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REPORT

Physico-Chemical and Metallic Characterization of Industrial Effluent and Nearby Well Water in Pen Region, Dist. Raigad, Maharashtra

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The paper presents the results on physico-chemical studies of different water and industrial samples of highly polluted industrial area of Pen. The author has analyzed the samples for water quality parameters like colour, pH, total hardness (TH), chlorides (Cl^-), calcium (Ca), magnesium (Mg), acidity, alkalinity, COD, BOD, Na, Cu, Cd, Pb, Fe etc. For the impact assessment of industrial wastes some nearby soil and ground water samples were also analyzed. The results are being discussed in the light of pollution status of the area and literature on public health aspects.

INTRODUCTION

Water is most essential commodity in the living system. In the last few years, water pollution problem has reached a crisis point[1]. Water pollution may be defined as the addition of any substance to water, as a result of which the natural and original physical and chemical characteristics of water are adversely altered.

Water is used for a variety of purposes such as drinking and cooking, cleaning of utensils and floors, washing of clothes, bathing, irrigation and industrial use. In this connection, it was considered essential to analyze the physico-chemical and metallic characteristics of certain samples from Ispat Industries Ltd. It is located near Pen town at a distance of 8 kilometres towards South. The area also possesses industries like chemical manufacturing, stone crushers, tiles manufacturing etc. The untreated or partially treated effluents are discharged into "Dharamther Khadi". There is also some chance of contamination of well water in the area[2].

EXPERIMENTAL

Samples were collected from different sampling stations as follows: W1: untreated effluent; W2: treated effluent; W3 (from Ispat Industries, Pen): effluent from drains to Dharamther Khadi; W4: water from nearby plants; W5: water from open well; and W6: water from bore well.

Sampling was done in the month of July 2002 from Dharamther Khadi, well water, handpump water and nearby plants of Pen city. All effluent samples were collected in one litre plastic cans and preserved until testing was done according

to standard methods[3]. The pH and conductance were measured by Equip-Tronics model No. EQ-611, while other paremeters like colour, odour, acidity, alkalinity, chlorides, calcium, magnesium, COD, BOD etc. were determined according to standard literature methods[4].

RESULTS AND DISCUSSION

The results obtained during the course of the present investigation are presented in Tables 1 and 2. The ground water was not colourless. It appeared pale green-blue in large quantities. All the samples were observed as colourless and odourless.

TABLE-1
PHYSICO-CHEMICAL CHARACTERISTICS OF WATER AND INDUSTRIAL WASTEWATER

Parameters	Sample No.					
	W1	W2	W3	W4	W5	W6
pH	9.4	8.9	7.6	6.9	7.1	7.3
Conductivity	510	480	410	370	281	288
Hardness	180	160	340	344	268	780
Alkalinity	216	244	56	—	288	528
Chlorides	97.98	100.82	301.04	201.64	61.06	386.24
Calcium	83	86	99	121	117	344
Magnesium	6.9	11.8	22.6	9.8	17.7	19.7
COD	< 9.5	< 9.5	< 9.5	974.63	< 9.5	< 9.5
BOD	1.8	0.6	0.6	384.0	0.9	0.6

Except pH and conductivity, the values are expressed in mg/L, conductivity values are in mho cm^{-1}

TABLE-2
METALS IN WATER AND INDUSTRIAL EFFLUENT SAMPLES

Sample No.	Na	Cu	Cd	Pb	Fe
W1	89.12	0.03	0.01	0.11	0.06
W2	83.05	0.02	0.02	0.34	0.30
W3	66.16	0.02	0.05	0.03	0.05
W4	42.73	0.05	0.01	0.41	31.7
W5	15.06	0.02	0.05	0.33	0.13
W6	54.12	0.02	0.04	0.58	6.24

Metal concentration in μg/mL.

pH is one of the most important physico-chemical parameters. It affects soil quality and many micro-organism activities. For Ispat effluents it was in the range of 7.6 to 9.4 which is alkaline in nature. Other three samples out of 6 were nearly neutral in nature having pH 7. The alkaline nature is due to basic compounds

used in industry. The pH values of ground water samples (W4–W6) were within permissible limits, *i.e.*, 6.9 to 7.3.[5]

Conductance is increasing due to the presence of salts and contaminamts in the waste water. The water samples W1 to W3 show conductance in the range 410 to 510 μmho cm^{-1}. while samples W4, W5 and W6 show it to be 370, 281 and 288 μmho cm^{-1} respectively (Table-1).

