



PHYSICO CHEMICAL PROPERTIES AND HEAVY METAL CONTENT OF WATER COLLECTED FROM IBRAHIMPATNAM NEARBY VTPS-VIJAYAWADA

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ABSTRACT

VTPS is one of the major sources for electricity to Andhra Pradesh state. It was located in Kondapalli village in Vijayawada-Hyderabad National Highway. Approximately 13 villages are there around of VTPS. In VTPS electricity is produced by rotating of turbines with steam of Krishna river water. Present paper deals with the impact of pollution on ground water at Ibrahimpatnam nearby VTPS. During investigation ground water is collected from 6 different locations of Ibrahimpatnam to evaluate physicochemical parameters such as pH, Alkalinity, DO, BOD, COD, Chloride, Electrical conductance, Nitrate, Phosphate and heavy metals. The investigation reveals that the six locations have an impact by VTPS effluents on Ground water.

KEYWORDS: DO, BOD, COD, Electrical conductance



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INTRODUCTION

Dr Narla Tata Rao Thermal Power Plant is also known Vijayawada Thermal Power Plant. It was developed under 4 stages, with the project cost of Rs 193 Cores and Rs 511 Cores respectively. The station stood first in country during 94-95, 95-96, 96-97, 97-98 and 2001-02 by achieving the highest plant load factor. VTPS is one of the major sources for electricity to the Andhra Pradesh state. It was located in Kondapalli village in Vijayawada-Hyderabad National Highway. Approximately 13 villages are there around of VTPS. In VTPS electricity is produced by rotating of turbines with steam of Krishna river water. In this process water was steaming by burning of Coal in huge amount. In continuous process so many bi products are causing environment (Air, water, Soil) pollution. The quality of water is vital

concern for mankind since it is directly linked with human welfare. So monitoring the quality of water is necessary for drinking water management [1]. By considering these aspects, the present study was undertaken to investigate the impact of VTPS effluents on the groundwater quality at Ibrahimpatnam (IB) of Krishna district, A.P, India. In this study, we examine the Physico chemical parameters of drinking water and VTPS pollution impact on ground water in villages which are nearby VTPS.

Study Area

In this study (Monsoon-2013, Winter-2014, Summer-2014) 6 samples were collected from Ibrahimpatnam village (IB) in 3 seasons. The sampling locations are given in Table 1.

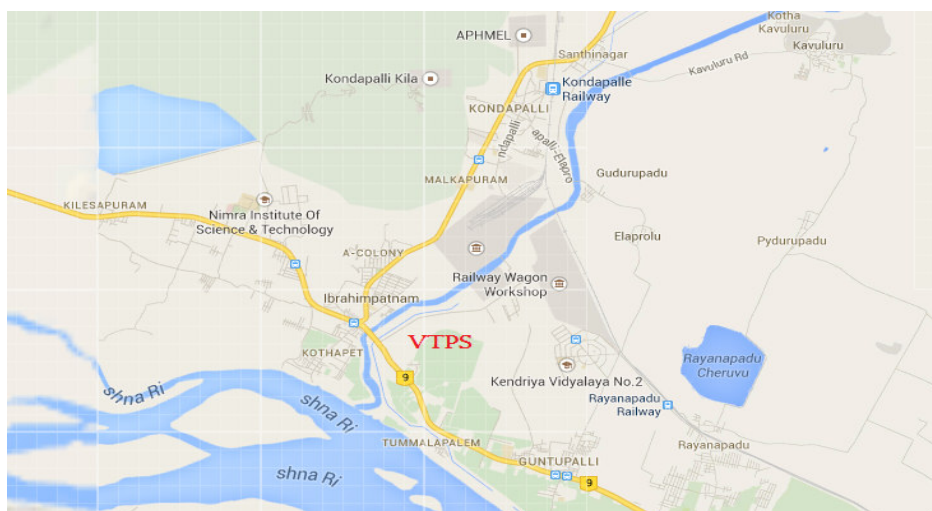


Image 1

Location of VTPS nearby National Highway-9 and Krishna River

Table 1
sampling location Ibrahimpatnam GPS data

S.NO	Code	longitude	latitude
1	IB-1	80° 31'62E	16° 35' 6.61N
2	IB-2	80° 31'2.33E	16° 35' 6.48N
3	IB-3	80° 31'25.61E	16° 35' 24.39N
4	IB-4	80° 31' 32.36E	16° 35' 26.38N
5	IB-5	80° 31'35.77E	16° 35' 43.65N
6	IB-6	80° 31' 33.79E	16° 35' 46.85N

