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Study water pollution spectrum in and around industrial areas of District Shahdol (M.P.) India

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Abstract
The present study intended to calculate Water pollution of industrial areas of well water samples in Shahdol district Madhya Pradesh, India were monitored. The quality of bore waters was assessed by comparing with existing standards for important parameters. Water pollution calculated from six parameters. The water was not conforming to drinking standards, and hence it is suggested to take all the necessary precautions before the waters are sent into public distribution system. It is concluded that WQI can be used as a tool in comparing the water quality of different source.

Keywords: Conductivity, pH, Biological Oxygen Demand, Chemical Oxygen Demand, Dissolve Solid

Introduction

Drainage from coal mines is one of the most important environmental legacies of industrial economies. Problems associated with coal mine drainage include sedimentation of chemical precipitates, soil erosion, loss of aquatic habitat, and the corrosion of bridge abutments, culverts, and other structures due to contact with acid water having high dissolved metal loads (Albers and Camardese, 1993 [1]; Sengupta, 1993[2]; Rosseland *et al.*, 1990) [3]. The extensive nature of mine drainage in many regions necessitates watershed-scale assessments and prioritization of remediation efforts (Gray, 1997) [4]. A cost-effective method to identify, map, and monitor the most severely degraded mine discharges and receiving streams would benefit regulatory authorities and environmental agencies, especially in areas where rough terrain or poor roads limit accessibility.

India's environment is becoming fragile and environmental pollution is one of the undesirable side effects of industrialization, urbanization, population growth and unconscious attitude towards the environment. At present, environmental protection is the main need of the society. Though industrialization and development in agriculture are necessary to meet the basic requirement of people, at the same time it is necessary to preserve the environment. In India, too, the environmental pollution has become a cause of concern at various levels (Paul, *et al.* 2012) [5]. In India, due to lack of sewage treatment plants, generally untreated sewage effluents are released either on agricultural land for irrigation or disposed of in nearby water bodies (Ladwani, *et al.* 2012) [6]. In general, sewage effluents from industries and municipal origin contain appreciable amounts of plants nutrients and variable amount of metallic cations like Zn, Cu, Fe, Mn, Pb, Ni, Cd, etc. Long-term irrigation with such effluents increases EC, organic carbon content Thus, it becomes necessary to study the composition of sewage waters and heavy metals accumulation, with the help of advance techniques. Therefore, studies have been carried out in Sitapura industrial areas of Jaipur in the state of Rajasthan (India) under the Environmental Engineering laboratory. Industries are major sources of pollution in this area. Based on the type of industry, various levels of pollutants can be discharged into the environment directly or indirectly through public sewer lines. Wastewater from industries includes employees' sanitary waste, process wastes from manufacturing, wash waters and relatively uncontaminated water from heating and cooling operations. The goals of our project is to characterize the waste water circulating around the Sitapura area of Jaipur in the post monsoon season to reduce pollution inputs, particularly toxicants, to restore natural productivity and to promote sustainable development of the surrounding as well as regulate the quality of the effluent realized into the environment. To fulfill this need specified waste water characterization guideline has been given by "Central Pollution Control Board" of India. These guideline documents are comprehensive, detailing the sampling methods, QA/QC requirements, parameters to be measured for the different types of industry and the analytical methods to be used. During this I have characterized the wastewater from four different areas using sampling over a one to three day period (Ram, *et al.* 2011 and Sharma, *et al.* 2012) [7, 8].

Study Area

The present study is carried in Orient paper mill (OPM), Amlai, Thermal power plant (TPP), Chachai, Hukumchand jute mill (HJM), Amlai and Coal field areas in Shahdol (M.P.). Each industrial area is divided into one zones to select sampling area.

Location of sampling points

The method of random sampling was adopted to collect water pollution samples area and around industrial areas of Orient paper mill (OPM), Amlai, Thermal power plant (TPP), Chachai, Hukumchand jute mill (HJM), Amlai and Coal field areas in Shahdol (M.P.). The location of sampling station should be such that it should be in the free atmosphere, without interferences from stagnant spaces or large buildings etc. The selected parameters are Temperature, Colour, Turbidity, BOD, COD and Hardness. The high volume air sampler is used to collect the air samples at each sampling area as standards, for each different parameters and chosen

samples were analysed in the laboratory by following standard methods during the period of year 2012 and 2013.

Site Description

The Shahdol urban and rural parts are located in the East-south part of Madhya Pradesh. This district is situated between 23°00' N and 24°18'N latitude and 81°00' E to 82°00' E longitude, extending 100 Kms. The climate of the study area is seasonally dry tropical savannah with four Seasons.

Materials and Method

Various physical and chemical tests were done for the analysis of the sample.

1. Colour of the sample was compared with the glass comparator and colourless distilled water. In coloured sample, it is impossible to match the colour with standard so in this case the yellow colour of the sample was assumed.
2. pH meter: Consisting of potentiometer, a glass electrode, a reference electrode and a temperature compensating device was used to measure pH of samples
3. Conductivity is the capacity of water to carry an electrical current and varies both with number and types of ions in the solutions, which in turn is related to the concentration of ionized substances in the water which was measured by conductivity meter.
4. The potentiometric method was used since the sample was colored and turbid.
5. The Biochemical Oxygen Demand (BOD) is an empirical standardized laboratory test which measures oxygen requirement for aerobic oxidation of decomposable organic matter and certain inorganic materials in water, polluted waters and wastewater under controlled conditions of temperature and incubation period which was done for 3 days incubated at 27˚C in BOD incubator.
6. COD was done with open reflux method in which results was obtained in 3-4 hrs. The test is useful in studying performance evaluation of wastewater treatment plants and monitoring relatively polluted water bodies.
7. Hardness is determined by the EDTA method in alkaline condition. When EDTA was added as a titrant, Calcium and Magnesium divalent ions get complexes resulting in sharp change from wine red to blue which indicates end-point of the titration.

