CHEMICAL ANALYSIS OF TAP WATER OF SURROUNDINGS OF CUTTACK TOWN

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Physico Chemical studies of the tap water of Cuttack Town were conducted during the season of 2016 March. Water samples were collected from four sampling stations and then twenty parameters like temperature, pH, turbidity, electrical conductivity, chloride ion concentration, total alkalinity and hardness, dissolved oxygen, BOD, COD, phosphate & fluoride ion concentration, Nitrate & Nitrite ion concentration. Iron, Zinc, Copper, Manganese ion, total dissolved solid and total coliform concentration were measured. The values of these parameters show that the drinking water quality of Cuttack Town is becoming polluted due to untreated industrial and sewage water discharge which can be controlled by adopting standard methods for water treatment.

INTRODUCTION

Water is one of the most essential constituents of the environment. It is the primary need of all vital life processes. Its pollution has become a global problem and several studies have been made from time to time [1-13] but still with increasing population this problem is also increasing. Industries located off the river and coast are disposing effluents of land and are causing threat to ground water pollution.

The natural and man made factors are responsible for water pollution, *viz*., sewage, sludge, solid wastes, industrial wastes etc. produce many toxic chemicals, hazardous compounds, phenols, aldehydes, ketones, amines, cyanides, metallic wastes, toxic acids corrosive alkalies, oils, greases, dyes, biocides, suspended solids etc. from numerous locations and industries. The physico chemical parameters are disturbed due to introduction of several inorganic ions such as phosphate, chloride, fluoride, nitrate etc. Apart from these ions, introduction of several other inorganic and organic wastes disturb the quality of water, *i.e.*, conductivity, hardness, alkalinity, dissolved oxygen, chemical & biochemical oxygen demand, total coliform and total dissolved solid, etc. increase in the concentrations of these parameters beyond permissible limit pose several pollution problems.

Our present study is aimed at to monitor the overall pollution status of drinking water of Cuttack town with special emphasis on physico chemical parameters. An attempt has been made to determine the suitability of tap water for drinking purpose and identify the origin of various pollutants including heavy metals and coliform tap water. A systematic physicochemical investigation contains the initial phase of scientifically managing water resources of sampling stations.

The present research study has been undertaken for tap water of Cuttack district to generate a case study in our state.

MATERIAL AND METHODS

In the present investigation, drinking water samples were collected from the monitoring points of Cuttack town. The samples were collected according to standard method of collecting samples at international level, *i.e.*, APHA & BIS procedure. Water samples were collected from five stations, *i.e.*, from Station I, Station II, Station III, Station IV and Station V in the year 2016 March.

Following Table (Table I) gives an information about the physico-chemical characteristics of drinking water standards as prescribed by WHO (World Health Organisation) & ICMR (Indian Council of Medical Research)

Table 1. Drinking Water Standards

	Characteristics		**Tolerance limits recommended by**	
		Unit	**W.H.O.(b)**	**I.C.M.R.(a)**
1.	Temperature	^{o}C	-	-
2.	pH		6.5 to 8.5	7.0 to 8.5
3.	Turbidity	NTU	5	25
4.	Specific conductivity (at $25^{o}C$)	mhos/	-	-
5.	Chloride	mg/L	200	1000
6.	Fluoride	mg/L	1	1.50
7.	Alkalinity	mg/L	-	-
8.	Total Hardness as $CaCO_3$	mg/L	300	600
9.	Calcium Hardness	mg/L	200	600
10.	Magnesium Hardness	mg/L	100	-
11.	Dissolved Oxygen	mg/L	6.0	8.5
12.	Biochemical Oxygen Demand	mg/L	2.5	3
13.	Total coliform	MPN	100	100
14.	Total dissolved solid	mg/L	500	500

(a) Objectionable, (b) Maximum allowable concentration.

Ref: WHO Recommendation (1984), Indian Council of Medical Research (1984).

EXPERIMENTAL

1. **Temperature** : Temperature of the underground water was recorded at the time of collecting the samples.

2. **Turbidity** : It was determined by using Naphelo-Turbidity-Meter.

3. **pH** : It was determined with the help of portable pH-meter previously caliberated by buffer solution of 4.0 & 92 pH.

4. **Electrical Conductivity** : It was measured with the help of conductivity meter.

5. **Total Alkalinity** : Total alkalinity was measured by the summation of both phenolphthalein alkalinity (8.2 pH) and methyl orange alkalinity (4.5 pH).

6. Total Hardness : The metallic cations other than those of alkali-metals when expressed as equivalent to CaCO$_3$ represent the total hardness.

7. Calcium Hardness : It was measured by EDTA titration method.

8. Magnesium Hardness : It was measured by the following formula:

Mg Hardness as mg CaCO$_3$/lit

= Total Hardness as mg CaCO$_3$/lit. – Ca hardness as mg CaCO$_3$/lit.

