# Physicochemical and seasonal changes of some selected polluted sites of Ankaleshwar GIDC

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**ABSTRACT**

*In present study seasonal collection of wastewater samples were done in 2011 from different places of Ankleshwar GIDC, Gujarat. The four sites are Amalakhadi, Vallya chokdi near, nalla near Byers Company and nalla near Cadila health care selected for wastewater collection. The collected wastewater samples were analysis for physico-chemical tests and heavy metals. In present study Vallya chokadi and Amalakhadi are most polluted places in Ankleshwar GIDC, Gujarat because these two places contains heavy metals Chromium (Cr) 4.219 mg/l and 5.598 mg/l, Lead (Pb) 3.232 mg/l and 2.695 mg/l, Cadmium (Cd) 6.420 mg/l and 5.060 mg/l were measured..*

**Keywords:** Wastewater, Physico-chemical, Heavy meals and Seasonal collection
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## INTRODUCTION

Gujarat has witness impressive industrial development since its formation as a state in 1960. The industrial sector at present comprises of over 1200 large industries and over 3, 12,000 micro, small and medium industries. As per the results of the Annual Survey of Industry (ASI), 2004-2005 carried out by the Central Statistical Organization (CSO), under Ministry of Statistics [1-2].

Gujarat has more than 90,000 industrial units, according to the state government. About 8,000 of these units are polluting, also says the state government. Major polluting industries are located in the Vadodra Petrochemical Complex, Nandesari, Ankleshwar, Vapi, Vatava and Hazira near Surat. Ankleshwar the city is called as "Golden Corridor". Here hundreds of small and medium factories manufacturing chemicals, dyes, paints, fertilizer, plastics, pulp and paper, spew untreated waste into the air and waters[2].

Due to industrialization heavy metals like cadmium (Cd), chromium (Cr), lead (Pb) and Arsenate (As) is been present in industrial effluent which is hazards not only for humans but also to whole ecosystem and it's create diseases viz. cancer, skin, kidney etc. The well water from Bharuch site were mainly contaminated with Cr and Mn whereas Ankleshwar site contained Fe above the standard limit for irrigation. The well water has shown salinity and alkalinity hazards [3-4].

Water contaminated with metallic effluent can cause several health problems. Lead for instance, can interfere with enzyme activities and formation of red blood cells. It can affect nerves and brain at low concentration. Heavy metals such as mercury, cadmium, and chromium can bio-accumulate, and through the food chain, to toxic levels in man. Mercury can cause numbness, locomotors disorders, brain damage, convulsion, and nervous problems. Cadmium is responsible for kidney tubular impairment and osteomalacia [4-5].

Cadmium, zinc and manganese are reported to affect ion regulation if present in sufficient concentrations. Cadmium and manganese are also known to affect calcium metabolism, development and skeletal calcification as well as long term effect on spawning and recruitment of fish and other aquatic lives [5].

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The parameter of pH is very important because hydrogen ion concentration is an important variable, associated with major the reactions related to water quality. Any change in pH of water bodies as a result of influx of effluent, can cause serious change in water chemistry, which can affect resources especially around the coastal areas. These effects on water bodies can be very significant. Dyes in water bodies also affect photosynthetic organisms and consequently impact negatively on the food chain. The reason for this global effect also lies in the weather systems and the biogeochemical cycling of elements, which aid in rapid dispersal of the pollutants [5-6].

Lead is commonly found in industrial settings and lead exposure has the tendency to cause adverse health effects. The adverse health effects induced by lead exposure are depend on two important components: dose (how much of a contaminant) and duration (how long there has been contact with the contaminant) (ATSDR, 1999). Exposure to lead can occur from eating and drinking contaminated water or breathing in high levels of lead (ATSDR, 1999). Children are exposed to lead through eating lead based paint chips or through skin adsorption while playing in lead contaminated soil. These hazardous materials enter in the human body by the air we breathe, the drinking water and from the food [6-7].

In present study water quality of industrial wastewater of Ankaleshwar was done.

## MATERIALS AND METHODS

After survey Ankleshwar GIDC sides, twelve sides were selected for sample collection. First collection of effluent was done during the summer season, 2011. The selected places were Amalakhadi-1 (A1), Ashok pharma out let (A2), Randal optical outlet (A3), Nalla near SYNCHEM (A4), Nalla near Lean Tech. Ltd. (A5), Tolani factricator out let (A6), Amalakhadi-2 (A7), Vallya chokdi (A8), Shabri nalla (A9), SNCHEM out let (A10), Ice factory out let(A11) and nalla near UPL (A12). The collected samples were analyzed for pH, Dissolve oxygen (DO), Total alkalinity, Total acidity and Sulphate in laboratory condition. After that four sites were selected for wastewater collection [8]

Seasonal collection of wastewater samples were collected during the monsoon, post monsoon and winter, 2011 from Amalakhadi (A1), Vallya chokdi Near (A2), Byers Company (A3) and Nalla near Cadila health care (A4). These collected samples were used for physico-chemical analysis like pH, Nitrate (mg/l), Electro conductivity (ms/cm), Alkalinity (mg/l), Total hardness (mg/l) [8]. These samples were analyzed for determination of heavy metals like Chromium (Cr), Lead (Pb) and Cadmium (Cd). The collected samples were digested with $HClO_4$: $HNO_3$ (1:4 v/v) and diluted with milii −Q water. The concentrations of various metals were measured by using inductively Coupled Plasma Spectrometer, Perkin Elmer Corporation (ICP Optima 3300 RL) done in SICART.