MATERIALS AND METHODS

Sample collection

The water samples are collected in clean glass bottles from 6 different sites in Ibrahimpatnam for quality studies during the three seasons. The bottles are thoroughly rinsed with the sample water and then the samples were collected. While collecting the samples, the glass bottles were filled completely

without leaving any space for aeration as per the requirement [2-6]. The required chemicals are purchased of analytical grade from local vender in Vijayawada. The list of Equipment for this study is shown in Table 2. Water samples are analyzed followed by standard methods. Drinking water permissible and required parameters and list of methods are given in Table 3.

Table 2
List of Equipment

S.NO	Instrument	Make and Model number
1	pH Meter	Elico
2	Electrical Conductivity Meter	Elico
3	U.V-Visible Spectrophotometer	Tech comp, 2301,Hitachi software
4	Ion Selective Electrode Meter	Elico
5	Atomic Absorption Spectrometer	LABINDIA-7000
6	Electrical Balance	Denver-A200DS
7	Flame photometer	Electronics India- 1385

Table 3
Drinking water permissible and required parameters &List of methods

Test Parameter(s)	Test Method	Requirement acceptable Limit as per IS:10500: 2012	Permissible Limit in the absence of Alternative source as per IS 10500:2012
pH	4500. H ⁺ .B	6.5 to 8.5	No relaxation
Color	2120. B	5	15
Odor	2150. B	Agreeable	Agreeable
Electrical Conductivity	2510-B		
Total Dissolved Solids at 180°C	2540. C	500	2000
Turbidity	2130. B	1	5
Total Hardness as CaCO ₃	2340. C	200	600
Calcium as Ca	3500. Ca.B	75	200
Magnesium as Mg	3500. Mg.B	30	100
Total Alkalinity as CaCO ₃	2320. B	200	600
Chlorides as Cl ⁻	4500. Cl ⁻ .B	250	1000
Sulphates as SO ₄ ²⁻	4500. SO ₄ ²⁻ .E	200	400
Chemical Oxygen Demand	5220. B	-	-
Biochemical Oxygen Demand	IS: 3025	-	-
Dissolved Oxygen	4500. O.C		
Fluoride as F ⁻	4500. F ⁻ .C	1	1.5
Nitrates as NO ₃ ⁻	4500. NO ₃ ⁻ .B	45	No relaxation
Sodium as Na	3500-Na.B		
Potassium as K	3500-K.B		
Cadmium as Cd	APHA 3111B/3030E	0.003	No relaxation
Mercury as Hg	APHA 3111B/3030E	0.001	No relaxation
Arsenic as As	APHA 3111D/3030E	0.07	No relaxation
Lead as pb	APHA 3111B/3030E	0.01	No relaxation
Total Chromium as Cr	APHA 3111B/3030E	0.05	No relaxation
Iron as Fe	APHA 3111B/3030E	0.3	No relaxation
Manganese as Mn	APHA 3111B/3030E	0.1	0.3
Copper as Cu	APHA 3111B/3030E	0.05	1.5

RESULTS AND DISCUSSION

The physicochemical qualities of the ground water samples of Ibrahimpatnam are investigated and the levels of metal ions are estimated. The obtained results are compared with IS 10500:2012 drinking water standards. The IS 10500:2012 drinking water standards^[7] are given in Table 3. The concentrations of the most significant parameters in the various seasons are shown in Table 4, 5 and 6. pH In 2013 monsoon IB 5 only has higher pH (i.e 7.9) than other locations. In winter 2014 IB 5 has higher pH Value (i.e 8.2) than the other locations. In summer 2014 IB.4, IB.5, IB.6 samples have more pH i.e 7.8, 8.3, 7.9 respectively. It may be due to high temperature in summer^[8]. Hence microbial decomposition of organic matter in the water body may be caused because of higher pH values^[9]. But in the present investigation all the samples have pH values are with in the permissible limits.