The hardness in all the samples was found to be in the range 160–780 mg/L. Hardness in W6 is higher. The higher values of hardness make water unsuitable for drinking purpose. It needs pretreatment before use. The other samples W1, W2 and W5 have low hardness. Therefore these water samples are suitable for drinking.

The sample W3 shows alkalinity 56.0 mg/L while other samples like W1, W2, W5 and W6 have alkalinity higher than 100 mg/L. Therefore these water samples are not desirable for domestic use[2, 4].

The chloride content in all samples was found in the range 61 to 384.24 mg/L. Natural water contains low chloride ions. The water samples W1, W2, W5 have low chloride content. The permissible values are based on taste with less than 250 mg/L. The water samples W3, W6 are not permissible because they contain high chloride concentrations having salty taste. The permissible limits have been prescribed by WHO and ISI.[6]

Calcium is one of the most abundant substance of natural water. Disposal of sewage and industrial waste are also important sources of calcium. The calcium content in the samples was found in between 83–344 mg/L. The sample W6 contains 344 mg/L of calcium which is higher and it is not desirable for washing, laundering, etc. The water samples W1, W2 and W5 contain low calcium. Therefore they can be used drinking and domestic purposes[4, 6].

Magnesium was found to be in the range 6.9–19.7 mg/L. High concentration of magenisum has a laxative effect specially on new users. Water becomes unpalatable before toxic concentrations of magnesium are reached. Magensium content in all samples collected falls within the limits prescribed.

COD and BOD

COD was found to be < 9.5 mg/L except in sample W4. In sample W4, COD was detected to be 974.6 mg/L. The very high value is because of percolation of organic pollutants from the nearby industrial plant. BOD was detected to be 0.6–1.8 mg/L in all samples except W4 (384 mg/L. High BOD in sample W4 is because of percolation of organic pollutants from the industry towards the water (Table-1).

Trace metals concentration obtained by atomic absorption spectrometric analysis is tabulated in Table-2. Concentration of Na in all the samplles was found to be in the range 15.06–89.12 mg/L. It is high concentration. Only in W5 it was lower. The concentration of Pb was found to be 0.037–0.58 mg/L, whereas Fe concentration was in the range of 0.06–31.7 mg/L in all the samples (W1–W6). Fe in W4 is much higher. Metal concentrations[7, 8] in some samples are much higher because of percolation of industrial effluents through soil strata.

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REFERENCES

1. J.R. Kulkarni and V.S. Shrivastava, *Indian J. Environ. Prot.*, **20**, 252 (2000).
2. V.S. Shrivastava, *Indian J. Environ. Prot.*, **16**, 328 (1996).
3. APHA, Standard methods for the examination of water and waste water, 17th Edn., American Public Health Association (1989).
4. R.K. Trivedy and P.K. Goel, Chemical and Biological Methods for Water Pollution Studies. Environmental Publication, Karad, India (1984).
5. S. Tiwari, S. Khan and (Miss) H. Mohabey, *Asian J. Chem.*, **13**, 350 (2001).
6. R.S. Lokhande and C.N. Sathe, *Asian J. Chem.*, **13**, 190 (2001).
7. V.S. Shrivastava and J.R. Kulkarni, *Indian J. Environ. Prot.*, **20**, 252 (1999).
8. V.S. Shrivastava and G. Chaudhari, *Indian J. Environ. Ecoplanning*, **3**, 707 (2000).

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