Available online www.jocpr.com

Journal of Chemical and Pharmaceutical Research, 2014, 6(7):1856-1860

Research Article

ISSN : 0975-7384
CODEN(USA) : JCPRC5

Quality assessment of surface and ground water around thermal power plants at Warora district, Chandrapur(MS)

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ABSTRACT

Warora is developing city since last five years due to industrialization. Some thermal power stations such as Wardha Power Company Limited, G.M.R. are established and some new projects are going to establish. Industrial boom caused rapid growth of population and pollution which brought enormous problem and degradation of the environment. In order to evaluate the quality of water in study area and its suitability for domestic purposes Twelve water samples from different places around thermal power plants Warora were collected in summer and analyze for different physico-chemical parameters such as temperature, conductivity, pH, TDS ,turbidity, chloride, total alkalinity, hardness, calcium, magnesium, sulphate, and iron. The analysis of various parameters carried out using standard methods (APHA/NEERI) and then compared with the standard guideline values recommended by the BIS (1991). The results suggest that most of the parameters are beyond the permissible limits. Present study has been carried out to assess the contamination of water sources in surrounding villages closer to thermal power plant in Warora. Dist-Chandrapur.

Key words: Surface Water, Ground Water, Physico-Chemical Parameters, Thermal Power Plants, Warora.

INTRODUCTION

In recent years the global energy demand has increased with the advances in industrialization and this has been largely met by fossil fuels. Coal meets 29.6% of global primary energy needs and its share in the worlds electricity generation is about 42% **[1]**. Coal combustion in thermal power plant contributes to 52.32% of total electricity generation in India**[2]**. Conventional generation of electricity from fossil fuels based sources like coal results in serious environmental problems reaching local and global implications.

Major environmental problems associated with the use of coal in thermal power plant are likely contamination of air, water and land environment affecting the livelihood of the local people.

The Warora town is located in eastern Maharashtra at 20.23°N 79.0°E. It is a city & municipal council in Chandrapur district in the state of Maharashtra. During British Raj, the town was a part of central provinces and was coal mining centre**[3]**. Near to Warora, a charity trust for leprosy treatment well known as 'Anandwan' is established by late Shri. Baba Amte & Sadhanatai Amte. Warora is developing city since last five years due to industrialization. A coal based thermal power project like Wardha Power Company Limited (with installed capacity of 540 MW) & GMR (With installed capacity of 600 MW) are setup at Warora. Wardha Power Plant achieved commercial operation from 2011. Wardha River flows nearly 4 km from these power plants. The water for condenser cooling is pumped from Wardha River and water is returned after cooling in the cooling tower. The liquid effluents from the thermal power plants are being released to nearby streams. Industrial boom caused rapid growth of population and pollution which brought enormous problem and degradation of the environment.

Thermal Power Plants established in Warora greatly harms the natural environment. Thermal power plants are surrounded by many small villages. According to the results from the interviews with the local people, they are uneasy about their health because the power plant is very close to their settled area. In addition to this farmers are facing tremendous problems due to polluted water released in "Dahiwal Nala" flowing through local villages nearby these industries. According to recent news published in daily Lokmat dated 25th May 2013, eight goats and many fishes were killed by drinking polluted water released by thermal power plants. These evidences show that pollutants from industrial waste enter into the environment system and then in to food chain, which affects the animal and human health.

Effluents from thermal power plants include ash bund disposal, thermal discharges, waste water effluents, cooling water, material storage runoff, metal cleaning waste water and sanitary waste water.

In thermal power plant water slurry is used to take the ash from the power plant to the ash pond for the disposal. There are two impacts associated with ash decant. The first point is that, this water slowly sleeps in to ground while carrying with it the ash lichgate. The water may contain harmful substances which have tendency to letch out over the period of time. Due to this ground water is polluted and unsuitable for domestic use. Second factor affecting the water environment is release of ash pond in to local water bodies, such release increases turbidity of water bodies by decreasing the productivity **[4]**. The leaching potential of ash ponds is higher due to diurnal and seasonal variations in temperature, Moisture and other parameters**[8]**. Leaching of soluble ions from ash ponds in to the ground water was reported near Vijaywada Thermal Power Station **[9]**.

Another most important environmental impact of thermal power plants is Cooling Water and the need for cooling water is not as small as it is regarded. Therefore they are usually set up very close to natural water sources such as rivers and resultant warm water has obtained being discharged into the lake or stream cause thermal pollution **[11,14].** When water is used as a coolant is returned to the natural environment. The change in temperature impacts organisms by a) Decreasing oxygen supply and b) Affecting ecosystem composition. Warm water contains less oxygen. So there is decrease in rate of decomposition of organic matter and affect natural environment **[7].**

The chemicals used in the process of water treatment before releasing in to the receiving environment cause a wide range of contamination **[18]**. Thermal power plants create such variety of waste pollutant. In this perspective water recycling and reuse of treated effluent in high water consuming industrial sectors seem be to be a viable alternative to save valuable resources.

The suitability of water for drinking and other domestic use is determined by keeping in view the effect of various chemical constituents in water on biological system of human being and other living organism**[5]**. The objective of this study is to assess the environment impacts of effluent discharge on the surrounding environment focusing on the surface and ground water quality in the vicinity of thermal power plant.

EXPERIMENTAL SECTION

To assess the water quality in study area total twelve samples from different area around thermal power plants were collected in summer season. The samples were collected in sterilized polythene bottles and prior to the sampling all the sampling containers were washed and rinsed with the groundwater. Sampling points were chosen to cover all different directions of thermal power station after preliminary survey of area. The samples were collected & measured temperature with the help of thermometer. Then were sealed and brought to the environment laboratory for analysis. Various Physico-chemical parameters were analyses as given in standard manual of water and waste water analysis (APHA/NEERI).

