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Research Article

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Assesment of water quality from Hindustan Lalpeth Coal Mine, Chandrapur

Pratiksha Tambekar[1], R. J. Batra[2] and R. G. Weginwar[3]

[1]Shri Sai Polytechnic, Chandrapur
[2]Ramdeo Baba College of Engineering & Technology, Nagpur
[3]Rajiv Gandhi College of Engineering, Research & Technology, Babupeth, Chandrapur

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ABSTRACT

The piece of investigation was carried out to study the surface water quality and physico-chemical characteristics of Hindusthan Lalpeth Coal Mines (HLCM) surface water Chandrapur district,(M.S) during the period October 2011 to March 2012. Chandrapur district is located in the eastern edge of Maharastra in Nagpur Division, the coal mining industry has to dispose of millions of litres of water everyday to dig out coal from this mine . The water is the main source of various water supplies in the thickly populated coal field and general use. Chandrapur city is surrounded by many other major and minor coal industries. In this study, water samples from Hindusthan Lalpeth coal mine were collected and analyzed. Attempt is made to reflect the impact of mining on surrounding water quality of these areas. Various physico-chemical characteristics of the mine water were analysed with respect to different parameters like Temperature, pH, TDS, DO, Chloride, Fluoride, Turbidity, Hardness and metal like Fe, to get clear picture of quality parameter in HLCM water of the Chandrapur town. This investigation reveals that mining activity, markedly pollute the mine water. Mine water is of highly complex nature and of widely varying composition and nearly neutral or slightly alkaline in nature. By observing the result it can be concluded that the parameters which were taken for study the surface water quality such as Turbidity, Chloride, Alkalinity, COD, Total Dissolved solids are more than that of permissible limits. Where as Total Hardness , Fluoride, Iron is less than permissible limit. And Dissolved Oxygen is almost same as per WHO standards.

Keywords: Surface water, coal mine reservoir, Physico-Chemical Parameters, APHA.

INTRODUCTION

It has been known that the Earth is an unique planet in the solar system and in the Universe to originate and flourish living creature on it, due to one of the very important factor that is water . But it is polluted more or less at every nook and corner of the world . Water resourses has no exception for this phenomenon (1,2).

Surface water resourses cover as 176.8 x 10^4 million cubic meter and out of this only 50 percent can be put to beneficial use. The distribution among various uses of water is domestic 2.1%, agriculture 88 %, industry 2.47% . It is estimated that 31% rural and 75% urban population in India has to assess potable water supply. Surface water is dominant source in organized urban and rural area always ground water is remain the basic source .The nature of pollutants entered in water depends on composition of waste water and the raw material processed. The process and toxicity of anions , cations, hydrocarbons constituted in waste. Fresh water availability is a critical limiting factor in economic development and sustainability which have directly impact on electric power supply (3 – 7).

Chandrapur is located on estern edge of Maharashtra State in the Nagpur division and forms the eastern part of Vidharbha region. The district (population in 2011 was 21,19,262) lies between 18º 40'and 20º 50' north latitudes and 78º 50' and 80º 60' east longitudes. Chandrapur district is encircled by Nagpur, Bhandara and Wardha Districts in Northern side, Gadchiroli in Eastern side, Adilabad District of AndraPradesh on Southern side, and Yavatmal on Western side. The District of Chandrapur has an area of 10695 sq. m. This city is situated near the Irai and Wardha river from which water is supplied to Chandrapur City through Irai Dam constructed by Chandrapur Super Thermal Power Station. Chandrapur is also famous for paddy and soyabean crop growing area and vast dense forest. Apart from major coal mines, the main industries of the district are Rice Mills, Poha Mills, Cement Industries like L&T, Manikgarh, Ambuja, Murli Cement, ACC etc., Ballarpur Paper Mill Limited (BILT), Chandrapur Super thermal Power station (Capacity 2340 MW), Maharashtra Electrosmelt Limited (MEL), Ordanance Factory, Coal Washeries, various Power Plants, Western Coal Fields Limited Mines (Durgapur, Bhatadi, Padmapur, Hindustan Lalpeth, Rayyatwari, Mahakali, Sasti, Mana, visapur, Gauri etc are situated very close to the city (8).