## RESULTS

First seasonal wastewater sample collection in the Summer season, 2011.(Table: - 1 & 2)

### Table: - 1

| Sample No. | Dissolve Oxygen (mg/l) | Total Alkalinity (mg/l) | Total Acidity (mg/l) | Sulphate (mg/l) | Hardness (mg/l) | pH |
|---|---|---|---|---|---|---|
| A1 | 1.90 | 365 | 180 | 500 | 67.2 | 7.87 |
| A2 | 1.81 | 600 | 460 | 210 | 31 | 6.98 |
| A3 | 1.52 | 1200 | 96.00 | 430 | 220 | 8.05 |
| A4 | 1.52 | 720 | 265 | 1600 | 130 | 6.57 |
| A5 | 1.90 | 0.00 | 1180 | 600 | 25 | 1.74 |
| A6 | 2.05 | 760 | 96.00 | 150 | 289 | 8.35 |
| A7 | 1.52 | 745 | 254 | 380 | 77 | 6.54 |
| A8 | 1.74 | 820 | 12 | 680 | 162 | 6.71 |
| A9 | 1.44 | 104 | 725 | 680 | 38 | 4.86 |
| A10 | 1.52 | 72 | 12 | 240 | 72 | 7.09 |
| A11 | 2.43 | 80.30 | 0.00 | 150 | 121 | 7.85 |
| A12 | 2.20 | 50 | 0.00 | 220 | 181 | 7.59 |

Selected four sites to analyzed for determination of heavy metals (Table: - 2).

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**Table: - 2**

| Sample No. | Ammonical Nitrate (mg/l) | Nitrate (mg/l) | E.C. (ms/cm) | BOD (mg/l) | COD (mg/l) | Heavy metals | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Cd (mg/l) | Cr (mg/l) | Pb (mg/l) | As (mg/l) |
| Water A1 | 460 | 139 | 3.93 | 217 | 715 | 5.060 | 4.219 | 3.232 | BDL |
| Water A2 | 253 | 185 | 8.33 | 194 | 756 | 6.420 | 5.598 | 2.695 | BDL |
| Water A3 | 814 | 127 | 4.52 | 173 | 547 | 2.303 | 2.219 | 1.231 | BDL |
| Water A4 | 698 | 158 | 3.62 | 251 | 886 | 3.231 | 3.462 | 1.904 | BDL |

Second seasonal wastewater and soil samples collection:  The post monsoon season, 2011. (Table: - 3)

**Table: - 3**

| No. | Total Alkalinity (mg/l) | Total Acidity (mg/l) | Nitrate (mg/l) | Sulphate (mg/l) | PH | E.C. (ms/cm) | Hardness (mg/l) | Ammonical Nitrate (mg/l) | Dissolve Oxygen (mg/l) | COD (mg/l) | BOD (mg/l) | Heavy metals | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Cd (mg/l) | Cr (mg/l) | Pb (mg/l) | As (mg/l) |
| Water A1 | 460 | 600 | 87.5 | 210 | 6.98 | 3.13 | 42.5 | 103.5 | 6.19 | 421 | 162 | 1.82 | 0.952 | 1.369 | BDL |
| Water A2 | 253 | 198 | 90.8 | 240 | 7.09 | 5.41 | 34.8 | 111.8 | 5.54 | 482 | 183 | 2.26 | 1.36 | 3.542 | BDL |
| Water A3 | 98 | 69.9 | 112.5 | 151 | 7.85 | 8.01 | 23.2 | 98.5 | 3.43 | 624 | 215 | 8.20 | 0.631 | 2.25 | BDL |
| Water A4 | 86 | 86.3 | 104.2 | 229 | 7.43 | 5.05 | 19.6 | 142 | 4.23 | 548 | 197 | 25.20 | 0.621 | 1.96 | BDL |

Third seasonal collection for wastewater and soil samples: The winter season, 2011. (Table:- 4)

