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Physico-Chemical analysis of Industrial wastes water of selected area of Satna, M.P – (A case study of Seasonal Variation)

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Abstract

Quality of water is an important criterion for evaluating the suitability of water for drinking and irrigation.Concern over agricultural diffuse pollution sources in integrated water has been growing recently .The term diffuse essentially point to this feature of the discharge of such pollution leads which makes them somewhat difficult to notice, monitor or control. In the present the study of seasonal variation in inorganic content as well as physico-chemical parameters, monitoring was done during summer, rainy and winter season year 2013 to 2014. The parameters like pH, dissolved oxygen (DO) biochemical oxygen demand (BOD), chemical oxygen demand(COD), fluoride, MPN Index by bacterial load and heavy metals have taken for water analysis . The study revealed that the water sources in the area are heavily polluted. The heavy metals concentrations were found more than the permissible limits during all the seasons. It was found that some of the water quality parameters were above the permissible limit and some were not.

Key-Words: Satna district, Diffuse pollution, Heavy metals, Industrial waste water

Introduction

Water is one of the most vital resources for the sustenance of human, plants and other living beings. It is required in all aspects of life and health for producing food, agricultural activity and energy generation. Groundwater is rarely treated and presumed to be naturally protected, it is considered to be free from impurities, which are associated with surface water, because it comes from deeper parts of the earth. The focus has been on regulating the point source pollution load from urban and Industrial sources and non-point or diffuse load from agriculture, animal husbandry and rural sources were largely ignored in water quality management. Increasing use of chemicals, fertilizers, pesticides, perfumes, cosmetics, petrochemicals, harm aquatic life and human health. Other chemical in recent years has caused the more diffused chemicalspollution[1].

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A number of major and minor Industries include flour and oil seed milling and cement manufacturing; are established in Satna. The Vindhya Pradesh plateau is environmentally very important to understand the rich Indian biodiversity and diffuse chemical pollution. The district of Satna is situated between latitude 23” 12’ north and longitude80” 21’ and 81” 23’ east in mid northern part of Rewa commissioner’s division in Madhya Pradesh State of India. Heavy metals viz, Cr, Pb, Cd, Ag, Co, Ag, Hg, Ca and Sc are recognized highly toxic and dangers pollutant. However, continuous disposal of industrial effluents on lands leads to percolation of pollutants to the groundwater through seepage and leaching, causing contamination. As a result, farmers in the adjoining areas find the ground water unsuitable for irrigation .Drinking water wells may also get affected. Environmental problems related to industrial effluent disposal on land have been reported from various parts of the country. Disposal on land has become a regular practice for some industries and creates local/regional environmental problems[2-12]
Watershed management for any city requires the estimation of both point and non-point sources of water pollution. An effective land-use planning plays a crucial role in efficient management of water resources of any area. Both diffuse and point source pollution is dependent upon the land use pattern of a city. The total

amount of runoff generated from an area depends upon the land use type of that area. High impervious area in a city results in more runoff generation thereby allowing more pollutants to enter into the surface water bodies directly and indirectly. Similarly the point source pollution of water is also dependent upon the land use pattern of the city. Densely populated city like National Capital Territory (NCT) of India will generate more domestic sewage. Also, urban runoff on percolation results in salinization of the groundwater.[13]

In the Satna there are 14 large ,3middle scale and 178 small scale industries .All these industries are releasing pollutants and contaminations in water of surrounding areas and naturally these water have different contamination .These contamination are going deteriorates water quality .As we known water is basic need of any society .If water quality is not good, the society can't survive slightly. Because polluted water will generate a number of health problems by intake of drinking water, vegetable and, fruits of the area ,milk product of area and daily need of the society.

In present study authors thought to study some physico- chemical characteristic of water sample collected from different industrial zones in Satna region. The parameter pH, DO, BOD ,COD, Fluoride, ,MPN Index by bacterial load and heavy metals like Pb, Fe, Mn and Cu have been taken to analyze. The estimation of heavy metals Pb, Fe, Mn and Cu have been also done in collected water sample.

