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PHYSICO-CHEMICAL ANALYSIS OF HEAVY METAL CONTAINING EFFLUENTS

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ABSTRACT

Industrial Effluents entering the water bodies is one of major sources of environmental toxicity. It not only affects the quality of drinking water but also has deleterious impact on the soil microflora and aquatic ecosystems. The south Gujarat area is "Toxic Hotspot" in the state. In the presence study we collected effluent sample From Different Industrial area near Vapi Gujarat .The parameters such as temperature, of the water have been studied using standard protocol APHA. The levels of heavy metal pollution such as mercury (Hg), Arsinate (As) and Nickel (Ni) were determined by using Atomic Absorption Spectrophotometer (AAS). The physicochemical analysis reveals that the all the samples are polluted and having the values higher than the permissible limits. Some remedial steps to be taken for avoiding water pollution.

KEYWORDS: Industrial Effluent, Physicochemical, Pollution, Metal concentration , Atomic Absorption Spectrophotometer.

INTRODUCTION

Environmental pollution in its various forms constitutes a serious threat to the well being and the prosperity of our world. This is so because of the various undesirable changes it triggers on the physical, chemical and biological characteristics of air, water and soil, finally affecting humans, animals plants and microbial life [1]. Pollution is usually caused by human actions but can also be the consequences of natural disasters [2]. A pollutant is defined as a substance that occurs in the environment as a result of human activities and which has a harmful effect on the environment [3]. Domestic, industrial and agricultural processes and other sources produce large quantities of waste products that cause rapid changes to the environment. Exposure to these pollutant at sufficiently high Concentration can cause a variety of health problem [4].

The heavy metals is very prominent in industrialized and mining areas and these metals are released or leached to the water bodies[5][6]. Heavy metals have also been found to be highly toxic especially when their natural concentrations are exceeded. At normal concentration, they promote the functions of the enzymes but could lead to a lot of adverse metabolic reaction when their concentration rises beyond tolerance limit. Such heavy metals as Hg, arsenate and ,nickel are very harmful to the body; they form complexes with certain enzymes . These heavy metals find their way into water bodies from industries that generate them as part of their waste effluents. The heavy metals have cumulative effects over the years; the presence of these heavy metals in the ecosystems has increased as a result of increase in industrialization process. Health problems such as genetic mutation, deformation, cancer, kidney problems etc, have been attributed to pollution by heavy metals. Therefore finding the level of pollution and effluent analysis this study conducted near industrial area Vapi Gujarat.

MATERIALS AND METHODS

The samples of untreated effluent were collected from industrial area near vapi. sample were store at room temperature for 30 day before analysis .

Determination of physico-chemical parameters

The Physico-chemical parameters of the samples were investigated as shown: color, pH, total dissolved solid, (TDS), Total solid (TS), total suspended solid (TSS), Others include: total acidity,biochemical oxygen demand (BOD) and

chemical oxygen demand (COD) using standard procedures.The metals concentration determined in sample by Atomic Absorption Spectrophotometer [7] .

RESULTS AND DISCUSSION

Overall all the parameters were found on the higher side and the pollution levels and hence proper treatment methods are advised before the industrial effluents are released to the sewage. The data of different physical ,and chemical parameters are presented in Table-1 andTable-2.metal concentration by AAS presented in table-3 and graphs.

Table-1 Physical Parameter For Effluent

parameter	Sample number									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
colour	Light yellow	Light yellow	white	Dark black	Light green	Light yellow	Light yellow	colorless	Drak black	Dark red
PH	1.56	1.61	1.96	1.32	2.06	2.15	1.96	6.26	2.56	1.82
Total solids (mg/l)	70	90	40	160	110	50	40	60	170	100
Total dissolved solids (mg/l)	50	81	32	140	98	43	29	56	168	97
Total suspended solids (mg/l)	20	09	08	20	12	07	11	04	02	03

pH

The pH values are in the range 1.32-6.26. This is in accordance with the WHO permissible limit (6.0-8.5). only sample number 8 have permissible PH range.other sample has very lower pH that may cause problems to survival of aquatic life. It also interferes with the optimum operation of wastewater treatment facilities. Water with high or low pH is not suitable for irrigation. At low pH most of the metals become soluble in water and therefore could be hazardous in the environment. At high pH most of the metals become insoluble and accumulate in the sludge and sediments. The toxicity of heavy metals also gets enhanced at particular pH [8].

Total solids

Total dissolved solid is the measure of total inorganic salts and other substances that are either in dissolved or in undissolved form present in water.TS of sample ranging between 40-170 mg/l.