Total hardness

The hardness of water samples collected from the study area ranged from 315-470 mg/L (monsoon), 329-531 mg/L (winter) and 344-557 mg/L (summer) and found to be above the acceptable limit as per IS:10500: 2012. All the samples collected from the study area are hard and hence require proper treatment before use.

Alkalinity

It constitutes an important parameter in determining the quality of water. A variation in alkalinity values are recorded as a maximum of 513 mg CaCO₃/L at IB-3 in summer, minimum of 280 mg CaCO₃/L (Jan) at IB-2. No significant variation was noticed among the values of other seasons. Furthermore the total alkalinity is significantly below the reasonable limit (600 mg/l) as per WHO^[10].

Dissolved Oxygen (DO)

Temperature plays an important role in determining DO in an aquatic body. Dissolved oxygen data are valuable in determining the water quality criteria of an aquatic system in which rate of respiration and organic

decomposition are high. The DO values remain lower than those of system where the rate of photosynthesis is high. A high pollution load may also decrease the DO values to considerable level. The DO values range from a minimum of 4.0mg/L (Monsoon) at IB-3, IB-6 to maximum of 5.1mg/L (summer) at IB 4.

Chloride

Chloride is one of the major inorganic anion in water^[10-11] and is widely distributed in the environment. It is present in water, soil, rock, and many foods. Chloride is found naturally in groundwater through the weathering and leaching of sedimentary rocks, soils, the dissolution of salt deposits and leachate from dumps or landfills. The chloride shows variation with a range of 699mg/l (summer) at IB-3 to 410mg/L (Monsoon) at IB-2. The Chloride values remain higher in summer season. The higher values are found in IB-3 than other five places.

Electrical conductance (EC)

Electrical conductance is reciprocal to electrical resistance and EC values show total ion per cm. It is numerical expression of the ability of water sample to carry an electric current. Higher electrical conductivity affected the germination of crops and it results in reduced yield^[11]. The value ranged from maximum of 2586 μmos/cm (summer) at IB-5 to minimum of 1520 μmos/cm (monsoon) at IB-1. The lower values are found in IB-1 in monsoon season.

Chemical Oxygen Demand (COD) and Biochemical Oxygen Demand (BOD)

COD analysis is a measurement of the oxygen-depletion capacity of a water sample contaminated with organic waste matter. Specifically, it measures the equivalent amount of oxygen required to chemically oxidize organic compounds in water. BOD, also often referred to as biological oxygen demand, is a test performed to measure the potential of wastewater and other waters to deplete the oxygen level of receiving waters. The COD values of all the collected samples are <5 mg/l except in IB-4(9.8 mg/l) in all 3 seasons. The BOD values are found below the detectable limit in all 3 seasons.

Fluoride

Fluorine, a naturally occurring element never exists in its elemental state in nature because it is the most reactive non-metal. So it occurs in environment in combination with other elements, except oxygen and noble gases, including fluorspar, rock phosphate, cryolite, apatite, mica, hornblende and others [12]. Drinking-water is typically the largest single contributor to daily fluoride intake. However, this is not necessarily true in every case [13-16]. The fluoride content of groundwater generally ranges from 20 to 1,500 $\mu\text{g L}^{-1}$ [17, 18]. In many countries potable water contains high levels of fluoride. From the past 15 years ground water study results showing Fluoride presence in ground water throughout Krishna river belt. The

present study area is located nearby Krishna River. The radius of study area from river is approximately 1-1.5 KM. The higher fluoride values found to be 2.7 mg/ml at IB-4 in Monsoon. Most of the samples showed positive for fluoride.

Heavy metals

Lead is found in all the samples except IB-4 in monsoon and below detectable limit in other two seasons. Cr is found in monsoon and winter at IB-2, IB-5 only. Remaining heavy metals like As, Hg, Cd, etc are below detectable limit. The presence of Lead and chromium are because of Coal burning for a very long period of time in VTPS and small scale industries around the Ibrahimpatnam.