9. DO : Dissolved oxygen acts as an index for the suitability of water was regards of life. It was determined by the process of Azide modification Wrinkler's method.

10. B.O.D. : Biochemical oxygen demand represents the amount of oxygen required to oxidize the biodegradable fraction of total organic matter in a water body. It is a good indicator of organic pollution. It was determined by dilution and incubation method.

11. C.O.D. : Chemical oxygen demand is a measure of oxygen consumed by strong chemical oxidant while oxidising the available organic matter. It was determined by the help of COD digestor.

12. Chloride Detection : It was estimated according to Mohr's method.

13. Fluoride : The basis source of fluoride are mineral deposits. Fluoride evaluation was done by Ion-Selective-Electrode using an Ion-Analyser.

14. Zinc : It was measured by the Zircon method.

15. Manganese : It was measured by Persulphate method.

16. Other inorganic ions such as Phosphate, Nitrate, Nitrite were detected by the help of different reagents and spectrophotometer.

OBSERVATIONS

In our study of nature of water during March 2016 following observations were noticed (Table 2).

RESULTS AND DISCUSSION

1. At all the four sampling stations, the fluoride ion concentra- tion was found to be below the prescribed limit of 0.5 mg/L, hence it may cause dental carries if taken upthrough by drinking water.

2. BOD, which gives an idea of pollution due to domestic wastes, was found to be higher than the prescribed limits (*i.e.*, 2.5 mg/L).

3. The desirable limit of COD is 10 mg/L in drinking water, but in the present study, the values of COD are higher than BOD values which indicate organic pollution in the underground water. It is probably due to the dissolved chemicals present at the surface.

4. Higher concentration of chloride indicates pollution due to industrial effluents.

5. In accordance with EC total dissolved solid value also varied from 1645 mg/L to 2340 mg/L. The desirable limit of T.D.S in drinking water according to Bureau of Indian standard is 500 mg/L. Excess quantity of T.D.S leads to wide spread gastric disorders and jaundice.

Table 2.   Physico-Chemical Analysis of Municipal Tap Water during December 2015 to March 2016.

Parameter	Unit	Ranihat Station-I	Zobra Station-II	Buxi Bazar Station-III	Chandini Chowk Station-IV	C.D.A Sector-6 Station-V
Temp.	^oC	32.3	22.9	32.8	22.4	23
Turbidity	NTU	5	5	6	8	7
pH	–	7.3	7.3	7.4	7.4	7.5
El.Conductivity	Mhos/cm	183	167	158	169	155
Chloride	mg/L	188	210	205	190	201
Total alkalinity	mg/L	350	430	405	380	421
Total Hardness	mg/L	275	320	324	298	310
Ca.Hardness	mg/L	190	214	206	198	212
Mg.Hardness	mg/L	110	129	]94	87	108
DO	mg/L	4.56	5.59	5.48	3.94	5.4
BOD	mg/L	3.74	3.65	9.65	9.00	7.8
COD	mg/L	13.6	15.8	18.8	14.7	16.4
Phosphate	mg/L	0.28	0.27	0.27	0.29	0.23
Nitrate	mg/L	13.0	1.24	1.39	2.75	10.2
Nitrite	mg/L	0.018	0.025	0.025	0.006	0.01
Iron	mg/L	0.339	0.206	0.116	0.334	0.32
Fluoride	mg/L	0.205	0.195	0.195	0.291	0.21
Copper	mg/L	0.061	0.073	0.073	0.150	0.08
Zinc	mg/L	0.28	0.18	0.18	0.34	0.29
Manganese	mg/L	0.195	1.31	1.32	1.33	1.20
Total dissolved solid	mg/L	1645	1706	1685	2340	2280
Total coliform	MPN/100 ml	1750	1800	1570	1680	1750

6.   M.P.N count of coliform in the water sample collected from taps in different localities shows higher value of MPN (1570-1800 MPN). The acceptable limit of MPN/100 ml should remain within 100 as stated by Indian standard.

The probable reason of high bacterial load (coliform) in these tap water might be their location in close proximity to septic tank or junked pipe coliform bacteria will cause illness and jaundice. However their presence in drinking water indicates that disease causing pathogens could be present in water system.

The values of the other parameters calculated as given in Table-2.

Hence these results indicate that drinking water quality of Cuttack town is becoming polluted due to untreated industrial and sewage water discharge.

Suggestions

1. People should be made aware.

2. District authorities should repair the broken pipelines as soon as possible.

3. Better water management by the Govt. of Community can help in onserving water.

4. Through strict implementation of the Govt's water treatment programme water can be rendered safe for drinking.

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