Total dissolved solids

Total dissolved solid is the measure of total inorganic salts and other substances that are dissolved in water. The effluents with high TDS value may cause salinity problem if discharged to irrigation water8.The total dissolved solids in various industrial effluents ranged from 1557- 39643 mg /L. but all 10 effluent samples has TDS range between 29-168 mg/l .

Total Suspended solids

In the present Study, the total suspended solid were found in the range of 2-20 mg/l, which was very higher value compare to limit set by WHO.

Table-2 Chemical parameter for Effluent										
parameter	**Sample number**									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Acidity (mg/l)	150	110	92.5	-	154	87.5	68	-	69	78.5
Dissolved oxygen(mg/l)	2.18	1.76	1.88	2.54	1.22	2.71	2.80	1.28	1.60	1.51
Biological oxygen demand(mg/l)	27	12	17	29	17	24	27	09	44	23
Chemical oxygen demand (mg/l)	1984	534	1144	1984	915	1908	763	764	4197	534
Chloride (mg/l)	3539	5172	3130	8167	2314	5445	4900	3947	7623	5174

Acidity

Acidity of samples ranging between 68-154 mg/l. In essence, the acidic constituents in the discharge from the production activities being carried out in this industry are maximum. Although, there is no specified limit set by WHO, it is well known that the acidic level of an industrial effluent can determine the toxicity of other chemicals in wastewater and thus, renders it unfit for aquatic life (Poppe et al, 2006).

Dissolved Oxygen (DO)

Dissolved oxygen levels are found to be very low and hence a lot of oxygen has been used up. It shows the increased concentration of organic matter. Dissolved oxygen of sample ranging between 1.22-2.54 mg/l.The presence of free oxygen in water is an indication of the ability of that water to support biological life. Low value of DO may be due to higher water temperature and increased activity of microorganisms in the water which consumes a lot of oxygen due to metabolic process and the decomposition of organic material [9].

BOD (biological oxygen demand) and COD (chemical oxygen demand)

BOD measure the amount of oxygen requires by bacteria for breaking down to simpler substances from the decomposable organic matter present in any water and COD test is useful in pinpointing toxic condition and presence of biological resistant substances. In present study BOD ranging between 9-44 mg/l and COD ranging between 534-1984 mg/l which higher than WHO limit.

Chlorides

Concentration of Chloride varied from 2314-8167 mg/l . all sample has higher concentration of chloride than who limit. The fear of high level of chloride causing threat to all forms of biotic life is therefore not a problem rather its availability in small amount is beneficial to both plants and animals [10]. Highcontration of Chloride may due to use Chlorine compounds, like Hydrochloric acid, Hypochloric acid, chlorine gas [11].

Table-3 Metal concentration determination by Atomic Absorption Spectrophotometer										
Metals	Sample number									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Mercury (PPB)	6.0603	4.5448	5.4930	4.5861	5.0189	3.3081	16.0254	11.6683	4.5964	21.3769
Arsenic (PPB)	37.996	27.1777	30.7092	38.7367	38.0439	14.7816	14.6421	9.306	5.632	8.068
Nickel (PPM)	0.0417	0.0600	0.0028	0.110	0.2842	0.1197	0.1075	0.0077	1.2940	0.0953

Mercury
Mercury concentration in all sample ranging between 4.5448-21.3769 PPB. Major sources of mercury exposure include dental amalgams (vapor), fish (methylmercury), and vaccines (ethylmercury). Toxic effects, he suggests, spread across a broad spectrum of diseases including autism, Alzheimer's disease, ALS, multiplesclerosis, Parkinson's disease, neurodevelopmental diseases, nephrotoxicity, and cancer.

Arsenic
Arsenic concentration in all sample ranging between between 5.632-38.0439 PPB.

Nickel
Nickel concentration in all sample ranging between 0.0077-1.2940 PPM. Nickel is a ubiquitous metal frequently responsible for allergic skin reactions and has been reported to be one of the most common causes of allergic contact dermatitis, as reflected by positive dermal patch tests[12].

CONCLUSION
From the result of physico-chemical analysis of industrial effluents, it has been concluded that ,TS,TSS, TDS,Chlorides, BOD, COD, Sodium and Calcium are very high in concentration compared to the standards prescribed by WHO. all samples show acidic PH indicative of higher acidic pollutant in effluent. Such effluent should not be discharged in to the nearby water body or soil without treatment. They are unfit for irrigation. The high level pollution of the industrial effluents cause's environmental problems which will affect plant, animal and human life.

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