Table 4
Physico and chemical parameters of Ibrahimpatnam nearby VTPS-Vijayawada in Monsoon-2013

Test Parameter(s)	Unit	RESULTS					
		IB-1	IB-2	IB-3	IB-4	IB-5	IB-6
pH	--	7.1	7.1	7.3	7.5	7.9	7.45
Color	Pt.Co	<5	<4	<5	<5	<5	<5
Odor	TON	No Odor is observed	No Odor is observed	No Odor is observed	No Odor is observed	No Odor is observed	No Odor is observed
Electrical Conductivity	$\mu\text{mhos/cm}$	1520	2220	2100	1990	2010	1850
Total Dissolved Solids at 180°C	mg/L	1200	1375	1050	1126	1470	1200
Turbidity	NTU	3.20	4.20	2.50	2.10	3.50	2.80
Total Hardness as CaCO ₃	mg/L	470	420	410	400	315	410
Calcium as Ca	mg/L	115	90	100	85	85	90
Magnesium as Mg	mg/L	60	45	40	45	40	40
Total Alkalinity as CaCO ₃	mg/L	320	280	370	340	320	360
Chlorides as Cl ⁻	mg/L	420	410	590	480	520	510
Sulphates as SO ₄	mg/L	330	315	330	345	320	360
Chemical Oxygen Demand	mg/L	<5	<5	<5	9.9	<5	<5
Biochemical Oxygen Demand	mg/L	BDL	BDL	BDL	BDL	BDL	BDL
Dissolved Oxygen	mg/L	4.1	4.2	4.0	4.1	4.2	4.0
Fluoride as F ⁻	mg/L	1.5	1.9	2.3	2.7	1.0	0.8
Nitrates as NO ₃ ⁻	mg/L	58.4	42.9	49.6	87.2	66.3	40.8
Sodium as Na	mg/L	90	88	101	104	87	87
Potassium as K	mg/L	6	7	4	6	7	6
Cadmium as Cd	mg/L	BDL	BDL	BDL	BDL	BDL	BDL
Mercury as Hg	mg/L	BDL	BDL	BDL	BDL	BDL	BDL
Arsenic as As	mg/L	BDL	BDL	BDL	BDL	BDL	BDL
Lead as pb	Mg/L	0.06	0.06	0.04	BDL	0.02	0.05
Total Chromium as Cr	mg/L	BDL	0.05	BDL	BDL	0.05	BDL
Iron as Fe	mg/L	0.55	0.39	0.35	0.42	0.40	0.40
Manganese as Mn	mg/L	0.10	0.10	BDL	0.01	BDL	BDL
Copper as Cu	mg/L	0.02	0.01	BDL	0.02	0.04	BDL

Table 5
Physico and chemical parameters of Ibrahimpattam nearby
VTPS-Vijayawada in Winter-2014

Test Parameter(s)	Unit	RESULTS					
		IB-1	IB-2	IB-3	IB-4	IB-5	IB-6
pH	--	7.3	7.2	7.5	7.7	8.2	7.5
Color	Pt.Co	<5	<4	<5	<5	<5	<5
Odor	TON	No Odor is observed	No Odor is observed	No Odor is observed	No Odor is observed	No Odor is observed	No Odor is observed
Electrical Conductivity	µmos/cm	1800	2450	2340	2220	2440	2000
Total Dissolved Solids at 180°C	mg/L	1450	1625	1250	1358	1550	1360
Turbidity	NTU	3.20	4.22	3.07	2.12	4.12	3.13
Total Hardness as CaCO ₃	mg/L	331	458	462	445	329	430
Calcium as Ca	mg/L	127	102	128	94	99	101
Magnesium as Mg	mg/L	68	59	45	52	49	46
Total Alkalinity as CaCO ₃	mg/L	346	323	331	377	401	399
Chlorides as Cl ⁻	mg/L	453	445	645	498	546	539
Sulphates as SO ₄	mg/L	367	331	359	391	397	388
Chemical Oxygen Demand	mg/L	<5	<5	<5	9.9	<5	<5
Biochemical Oxygen Demand	mg/L	BDL	BDL	BDL	BDL	BDL	BDL
Dissolved Oxygen	mg/L	4.0	4.3	4.1	4.3	4.3	4.2
Fluoride as F ⁻	mg/L	1.36	1.43	1.44	1.35	1.43	1.45
Nitrates as NO ₃ ⁻	mg/L	45	46	48	49	48	50
Sodium as Na	mg/L	90	88	101	104	87	87
Potassium as K	mg/L	6	7	4	6	7	6
Cadmium as Cd	mg/L	BDL	BDL	BDL	BDL	BDL	BDL
Mercury as Hg	mg/L	BDL	BDL	BDL	BDL	BDL	BDL
Arsenic as As	mg/L	BDL	BDL	BDL	BDL	BDL	BDL
Lead as pb	Mg/L	BDL	BDL	BDL	BDL	BDL	BDL
Total Chromium as Cr	mg/L	BDL	0.05	BDL	BDL	0.05	BDL
Iron as Fe	mg/L	0.41	0.42	0.37	0.45	0.43	0.44
Manganese as Mn	mg/L	0.12	0.13	BDL	BDL	BDL	BDL
Copper as Cu	mg/L	0.05	0.05	BDL	BDL	0.05	BDL