**Table: -4**

| Sample No. | Total Alkalinity (mg/l) | Total Acidity (mg/l) | Nitrate (mg/l) | Sulphate (mg/l) | PH | E.C. (ms/cm) | Hardness (mg/l) | Ammonical Nitrate (mg/l) | Dissolve Oxygen (mg/l) | BOD (mg/l) | COD (mg/l) | Heavy Metals | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Cd (mg/l) | Cr (mg/l) | Pb (mg/l) |
| Water A1 | 942 | 60.9 | 26.5 | 361 | 11.08 | 8.16 | 182 | 138.89 | 8.03 | 112 | 453 | 2.338 | 6.576 | 1.481 |
| Water A2 | 570 | 13.9 | 22.5 | 236 | 9.27 | 6.53 | 268 | 135.86 | 7.65 | 98.23 | 324 | 12.350 | 9.090 | 6.854 |
| Water A3 | 396 | 9.50 | 23.0 | 910 | 8.71 | 10.50 | 216 | 128 | 9.06 | 122 | 654 | 15.30 | 3.650 | 11.67 |
| Water A4 | 214 | 6.85 | 18.6 | 453 | 7.65 | 14.45 | 267 | 122 | 12.05 | 156 | 762 | 27.99 | 6.939 | 15.57 |

**DISCUSSION**

Samples collected during the summer season, 2011 shows high Sulphate concentration. High values of Sulphate signify increased decomposing of plant and animal material by autotrophic plants and incorporated into amino acids. The pH is very important become hydrogen ion concentration is an important variable, associated with major the reactions related to water quality. pH was observed in range of 6-8 which was slight basic due to high alkalinity of water. Handique (1998) has confirmed that the value of Sulphate gradually increased from summer & reaching high of pick during winter. During summer season temperature was high so, dissolved oxygen values were low in summer because oxygen holding capacity of as water was decreased at high temperature alkalinity was high that was generally due to the presence of carbonate, bicarbonate and hydroxide. Khan *et al* (1996) reported that the higher values of alkalinity in summer & post monsoon and reduced values in monsoon due to dilution effect [9-10].

In the post monsoon wastewater samples collected and analyzed for physico-chemical analysis like pH, Nitrate, Electro conductivity, Alkalinity, Total hardness. These samples were analyzed for determination of heavy metals like Chromium (Cr), Lead (Pb) and Cadmium (Cd). During the analysis of it was found that cadmium was higher in soil samples while lower in wastewater samples and arsenate were absent in all collected samples. Lead was present in all wastewater and soil samples. Electro-conductivity and dissolve oxygen were slide increase in wastewater samples [10-11].

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In the winter seasonal samples of wastewater samples collected shows high alkalinity and low acidity. The electro-conductivity, Sulphate and dissolved oxygen were higher in all the collected samples due to many minerals was present in higher concentration in all samples. Nitrate content was higher in all soil samples while low in water samples because during winter season phytoplankton were in more numbers and they consume more nitrate for physiological needs and photosynthesis rate was higher during winter in algae and hydrophytes. Total hardness was high in all wastewater samples it was because of calcium and magnesium ions [12].

## CONCLUSION

In present investigation lower values of dissolved oxygen were recorded in the summer seasons and highest values in the post monsoon and winter seasons. In summer Biological Oxygen Demand (B. O. D.) becoming lower because of higher temperature kills micro and macro organisms in water body and degradation of dead body of water organisms consume more oxygen.

Electro-conductivity, hardness and pH were higher during the winter seasons and lower during post monsoon and summer seasons. While heavy metals were detected in highest during winter seasons and lowest during summer seasons.

## REFERENCES

[1] Agency for Toxic substances and Disease Registry, ATSDR. **1999**. http://www.atsdr.cdc.gov.
[2] Aksu Z., Egretli G. and Kutsal A. *Process biochem.*, **1998,** 33: 393-400.
[3] Patel KP, Pandya RR, Maliwal GL, Patel KC, Ramani VP  *Polln Res*, **2003, 22**(2), 241-245**.**
[4] Asamudo, N. U., Daba A. S and Ezeronye O. U.*African Journal of Biotechnology.* **2005**, Vol. 4 (13), pp. 1548-1553,
[5] De Filippis LF, Pallaghy CK, E. *Scheizerbartsche Press*, Stuttgart, **1995,** pp. 31-77.
[6] Howells G (1990). Acid rain and Acid waters**.** *Ellis Horwood Series In Environmental Science. Ellis Horwood Ltd. New York*. pp. 134-136.
[7] Natural and Accelerated Bioremediation Research (NABIR) Program, Office of Biological and Environmental Research, Office of Science, U.S. Department of Energy. *What is Bioremediation.* **2003**. pp. 9.
[8] APHA, AWWA, WPCF, (19th Ed.), Washington D.C. 1995.
[9] Volesky B, Holan ZR. *Biotechnol.Progress,* **1999,** 11(3): 235-250.
[10] Nagendra Kumar Chaurasia and Ram Krishna Tiwari, *Advances in Applied Science Research***, 2011**, 2 (5): 207-211.
[11] A. Abdul Jameel, J. Sirajudeen and R. Abdul Vahith, *Advances in Applied Science Research*, **2012**, 3 (1):424-429.
[12] Animesh Agarwal and Manish Saxena, *Advances in Applied Science Research,* **2011**, 2 (2): 185 -189.