicals used were of AR grade. Double distilled water is used for the preparation of reagents and solutions. The water quality parameters like Temperature, P^H, Total dissolved solids, Salinity, Electrical Conductance, Total alkalinity, Total hardness, Calcium, Magnesium, Chloride, Dissolved Oxygen, Nitrate, Phosphate, Sulphate and Iron were studied. Physical parameters were measured by using water analyzer kit at the spot. The water samples were immediately brought in to the laboratory. Chemical parameters were analyzed within 24 hrs in the laboratory by using standard methods as prescribed by APHA, AWWA, Trivedy and Goel (2006) and Kodarkar (1992). Some parameters like Phosphate, Sulphate, Nitrate and Iron were analyzed by using Spectrophotometer (EImake). The present study was carried out during the period from October 2014 to September 2015 for seasonal studies Table-2.

Result and Discussions

Temperature

Water temperature plays an important factor which influences the Chemical, Biochemical and Biological characteristics of water body. In the present study, water temperature ranged from a minimum of 24.7°C to a maximum of 26.2°c.

P^H

The term P^H is used to express the intensity of the acid or alkaline condition of a water sample. Biochemical and chemical reactions occurring in water are determined by P^H. In the present study, P^H values of water samples were varied from a minimum of 6.66 to a maximum of 7.77 and were found within prescribed limits of BIS (1991).

Total Dissolved Solids

The drinking water quality especially taste depends on the dissolved minerals and also inorganic substances(Trivedy and Goel; 2006). The water with high TDS value indicates that water is highly mineralized. High concentration may lead to kidney and heart diseases. In the present study, Total dissolved solids ranged from a minimum of 440mg/L to a maximum of 1478mg/L. According to BIS standards, the values must be less than 500mg/L for drinking water, but in unavoidable cases 1500mg/L are permissible (Shrinivasa Rao and Venkateswaralu, 2000). The TDS concentration is found to be above the permissible limit, this may be due to leaching of rock minerals and also excess inorganic compounds into the water which causes decrease in the portability. Excess TDS may cause gastro-intestinal irritation in human.

Salinity

The measure of the salt content of water is called Salinity. It is an important factor in determining many aspects of Chemistry of water and of biological process with in it. In the present study, Salinity of water samples were ranging between a minimum of 483ppm to a maximum of 1833ppm.

Electrical Conductivity

Electrical Conductivity is a measure of total salt content in water. It signifies the amount of total dissolved salts (Dahiya and Kaur,1999) and is a useful tool to evaluate the purity of water (Acharya et al.,2008). EC values were ranged from a minimum of 672µs/cm to a maximum of 2277µs/cm. High EC values were observed for four sampling points S_3,S_5 S_6 and S_9 indicating the presence of high amount of dissolved substances. The tolerance EC limit is 1500µs/cm according to BIS (1991) standard..

Total Alkalinity

Alkalinity of water is its capacity to neutralize a strong acid and it is normally due to the presence of bicarbonate, carbonate and hydroxide compound of Calcium, Sodium and Potassium. In the present study, the total alkalinity content ranged between a minimum of 190mg/L to a maximum of 433mg/L. Alkalinity in itself is not harmful to human being, but imparts an unpleasant taste.

Total Hardness

Hardness of water is mainly depends upon the amount of Calcium or Magnesium salts or both. The hardness values ranged between a minimum of 268mg/L to a maximum of 811mg/L. The samples S_5 , S_6, S_9, S_{10},S_{11}, S_{14} and S_{15} were exceeded the prescribed limit(600mg/L).BIS (1998). Water having hardness below 300mg/L is considered potable, but beyond this limits cause gastro-intestinal irritation. Normal water hardness does not pose any direct health problems, but higher concentration of hardness (above 600mg/L) may cause kidney problems.