Material and Methods

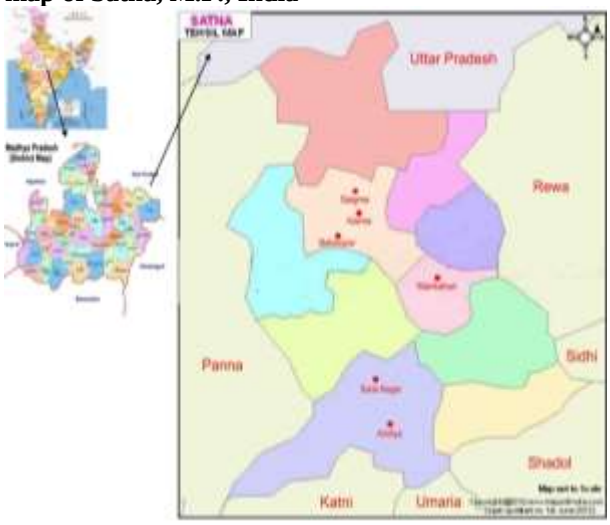
Study Area

The present study is carried out at industrial area of Satna district, Madhya Pradesh which is geographically bounded by 24°40' to 24°50' N latitude and 80°45' to 81' E longitude covering an area of above 900 km. The area is rich in natural resources namely: bauxite, laterite, flagstone and Ramraj (a type of clay used in paint). Accordingly, intensive industrial activities have been carried by various agencies. The waste materials of industries are dumped on the spot causing pollution problems. The region receives 900 mm average rainfall from the south west monsoon during the months of June to September and the climate is sub-humid. The temperature varies from 42°C (summer season) to 4°C (winter season). Geologically, the area comprises formations of the Proterozoic Vindhyan Supergroup. The main rock types are Kamour sandstone and shales of Upper Vindhyan. Bauxite and laterite are associated with the Rewa Group of Vindhyan Supergroup.

2. Sample Collection:

Six sampling locations consisting of industrial zones were selected in the study area. Sampling was done during summer, rainy and winter seasons (of year 2013 to2014). The month of March-June, July-September and November-February, were selected as representative month of summer, rainy and winter seasons respectively. Sampling was done in accordance with grab sampling methods in polyethylene bottles of one liter capacity. To avoid leaching of metals and interaction with the surface wall of the container, bottles were first cleaned with detergent and then with 1:1 HNO3 for 24 hours. Finally bottles were cleaned and rinsed with the distilled water. During sampling bottles were rinsed two to three times with the sample to be examined before finally filling with it. Samples were collected by immersing the rinsed bottles in river water19-20.During sampling from hand pumps and bore wells, the water pumped to waste for about five minutes and sample was collected directly. All the samples were refrigerated at 40^0C in the laboratory[13,14,15], and procedures were followed as per the standard methods[16-20], and different physicochemical parameters like, pH, dissolved oxygen, BOD, COD, fluoride and heavy metal were analyzed.. The digested samples were analyzed for heavy metals using Atomic Absorption Spectrophotometer. The locations of sampling stations are shown in figure 1.

Location of sampling point of Industrial map of Satna, M.P., India



Sampling point

Industry (Surface waste water)

S. 1- Bhilai J.P. Cement plant Babcopur near treated waste water.

S. 2- Baitul and flours, Kaima near treated waste water.

S. 3- Kamal sponge steel and power ltd., Sagma near treated waste water.

S. 4- Maihar Cement plant, Sarala Nagar near treated waste water.

S. 5- K.J.S. Cement Plant Amiliya, near waste water.

S. 6- Prism Cement Pvt. Ltd. Mankahari, Sajjanpur near waste water.

S = Sampling Water

Due to industrial activities and uncontrollable use of insecticides, pesticides and fertilizers the water pollution has become a threat in this region. The present paper has the target to give data base in formations of heavy metals found in water of this region as well as their effect on human health. For this purpose valuable help from P.H.E. Department, water pollution control authority and communication, and capacity development unit is availed. The test of different heavy metals is done using the method furnished by this unit.

Results and Discussion

The results obtained from analysis of six groundwater samples are given in Table 1 and 2. Its compare all parameters given in table 1 and 2.