HLCM is located in Chandrapur Area of WCL started in year 1985. HLCM is situated 3 kms away from South of Chandrapur town in Wardha Valley Coal field of Maharashtra State. Actually this project is planned in 1979 for Annual Capacity of 0.59 Metric Tones of coal and about 600 employees are working in this project. HLCM is situated within the Municipal Area of Chandrapur City. Irai river acts as the main drainage of the area which flows from North to South and meets Wardha river. Area covered under HLCM is about 311.66 Hectares (9 – 12).

Physiographically, the district is situated in the Wainganga and Wardha river basin. The eastern and western boundaries of the district are well defined by the rivers Wainganga Wardha and the tributaries of Godavari (2).

Chandrapur is known for hot and dry climate. Humidity is very low in the region. Temperatures start decreasing in October with December being the coldest month, with a minimum average temperature of 7.6 °C and maximum of 28.2 °C. The Southern region is warmer than the Northern region. The lowest recorded temperature is 3 °C (Northern region) and 8 °C (Southern). Temperatures begin to rise in February. May is the hottest month with a mean maximum temperature of 45 °C and minimum of 28 °C. It is common for temperatures to reach up to 46 °C, and temperatures in this region are often the highest in Southern Asia. The highest temperature ever recorded in Chandrapur was 48.3 °C on May 16, 1912 and lowest temperature recorded was2.8 °C on January 10, 1899. Monsoons bring humidity to the region in June, and this lasts until September.

The average annual rainfall is about 1420 mm. The Eastern region receives more rainfall than Wester monsoon season [Jun-Sep], which exceeds 70%, but it falls down rapidly in Summer [Feb-May] and average number of rainy days is 60 to 65 per year.(8).

As the study area is surrounded by many major and minor industries and thermal power station (CSTPS) they all in need of water for their various purposes .So the sources of water being exhausted day by day.In vicinity to those area ,urbanization and population also increasing day by day as employment is easily available hence demand of water is also increasing.

Coal escavation activity inside coal mines forms many pits where water is setteled in large amount, which can be utilized for domestic and industrial purposes. The present study was carried out to know the status of water quality of mine water bodies in the Hindusthan Lalpeth coal mines Chandrapur (2).

EXPERIMENTAL SECTION

Water samples were collected in pre-cleaned polypropylene bottles with necessary precaution given in APHA manual(13) from HLCM. Samples were collected from Oct 2011 to March 2012 particularly in winter and pre-summer season. The studies were carried out for six months during the end of rainy season . Various physico-chemical parameters were analyses as given in standard manual of water and waste water analysis of NEERI Mannual (13). Samples were collected from the sites in between 10:00 a.m. to 11:30 a.m. Sample for the analysis of dissolved oxygen was collected in BOD bottle (250 ml), just below the water surface slowly to avoid any air bubble entering into the bottle and fixed by Winkler's 'A' and Winkler's 'B' solution at site.

The parameters like Temperature, pH, Conductivity and Turbidity were analyzed with the help of thermometer and standard water analysis kit (systronics) and measurement of transparency carried out by Secchi disc method. For the

analysis of other chemical parameters, the samples were collected in plastic can and transported to the laboratory on same day (14 – 16)

The pH was measured with pH meter (ELICO), Analysis of DO, COD, alkalinity, chlorides, fluorides total hardness, total solids, turbidity, Iron content were carried out in our laboratory, as per NEERI manual for water and waste water analysis (13).

Reagents used for the present investigation were A.R. /G.R. grade and double distilled water used for preparing various solutions. All the reagents and calorimetric solution were prepared and purified according to standard method for the examination of water and waste water.