Calcium and Magnesium

Calcium and Magnesium are directly related to hardness. Calcium plays a significant role in blood clotting, muscular contraction and in enzymes assisting in metabolic processes. Excess Calcium leads to the formation of kidney and gal bladder stones. Excessive Magnesium may give water a bitter taste, but is normally not a health hazard. Calcium and Magnesium are both essential minerals for living organisms. Magnesium concentration is generally lower than the Calcium concentration (Tamarkar Chirika Shora, 2014). In the present study, Calcium concentration is ranged from a minimum of 28.1mg/L to a maximum of 90.5mg/L. The tolerance range for Calcium hardness is 200mg/L. The values were below the permissible limit. The Magnesium concentration is ranged from a minimum of 16.4mg/L to a maximum of 47.7mg/L. The tolerance range for Magnesium hardness is 100mg/L and the values were below the permissible limit.

Chloride

Chloride ion concentration of water sample is known to depend upon the characteristics of sediments and the pollution load of the water body (*Shivanna et al.,2012).* Higher Chloride concentration is considered to be risky for human consumption and causes unpleasant taste of water. In the present study, Chloride concentration is ranged

from a minimum of 89.2mg/L to a maximum of 489.5mg/L. While the tolerance range is 250 to 1000mg/L. High Chloride content can cause high blood pressure in people. Chloride in excess imparts a salty taste to water and people who are not accustomed to high Chloride may be subjected to laxative effect. The samples S_5, S_6, S_9 and S_{14} have high Chloride content. High Chloride concentration is also an indicator of large amount of organic matter.

Dissolved Oxygen

Dissolved Oxygen is one of the important Chemical parameter to assess the quality of water. It is an important parameter in water quality assessment and reflects the Physical and Biological processes prevailing in the water. It is a remarkable indicator of pollution *(* Basavaraddi *et al., 2012*). The unpolluted water is normally saturate with DO, presence of Oxygen demanding pollutants causes rapid depletion of DO. The DO value ranged from a minimum of 8.96mg/L to a maximum of 11.4mg/L. DO values were found to be above the standard values prescribed by both WHO and BIS.

Nitrate

The concentration of nitrate in water samples depends on the nitrification activities of micro-organisms. Nitrate-Nitrogen is one of the major constituents of organism along with carbon and hydrogen as amino acids, proteins and organic compounds in water samples. The nitrate content in water samples is ranged from a minimum of 13.7mg/L to a maximum of 30.2mg/L. The tolerance range for nitrate is 45mg/L (APHA, 2006) and the values were found well within the prescribed limit.

Phosphate

Phosphate content in the study area is ranged from a minimum of 0.029mg/L to a maximum of 0.07mg/L. The tolerance range for Phosphate is 0.50mg/L and the present values were found within the prescribed limit.

Sulphate

The sulphate content is ranged from a minimum of 29.9mg/L to a maximum of 112mg/L. The tolerance range for sulphate is 200mg/L to 400mg/L and the values were found within the prescribed limit. High concentration of sulphate has laxative effect and cathartic effects.

Iron

Iron is one of the most abundant elements in nature. All kinds of water, including ground water have appreciable quantities of Iron. The shortage of iron causes a disease called anemia and continues consumption of drinking water with high concentration of iron for a long time can lead to liver disease called as haemosiderosis (Basavaraddi *et al.*, 2015). The Iron content in the study area is ranged from a minimum of 0.11mg/L to a maximum of 0.22mg/L and the values were found within the prescribed limit (1mg/L).

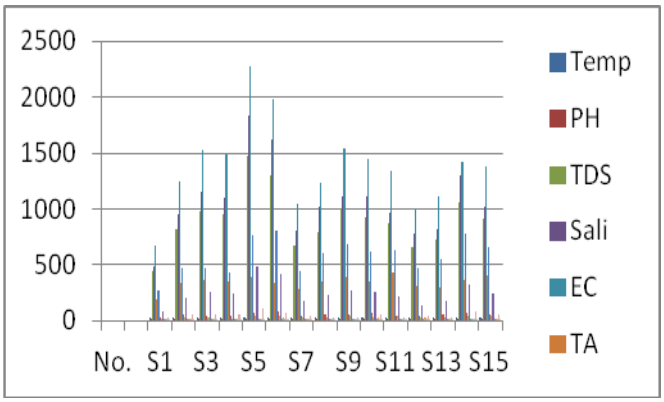
Table -1 Sampling Locations in Tiptur town