Table 1: Seasonal variations in physico - chemical characteristic of surface waste water samples at different locations in Satna District, MP

Parameters	*Sampling Locations*						
	Season	S_1	S_2	S_3	S_4	S_5	S_6
P^H	Summer	8.3	8.9	8.5	8.3	8.4	8.3
	Rainy	7.8	8.4	8.1	7.9	8.2	7.7
	Winter	7.9	8.5	8.2	8.2	8.3	8.1
DO (Dissolved Oxygen)	Summer	8.1	7.1	7.2	8.1	7.3	8.0
	Rainy	8.5	7.8	7.7	8.5	8.2	8.3
	Winter	8.8	8.1	8.4	8.7	8.4	8.6
BOD (Biological Oxygen Demand)	Summer	33	112	36	36	34.7	20
	Rainy	21.6	90	28.8	32.2	28.8	18
	Winter	17	85	24.9	28.1	26	16
COD (Chemical Oxygen Demand)	Summer	121	98	136	103	190	90
	Rainy	102	84	108	78	136	70
	Winter	82	81	93	56	115	56.35
Fluoride	Summer	0.44	0.36	0.33	0.44	0.28	0.44
	Rainy	0.36	0.27	0.27	0.35	0.20	0.38
	Winter	0.31	0.18	0.19	0.31	0.12	0.32
Lead	Summer	0.135	0.119	0.134	0.132	0.013	0.011
	Rainy	0.115	0.107	0.116	0.112	0.010	0.009
	Winter	0.107	0.095	0.109	0.104	0.009	.008
Iron	Summer	1.38	0.24	2.55	0.55	1.33	1.92
	Rainy	1.82	0.28	2.85	0.69	1.78	2.10
	Winter	1.18	0.19	2.25	0.38	1.16	1.75
Manganese	Summer	0.213	0.058	0.278	0.270	0.240	0.230
	Rainy	0.236	0.053	0.242	0.242	0.202	0.213
	Winter	0.198	0.045	0.223	0.223	0.214	0.196
MPN Index (E. Coli)	Summer	80	70	75	90	57	77
	Rainy	95	88	90	110	65	85
	Winter	65	64	58	74	50	55

pH

pH is a measure of the hydrogen ion concentration in water and indicates whether the water is acidic or alkaline. The measurement of alkalinity and acidity of pH is required to determine the corrosiveness of the water. The standard values of pH for drinking water by BIS is between 6.5-8.5 while, WHO is between 7.0-8.5.pH value for drinking water is limited from 5.5to 8.5 and for effluent discharge it is between 5.5and 9 as per IS: 2490 and CPCB. High value of pH may results due to waste discharge, microbial decomposition of organic matter in the water body (Patil et al., 2012)In present study we have observed that in case of industrial of surface water high pH value is observed 8.9 sample-2 in summer and minimum value is observed 7.7 sample-6 in rainy session. These results refer that in the reason of surface water pH value is the entire sample none of them in acidic in nature.

Dissolved Oxygen (DO)

Dissolved oxygen is an important parameter in water quality assessment and biological processes prevailing in the water. The DO values indicate the degree of pollution in the water bodies. The presence of dissolved oxygen (DO) enhances the quality of water and also acceptability. An ideal DO value of 5.0 mg/l is the standard of drinking water (Bhanja and Ajoy, 2000). In case industrial surface water high value of dissolved oxygen 8.8mg/l sample- 1 in summer season and minimum value is observed 7.1mg/l sample- 2 in summer season

BOD

Biochemical oxygen demand (BOD) is a chemical procedure for determining the amount of dissolved oxygen needed by aerobic biological organisms in a body of water to break down organic material present in a given water sample at certain temperature over a specific time period. It is not a precise quantitative test, although it is widely used as an indication of the organic quality of water (Suthar. et al., 2012). According to WHO (1993), the permissible limit of BOD in water is 5 mg/L .However, in all six stations samples showed the permissible limits. In case of industrial surface water high value of BOD is observed 112mg/l sample-2 in summer season and minimum value is observed 16 mg/l sample-6 in winter season

COD

Chemical Oxygen Demand (COD) is a measure of pollution in aquatic system. High COD may cause oxygen depletion on account of decomposition by microbes (Siva Kumar et al., 1989) to a level

detrimental to aquatic life. In case of industrial surface water high value of COD is observed 190 mg/l sample-5 in summer season and minimum value is observed 56 mg/l sample-4 in winter season.