GRAPHICAL REPRESENTATION OF VARIOUS PARAMETERS

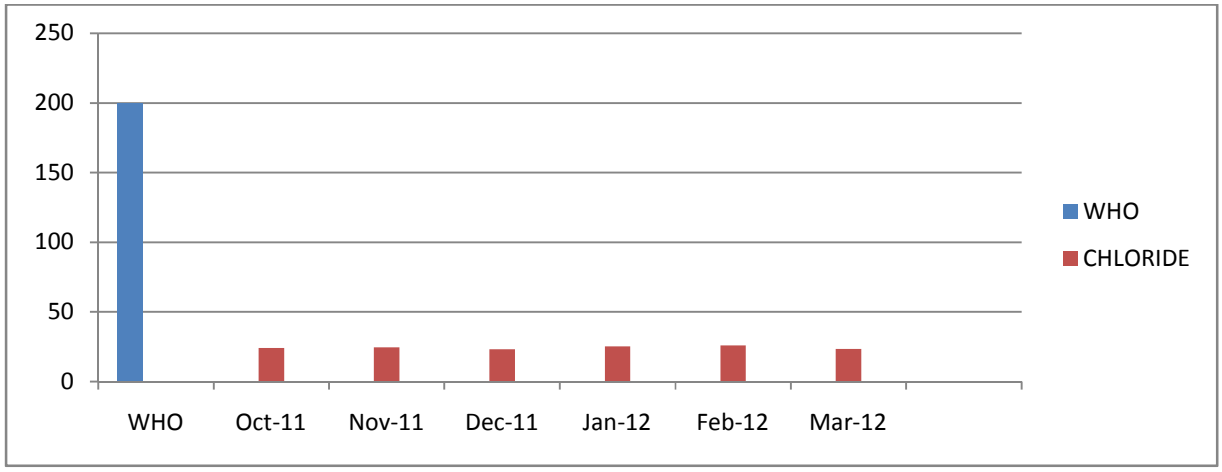

FIG-1 :- Month variation in Chloride

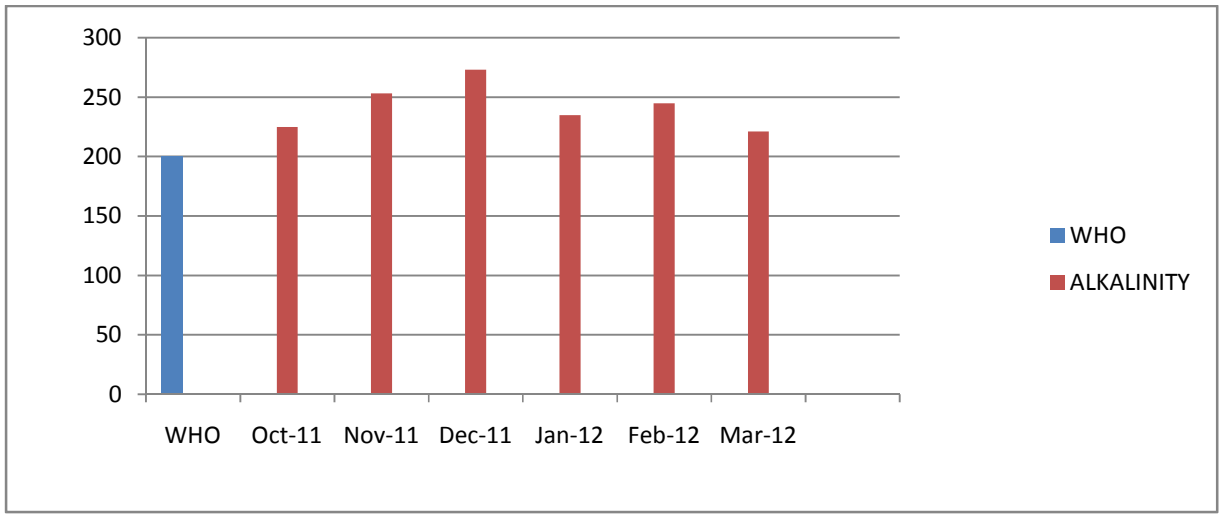

FIG-2 :- Month variation in Alkalinity

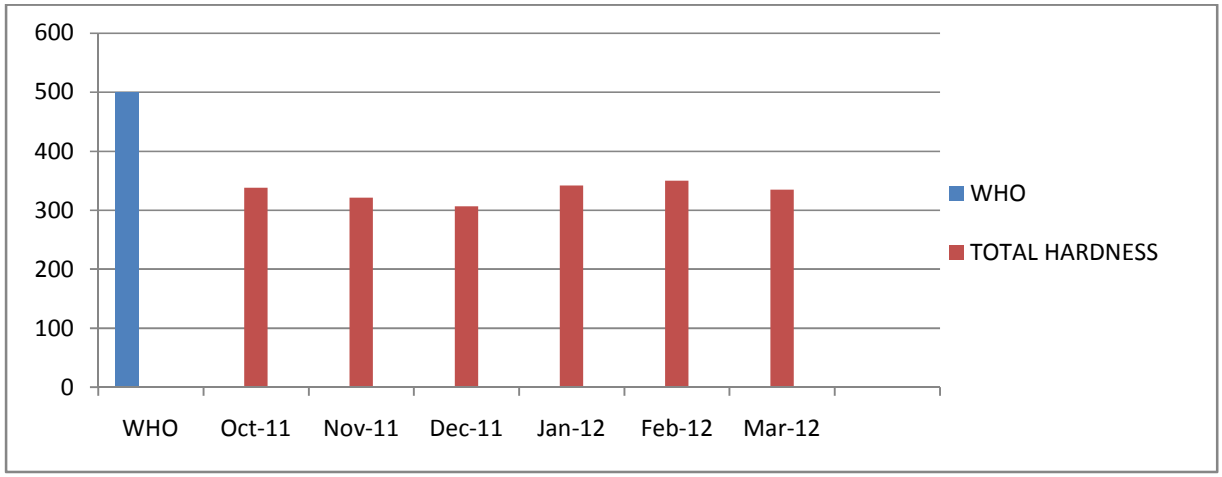

FIG-3 :- Month variation in Total Hardness

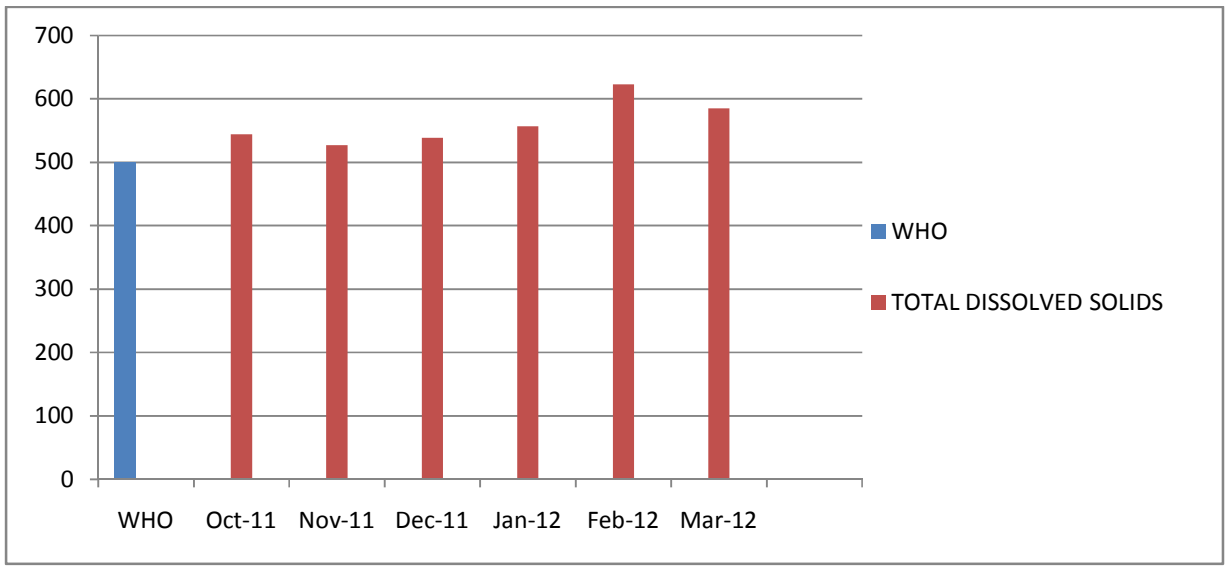

FIG-4 :- Month variation in Total Dissolved solids

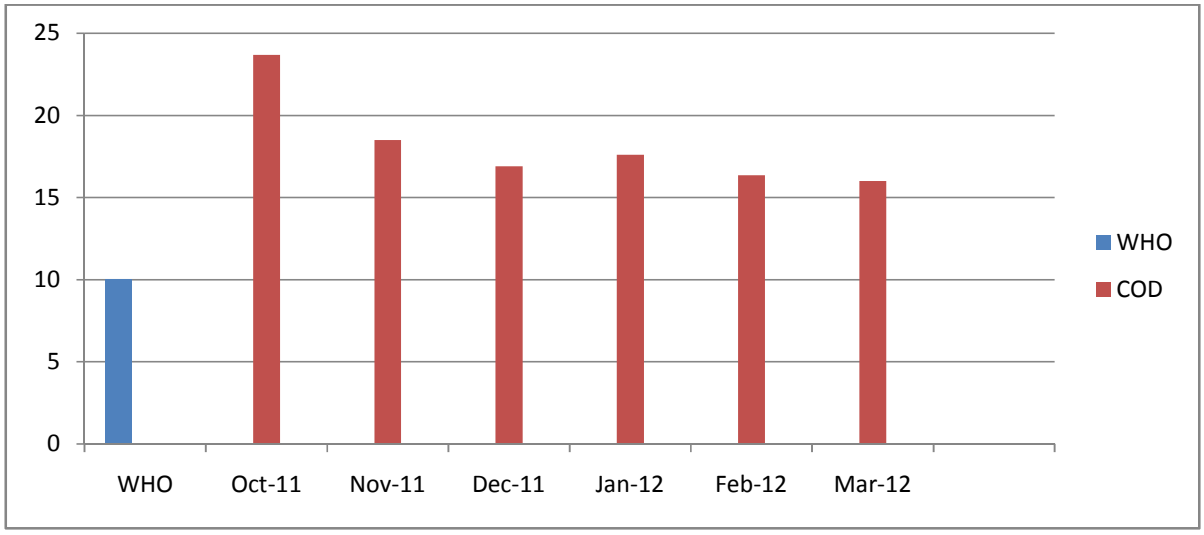

FIG-5 :- Month variation in COD

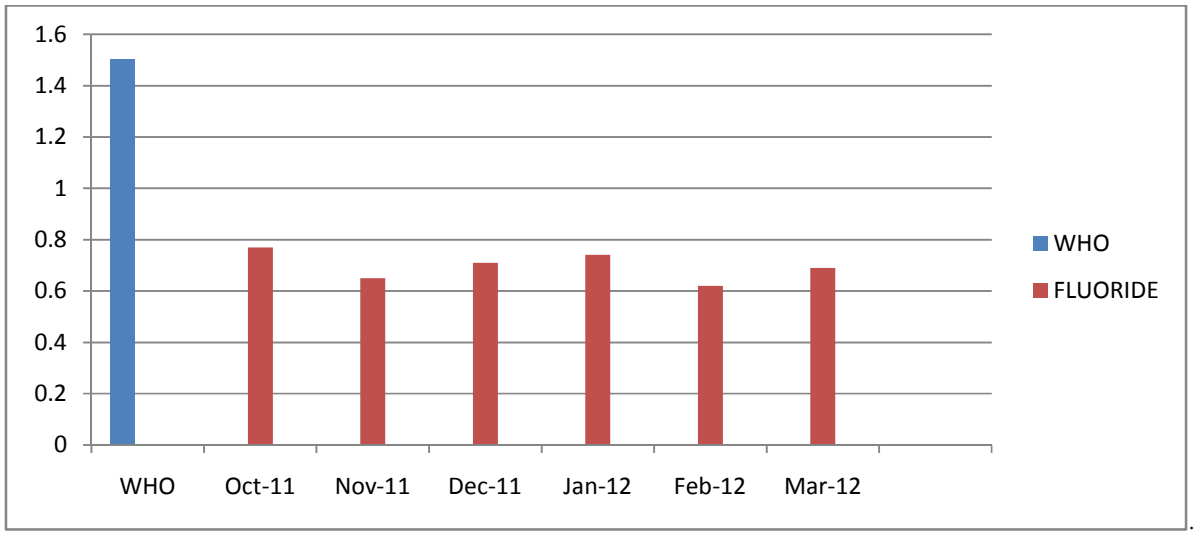