Sample No.	Sample station	Location
S1	Gandhinagara	Near Ramamandira temple
S2	Market yard	Near Raitha bhavana
S3	Kote	Behind Basaveshwara temple
S4	Doddapeti	Opposite to jewellary shop
S5	Halepalya	Near the temple
S6	Annapura	Near the School
S7	Manjunathanagara	Centre of the area
S8	K. R .Extention	Near the public park
S9	Shankarappa layout	First main road
S10	Govinapura	Public pump house
S11	Shadakshari badavane	Fourth cross
S12	Kenchagatta	Near the primary School
S13	Vidyanagara	Near the samudhaya bhavana
S14	Maranagere	Main road
S15	Vinayakanagara	Near the School

Average results of Physico- Chemical parameters during the period 2014-2015

No.	Temp t°c	P^H	TDS mg/l	Salinity	EC µs/cm	TA mg/l	TH mg/l	Ca^{++} mg/l	Mg^{++} mg/l	Cl^- mg/l	DO mg/l	NO_3 mg/l	PO_4 mg/l	SO_4 mg/l	Fe mg/l
S1	25.0	7.51	440	483	672	190	268	28.1	16.4	89.2	10.6	13.7	0.029	29.9	0.17
S2	24.9	7.29	815	950	1245	335	467	57.1	26.8	204	10.6	19.1	0.070	56.6	0.16
S3	24.8	6.89	978	1150	1522	365	472	45.6	29.3	253	10.0	24.1	0.031	62.6	0.16
S4	24.9	6.84	950	1100	1487	345	433	48.8	23.0	245	11.1	19.6	0.041	63.8	0.20
S5	25.2	7.29	1478	1833	2277	393	759	73.7	42.6	489.5	9.5	17.5	0.049	112	0.15
S6	25.7	7.40	1295	1616	1975	333	811	90.5	43.5	416	10.3	30.2	0.042	77.3	0.16
S7	26.1	7.77	678	800	1047	283	450	38.8	28.4	174.4	10.0	15.4	0.036	42.3	0.18
S8	24.7	6.82	795	1016	1230	347	599	53.1	34.6	233.9	11.1	17.4	0.035	36.8	0.18
S9	25.4	6.66	1006	1116	1537	395	686	54.9	46.9	277.6	10.8	16.9	0.047	36.1	0.14
S10	25.7	7.06	923	1116	1440	348	612	64.8	34.9	252	8.96	25.6	0.030	56.5	0.19
S11	25.7	6.70	875	966	1340	433	633	49.8	47.7	213.6	9.4	19.5	0.055	30.6	0.16
S12	26.2	6.95	660	783	995	317	478	45.0	29.9	136	10.5	24.8	0.034	41.8	0.11
S13	25.4	6.89	723	817	1113	302	555	56.5	33.2	180.7	11.4	19.6	0.034	31.2	0.15
S14	24.7	7.06	1053	1300	1423	368	781	73.9	47.1	328.5	9.7	19.1	0.032	80.2	0.22
S15	25.4	6.94	906	1016	1375	400	652	64.1	45.9	247	11.1	19.6	0.048	61.0	0.19

Graph showing variation of parameters during the period 2014-2015



Conclusions

1. Present study revealed that 60% of the samples showed TDS above permissible level of BIS standard.
2.In present study 50% of the samples slightly acidic.
3. EC values showed more dissolved minerals. Regular consumption may lead to health Hazards . Simply boiling and filtering and treatment of water is necessary before drinking.
4.Rest of the parameter under investigation were well within the BIS standards.
5. Municipal authorities must take precautionary measures.

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