Table 2: Drinking Water standards of BIS and WHO[22]

S/ No.	Parameter	BIS (IS : 10500 : 1991) mg/l		WHO (1996) mg/l		The study area in concentration the seasonal variation range (minimum to maximum)
		Desirable limits	Permissible limits	Desirable limits	Permissible limits	
1.	P^H	6.5 - 8.5	-	-	6.5 - 9.2	7.7 - 8.9
2.	DO	3.0	-	-	4 - 6	7.1 - 8.8
3.	BOD	-	-	-	6	16 - 112
4.	COD	-	-	-	10	56 - 190
5.	Fluoride	1.0	1.5	1.0	1.5	0.12 - 0.44
6.	Lead	0.05	No relaxation	0.01	0.05	0.008 - 0.135
7.	Iron	0.3	1.0	0.3	1.0	0.38 - 2.85
8.	Manganese	0.1	0.5	0.1	0.5	0.045 - 0.276
9.	Copper	0.05	1.5	0.05	1.0	0.020 - 0.124
10.	E. Cali	-	10/100 ml	-	10/100 ml	50 - 110

Except - P^H value are not in mg/l

Fluoride

Fluoride is an important constituent for the development of normal bones and teeth in small amounts. But use of water having excess of fluoride gets deposited on teeth and bones causes' dental fluorosis and skeletal fluorosis. In case of industrial surface water high value of fluoride is observed 0.44 mg/l sample-1, 4 and 6 in summer season and minimum value is observed 0.12 mg/l sample-5 in winter season. All surface water samples have fluoride content within desirable limits 1.0 mg/1 recommended by BIS and WHO for drinking water.

Copper (Cu)

The concentrations of Copper(Cu) were below the desirable limits. All the stations showed the concentrations between0.020 and 0.124 mg/L . The low concentrations of copper might be due to non utilization of copper compounds either as raw material or intermediates in the nearby industrial areas and agricultural practices. In case of industrial surface water high value of copper is observed 0.124 mg/l sample-2 in summer season and minimum value is observed 0.020 mg/l sample-8 in rainy season.

Lead (Pb)

In case of industrial surface water high value of lead is observed 0.135 mg/l sample-1 in summer season and minimum value is observed 0.008 mg/l sample-6 in winter season.The concentrations of lead (Pb) were in general very low and less than the permissible limits. Shrivastava and Mishra, 2011 reported the lead metal ranged from 0.006 to 0.110 mg/Lin surface water and 0.003 to 0.060 mg/L in ground water. All surface and ground water samples have lead content within Desirable limits 0.05 mg/1 recommended by BIS and WHO for drinking water

Iron (Fe)

The concentrations of Iron in the present study in case of industrial surface water high value iron is observed 2.85 mg/l sample-3 in rainy season and minimum value is observed 0.19 mg/l sample-2 in winter season. Concentrations of Iron(Fe) in the study area showed wide variations Iron is an essential element in human body (Moore, 1973) and is found in groundwater all over the world; higher concentrations of iron cause bad taste, discoloration, staining, turbidity, esthetic and operational problem in water supply systems (Dart, 1974; Vigneshwaran and Vishwanathan, 1995) Deficiency of iron results in hyochromic macrobiotic anemia; one of the world's common health problems.

Manganese (Mn)

The concentrations of Manganese (Mn) in the present study ranged from 0.045 to 0.278 mg/L. The Manganese concentrations were slightly exceeding the desirable limit (0.05 mg/L) in all the stations. According to the study the values of manganese are recorded between the range of0.01 – 0.08 ppm(ZahirHussain and MohamedSheriff, 2013). In case of industrial surface water high value of manganese is observed 0.278 mg/l sample-3 in summer season and minimum value is observed 0.045 mg/l sample-2 in winter season.

MPN Index (Bacteriological Study)

During present study, MPN index/100ml has been determined in various water samples collected from the study area. All the surface water samples, taken industrial zones show high value of MPN index in all seasons, indicates the fecal contamination of water.The concentrations of bacteriological load in the present study in case of industrial surface water high value MPN Index is observed 110 mg/l sample-3 in rainy season and minimum value is observed 50 mg/l sample-2 in winter season.

Conclusion

The present study was undertaken with an aim to analyze certain physico - chemical parameters in the

waste water samples in Satna district. The analysed surface of industrial wastewater samples of the study area indicates a slightly alkaline nature of surface water. In nutshell, the parameters analyzed have shown that they are all within the permissible limits for drinking water in certain water samples. In case industrial zone the located from 150 to 300m are contaminated and have been showing higher values for the total parameters studied. Heavy metal pollutants have the values of Fe, Cu, Mn and Pb slightly above season variation the WHO maximum permissible values. The concentration of manganese is elevated in a few localities due to its affinity with iron. Higher concentrations of manganese may cause metabolic disorder. The study reveals that iron and manganese are exceeding permissible limits and their main sources are combined effects of geogenic and anthropogenic sources. Proper monitoring is needed to avoid anthropogenic contamination. It may be concluded that there is definite impact of industrial waste on the quality of surface and ground water in near future.