FIG-6 :- Month variation in Fluoride

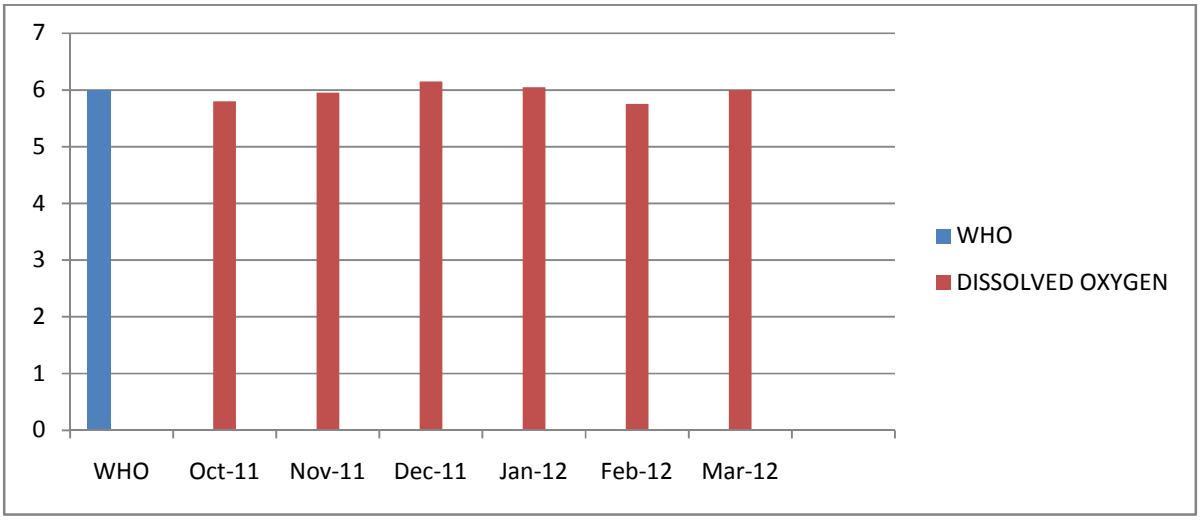

FIG-7 :- Month variation in Dissolved Oxygen

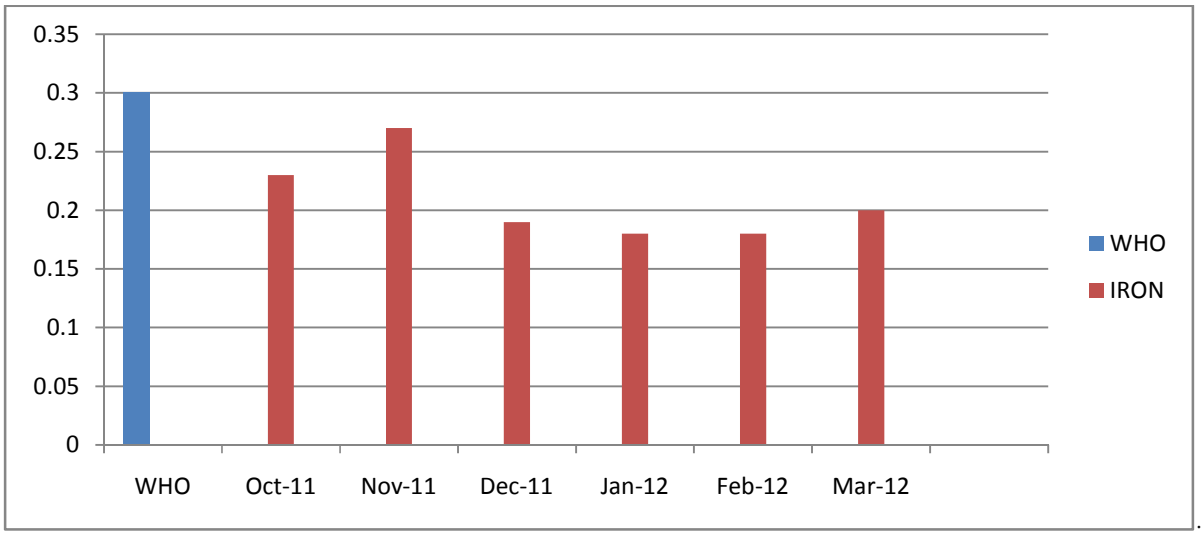

FIG 8 :- Month variation in Iron

RESULTS AND DISCUSSION

Analytical results as depicted in Table revealed physicochemical characteristics of water samples from the month of October 2011 to March 2012.

The result of physico chemical analysis of surface water have been presented in Table No.1.The obtained results of surface water analysis has been compared with the WHO standards for drinking purpose.

In present study pH ranged between 6.9 to 8.1 sample water and was found to be slightly higher alkaline value in the month of January but according to IS:10 500(17) it is in permissible limit.Alkaline range of pH may be due to occurrences of limestone in the surrounding region of sampling stations.An anionic radical such as carbonates , bicarbonates ,hydroxide and phosphate contributes to increase in alkalinity. This phenomenon has been recorded by (Baruh et al and Bruvold et al (1970) and Singhan et al (1986),total alkalinity comes down with rain fall and goes up after evaporation of water which is also reported by Dara S.S. (14-16)

These mine water contains very high amount of dissolved solids and hence corrosive in character particularly due to sulphate and chloride contents mentioned by (15). A exhaustive survey of corrosivity of underground mine waters from Indian coal mines was carried out. But chloride content of mine water is very low in our study. Dissolved solids are appreciably high in all the stations but within WHO higher range value .The value of TDS showed significant variations in the study sites which is shown in Fig 4 .TDS varied between 527 to 623mg/l.The high values of TDS were observed that the stations is in coal mining area. HLCM showed high total dissolved solid values.

Table 1: Values of physico-chemical parameters of sampling stations of HLCM Chandrapur .