RESULT AND DISCUSSION

Results of Analysis of water samples were presented bellow and these parameters were compared with standard guideline values recommended for the drinking and public health purpose.

Table 1: Description of Water Sampling Sites:

Sample code	Source	Location	Temperature
S - 1	Dahiwal Nala	Just before entering the Thermal Power Plant	28°C
S - 2	Bore Well	Nimsada Village. 1 km away from Power Plant	28°C
S - 3	Bore Well	800 Mt - South East to Power Plant	29.5°C
S - 4	Pond	Near Nimsada Villege. 500 Mt away in North East Direction from Power Plant	29.5°C
S - 5	Bore Well	Near Railway Gate, 200 Mt East to Thermal power Plant	30°C
S - 6	Pond	Near Entrance Gate of GMR Power plant	26°C
S - 7	Bore Well	Near outer Wall , East to GMR Power Plant	30.5°C
S - 8	Pond	Near Railway Line used for Coal Transportation to power Plant	31°C
S - 9	Pond	Back side of GMR Power Plant, Just behind the coolant.	29°C
S - 10	Pond	West to Wardha Power Plant , Near Coolant	29.5°C
S - 11	Open Well	Open well in Naidev Villege, just behind Wardha Power Plant Wall	28.5°C
S - 12	Dahiwal Nala	Effluent Discharge of Wardha Power Plant	28.5°C

Table 2 and 3:- Analytical Result of Physicochemical Parameters of Water samples from twelve different sources

Table 2

Sample code	pH	Conductivity Milli-siemens/cm	TDS Mg/Lt	Turbidity NTU	Chloride Mg/Lt	Alkalinity Mg/Lt
S - 1	8.48	0.72	208	15.9	24.9	260
S - 2	7.71	4.71	1350	8.6	809.1	432
S - 3	7.64	2.53	756	7.4	346.75	506
S - 4	8.34	0.42	177	9.1	23.31	140
S - 5	7.83	0.61	180	5.6	10.59	240
S - 6	8.24	0.22	84	22.5	10.5	108
S - 7	7.77	0.93	262	6.6	43.45	312
S - 8	8.35	0.61	180	6.8	21.20	120
S - 9	8.45	0.32	86	16.2	10.10	112
S - 10	9.23	0.34	84	6.1	13.25	100
S - 11	8.00	1.00	268	4.2	123.39	292
S - 12	8.30	2.00	554	16.7	228.95	186

Table 3

Sample Code	Hardness Mg/Lit	Calcium Mg/Lit	Magnesium Mg/Lit	Sulphate Mg/Lit	Iron Mg/Lit
S - 1	214	70	144	166	0.47
S - 2	1180	630	550	316	0.45
S - 3	590	230	360	288	0.32
S - 4	172	90	82	68	0.42
S - 5	226	148	78	41	0.21
S - 6	124	100	24	23	0.32
S - 7	250	178	72	193	0.21
S - 8	136	96	40	131	0.11
S - 9	114	72	42	41	0.60
S - 10	78	32	46	52	0.42
S - 11	344	124	220	68	0.33
S - 12	680	250	430	350	0.70

Table 4 - Indian Standards for Drinking Water

Sr. No.	Substance OR Characteristics	Requirement (Desirable Limit)	Undesirable Effect (Outside the Desirable limit)	Permissible limit in the absence of alternate source
1	**pH Value**	6.5 – 8.5	Beyond this range the water will affect the mucous membrane and water supply system	No relaxation
2	**TDS** Mg/Lit	500	Beyond this palatability decrease and may cause gastro-intestinal irritation	2000
3	**Turbidity** NTU	05	Above 05 consumer acceptance decreases	10
4	**Chloride** Mg/Lit	250	Beyond this limit taste, corrosion and palatability are affected	1000
5	**Alkalinity** Mg/Lit	200	Beyond this limit taste becomes unpleasant	600
6	**Total Hardness** Mg/Lit	300	Encrustation in water supply structure and adverse effects on domestic use	600
7	**Calcium** Mg/Lit	75	Encrustation in water supply structure and adverse effects on domestic use	200
8	**Magnesium** Mg/Lit	30	Encrustation in water supply structure and adverse effects on domestic use	100
9	**Sulphate** Mg/Lit	200	Beyond this limit causes Gastro-Intestinal irritation when Mg or Na are present	400
10	**Iron** Mg/Lit	0.3	Beyond this limit taste, appearance are affected, has adverse effect on domestic uses and water supply structure and promotes iron bacteria	1

CONCLUSION

From analysis results mention in table 2 and 3 it can be concluded that some sampling stations show permissible range of concentration of physico-chemical parameters but in most of the case it is beyond permissible limits given by bureau of Indian standards. Hence water is not very much suitable for drinking and domestic purpose, but by slight treatment the water can be useful.

When compared results of S1 (Dahiwal Nala before Effluent Discharge of Power Plant) and S12 (Dahiwal Nala after Effluent Discharge of Power Plant) , we observed tremendous increase in magnitude of Physico-Chemical parameters. Our observations suggest that, Industrial area especially in case of thermal power plants needs regular monitoring of water sources, because it is surrounded by villages and hence can affect the health of local biota.

Acknowledgement
Authors are thankful to Prof. P. N. Bagade. Head, Department of Chemistry, Anand Niketan College Warora and Mr. S. S. Sayare, Sayare Industries, Warora for their support. We are also thankful to Dr. Mrs. Farhin Inam, Department of Chemistry, Institute of Science, Nagpur for her constant encouragement.

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