Table 6
Physico and chemical parameters of Ibrahimpattam nearby
VTPS-Vijayawada in Summer-2014

Test Parameter(s)	Unit	RESULTS					
		IB-1	IB-2	IB-3	IB-4	IB-5	IB-6
pH	--	7.6	7.4	7.7	7.8	8.3	7.9
Color	Pt.Co	<	<5	<6	<5	<5	<5
Odor	TON	No Odor is observed	No Odor is observed	No Odor is observed	No Odor is observed	No Odor is observed	No Odor is observed
Electrical Conductivity	µmos/cm	1972	2621	2404	2297	2386	2233
Total Dissolved Solids at 180°C	mg/L	1510	1691	1404	1500	1603	1312
Turbidity	NTU	4.47	4.29	3.87	2.68	4.56	3.93
Total Hardness as CaCO ₃	mg/L	557	478	491	459	344	453
Calcium as Ca	mg/L	134	112	135	103	110	109
Magnesium as Mg	mg/L	77	63	83	64	58	81
Total Alkalinity as CaCO ₃	mg/L	432	457	513	399	463	448
Chlorides as Cl-	mg/L	528	563	699	568	631	597
Sulphates as SO ₄	mg/L	373	335	361	396	393	394
Chemical Oxygen Demand	mg/L	<5	<5	<5	9.9	<5	<5
Biochemical Oxygen Demand	mg/L	BDL	BDL	BDL	BDL	BDL	BDL
Dissolved Oxygen	mg/L	4.6	4.7	4.4	5.1	4.9	4.8
Fluoride as F-	mg/L	1.39	1.44	1.45	1.37	1.45	1.46
Nitrates as NO ₃ -	mg/L	60	51	54	62	56	58
Sodium as Na	mg/L	99	96	110	116	98	100
Potassium as K	mg/L	8.9	8.3	7	7.4	6.9	8
Cadmium as Cd	mg/L	BDL	BDL	BDL	BDL	BDL	BDL
Mercury as Hg	mg/L	BDL	BDL	BDL	BDL	BDL	BDL
Arsenic as As	mg/L	BDL	BDL	BDL	BDL	BDL	BDL
Lead as pb	Mg/L	BDL	BDL	BDL	BDL	BDL	BDL
Total Chromium as Cr	mg/L	0.06	BDL	BDL	0.00	0.05	BDL
Iron as Fe	mg/L	0.46	0.38	0.60	0.54	0.49	0.62
Manganese as Mn	mg/L	0.18	BDL	BDL	0.21	BDL	BDL
Copper as Cu	mg/L	BDL	0.18	BDL	BDL	0.24	BDL

CONCLUSION

From this study, we concluded that, the Ibrahimpattam ground water showing higher values for all parameters in all seasons. In very few places physico and chemical parameters are of ground water of IB are within limits. We identified that all the villagers are drinking mineral water, which are providing by private sectors. No one using ground water for drinking purpose. They are using for washing and other utilizations. The final result of this

study concluding that the six locations of ground water is not useful for drinking purpose.

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