S.No.	Parameter Studied	OCT 11	NOV 11	DEC 11	JAN 12	FEB 12	MAR 12	WHO/ BIS
1	pH	6.90	7.40	7.30	8.10	7.20	7.90	6.5-8.5
2	ALKALINITY (mg/l)	225	253	273	235	245	221	200
3	COD (mg/l)	23.70	18.50	16.90	17.60	16.35	16.00	10
4	DO (mg/l)	5.80	5.95	6.15	6.05	5.75	6.00	4-6
5	CHLORIDES (mg/l)	24.05	24.60	23.20	25.30	25.90	23.50	200
6	FLOURIDES (mg/l)	0.77	0.65	0.71	0.74	0.62	0.69	1.5
7	TOTAL HARDNESS (mg/l)	338	321	307	342	350	335	500
8	TOTAL DISSOLVE SOLIDS (mg/l)	544	527	539.	557	623	585	500
9	TURBIDITY	27.10	31.20	27.90	29.40	28.30	28.90	
10	IRON (mg/l)	0.23	0.27	0.19	0.18	0.18	0.20	0.3

Dissolved oxygen in this study is with in permissible limit, except in the month of December and January, the dissolved oxygen is 6.15 and 6.05 mg/l.respectively The change in oxygen content leads to undesirable abnoxious odour , under anaerobic conditions. (3)

In potable water, the salty taste is due to more chloride concentration present in water . Chloride is one of the major inorganic anion of water .High concentration of chloride indicate pollution due to organic waste .Chloride was found in the range of 23.20 to25.90 mg/l .Hence it is within the tolerance limit.(200 mg/l) as per IS10 500(17)

High fluoride intake over a period of time can cripple one for life. It is well known that excess fluoride ion intake beyond a limit is responsible for dental and skeletal fluorosis which is a serious health problem in many areas of the world. At the same time fluoride ion concentration less than 0.8mg/l result in dental carries and high fluoride ion causes dental fluorosis. (Disfigurement of the teeth). Hence it is essential to maintain the fluoride ion concentration between 0.8 to1.0 mg/l in drinking water (17).In the present study ,fluoride ion concentration is found in the range of 0.62 to 0.77 mg/l . Which shows less fluoride ion concentration and no detrimental effect on human beings (18-22).

Mine water from these coalfield are quite hard .Hardness is mainly due to the presence of carbonate, bicarbonate and sulphate of ca & mg ions. Soft water are also encountered in a very few sumps. Hardness of water is a measure of the soap consuming capacity of water. Hard water causes harmful effect upon the health of consumer. Total hardness of sample sites varied from the range 307 to 350 mg/l .According to IS:10500 2004 total hardness found to be higher side it is 300 ppm and permanent hardness is in permissible limit i.e. 200 ppm (23).

Turbidity in water is caused by suspended matter that is clay, slit and finely divided organic and inorganic matter , soluble coloured organic compounds, planktons and other microscopic constituents.Turbid water interferes the self purification of water by reducing photosynthesis activity of aquatic plants . Turbidity in present sample was found in the range of 27.10 to 31.20 NTU .Turbidity is comparatively higher than the limit with respect to IS:10500:2004 (13-14).

The high value of COD is due to increase in concentration of oxygen demanding pollutant and also because of high sun radiation and lowering water level. But in present study COD is in range of 16.00 to 23.70 mg/l .COD is high in the month of October that is 23.70 and low in month of March that is 16.00 mg/l . It is observed that COD of mine water is much higher than standard or permissible limit (23-32).

Iron is one of the most important constituent of blood in human and other living organism. Iron is an essential element for human nutrition and metabolism . But in large quantities results in toxic effects like haemochromoitosis

in tissues if more iron accumulation takes place. The maximum permissible limit of iron in drinking water is 0.3 ppm. The study reveals that the iron content in samples is in permissible limits (23-32).

CONCLUSION

Hindusthan lalpeth coal mines has plenty of surface water potential but when we study the sample from the month October 2011to March 2012. during this six months span water quality was found almost same except few parameters. The obtained data shows that hardness, turbidity ,chloride ,TDS exceed the limits of drinking water as per norms. Therefore, the treatment is necessary before supply of water for domestic purposes (2, 33-35).

The study reveals that surface water of Hindusthan lalpeth coal mines is only suitable for drinking purpose with suitable water treatment and process.

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