References

1. Agarwal G.D., Lunkad S.K., Malkhed T., Diffuseagricultural nitrate pollution of ground waters in India,*Water Science and Tecnology.*, **39(3),** 67-75 **(1999).**
2. Tripathi, Indra Prasad et.al.(2013)Charecterization of Diffuse Chemical Pollution in SatnDistrict ofVindhya Region, India, *International Research Journal of Environment Sciences,* Vol. 2(11), 46-60, November (2013)
3. PadmaparnaGhosh, Drug abuse: Ranbaxy, Dutch pharmaput paid to groundwater, *Down To Earth,* **14(17),** 7-8**(2005)**
4. BeheraBhagirath and Reddy V. Ratna., *Environment andAccountability: Impact of Industrial Pollution on RuralCommunitie, Economic and Political Weekly,* 257-265**(2002)**
5. Biradar B. S. and Biradar C.B., Groundwater pollution dueto improper treatment and disposal arrangements bydistillery - A case study. Chapter 36 in Trivedy, R. K. (ed.),"Industry and Environment'' Daya Publications Delhi,**(2002)**
6. Salunke K. J. and Karande S. M., Effect of pulp and paper mill effluent on the seed germination and early seedlinggrowth in Mungbean, Chapter 68 in R. K. Trivedy (ed.)Industry and Environment, Delhi, Daya Publications.**(2002)**
7. Kumar R.D., Senthil and Narayanaswamy .R.,Spectroscopic on the heavy metal pollution of the Sugarmill effluents and its impact on groundwater, Chapter 34 inTrivedy, R. K. (ed.). Industry and Environment, DayaPublications Delhi, **(2002)**
8. GowdSrinivasa S. and Kotaiah B., Groundwater pollutionby Cystine manufacturing industrial effluent around thefactory, *Environmental Geology,* **39(6)**, 679-682 **(2000)**
9. Singh K.P. and Parwana H.K., Groundwater Pollution dueto Industrial Wastewater in Punjab State and Strategies forits Control, *Indian Journal of Environmental Protection,***19(4),** 241-244 **(1998)**
10. Ma J., Ding Z., Wei G., Zhao H. and Huang T., Sources ofwater pollution and evolution of water quality in the WuweiBasin of Shiyang River, Northwest China. *Journal ofEnvironmental Management.,* **90,** 1168–1177 **(2009)**
11. Taebi A., Droste L.R., Pollution loads in urban runoff andsanitary wastewater, *Science of the total Environment,* **327,**175–184 **(2004)**
12. Petersen M.T., Rifai S.H., Suarez P.M., Stein A.R.,Bacteria loads from point and non-point sources in an urbanwatershed, *Journal of Environmental Engineering,* **131,**1414–1425 **(2005)**
13. Hasan M. Z., Panday S.., Pathak B. N., Bulusu, K..P.,Project No-1428, NEERI Nagpur, **(1981)**
14. ICMR Manual of standards of quality for drinking water,ICMR Delhi 2nd ed, **(1975)**
15. NEERI manual on water and waste water analysis, Nagpur**(1988)**
16. WHO, guidelines for drinking water quality, **(1994)**
17. Standard method for the examination of water and wastewater, APHA AWWA and WEF, 18th ed. **(1992)**
18. Piper C.S., A laboratory manual of methods for theexamination of soil and the determination of the inorganicconstituents of plant, Original Edition-1942. Printed inIndia.Scientific publishers Jodhpur (Raj.) India **(1942)**
19. Suthar, K., Sharma, R., Mathur, R. and Sharma,S.(2012): Physico - chemical and microbiologicalstudies of drinking water of Palidistrict,Rajasthan. J. of Chemical, Biological and Physical, 2: 1061 – 1088.
20. Bhanja, K. M. and Ajoy, K. P.(2000): Studies

onthe water quality index of riverSanamachnakandan at KeonjherGarh, Orissa,India. Poll. Res., 19: 377- 385.
21. Abdul Jameel, A., Sirajudeen, J. and Abdul Vahith,R. (2012): Studies on heavy metal pollution ofground water sources between Tamil Nadu andPondicherry, India. Advances in Applied ScienceResearch, 3: 424 – 429.
22. WHO (1993) Guidelines for drinking water. Vol. 2, Recommendations, World Health Organization Geneva.

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