Results and Discussions

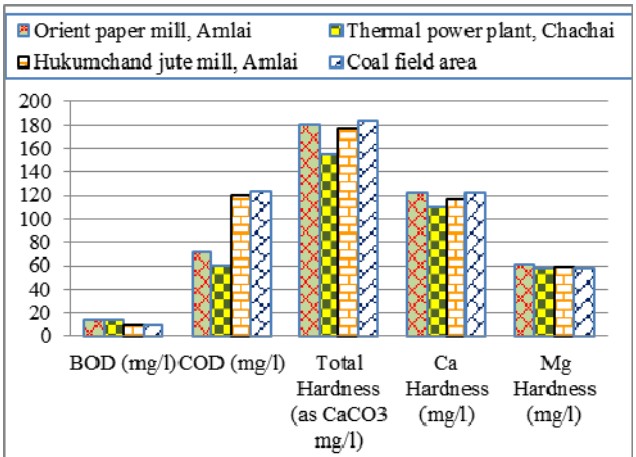
The results of physico-chemical parameters of industrial water at various points are given in table 1 and 2.

Table 1: Annual average of parameter of water analysis sampling site of Shahdol region 2012.

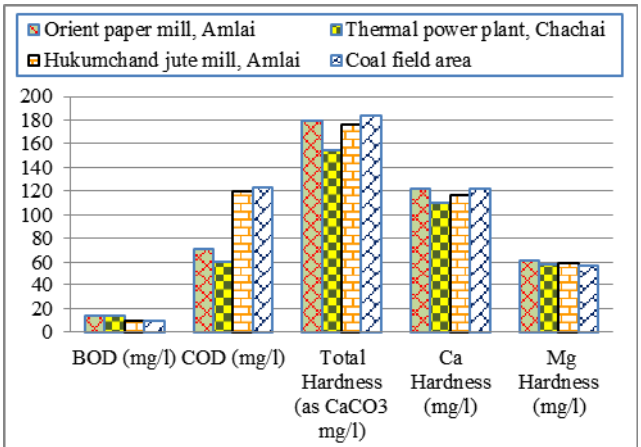
Parameters	Orient paper mill, Amlai	Thermal power plant, Chachai	Hukumchand jute mill, Amlai	Coal field area
Temperature	19.58	21.58	21.6	22.6
Turbidity	Turbid	Turbid	Turbid	Strong Turbid
Colour	Whitish	Light Whitish	Muddy	Light Muddy
BOD (mg/l)	21.75	15.25	11.75	8.75
COD (mg/l)	141.25	94.51	124	113.8
Total Hardness (as $CaCO_3$ mg/l)	183.25	177.00	173.5	182.3
Ca Hardness (mg/l)	121.50	119.25	124	119.8
Mg Hardness (mg/l)	63.25	69.75	70.25	58.5

Table 2: Annual average of parameter of water analysis sampling site of Shahdol region 2013.

Parameters	Orient paper mill, Amlai	Thermal power plant, Chachai	Hukumchand jute mill, Amlai	Coal field area
Temperature	20.38	19.88	21.08	21.33
Turbidity	Turbid	Turbid	Turbid	Strong Turbid
Colour	Whitish	Light Whitish	Muddy	Light Muddy
BOD (mg/l)	14.25	14.00	9.00	9.75
COD (mg/l)	71.58	60.25	120.4	123.4
Total Hardness (as $CaCO_3$ mg/l)	179.8	154.32	176.3	184.3
Ca Hardness (mg/l)	122.3	110.02	116.5	122
Mg Hardness (mg/l)	61.00	58.01	59.25	57.5



Graph 1: Annual average of parameter of water analysis sampling site of Shahdol region 2012



Graph 2: Annual average of parameter of water analysis sampling site of Shahdol region 2013

Temperature

The temperature of wastewater was higher than that of the water supply because warm municipal water October have been added. The measurement of temperature is important because most wastewater treatment schemes include biological processes that are temperature dependent. The temperature of wastewater October vary from season to season and also with geographic location. Here the samples were taken in pre and post monsoon season and temperature varied from 19-25°C.

Colour

Color has help to assess the qualitative characteristic for the general condition of wastewater. Wastewater which was pale white in color was collected from site 1, while a light-to-medium grey color was characteristic of wastewaters that have undergone some degree of decomposition since it was stored for some time. The color of site 4 sample was dark grey or black, showing the wastewater was typically septic, having undergone extensive bacterial decomposition under anaerobic conditions. The blackening of wastewater was October be due to the formation of various sulphides, particularly, ferrous sulphide. This results when hydrogen sulphide produced under anaerobic conditions combines with divalent metal, such as iron, which October be present. Color was measured by comparison with standards.

Electrical Conductance

(At 25°C) The electrical conductance is reciprocal to the electrical resistance and the G values show total ions per centimeter. It is a numerical expression of the ability of a water sample to carry an electric current. There was not much variation in the Site 1 samples between 1st and 3rd week but there was significance variation was noted in site 4 sample which was found to be 2846 µS in 1st week and 3846 µS. The total solids in a wastewater consist of the insoluble or suspended solids and the soluble compounds dissolved in water. The organic matter consists mainly of proteins, carbohydrates and fats. Between 40 and 65% of the solids in an average wastewater are suspended. In this fig. the sample of 1st week and 3rd week was compare and TS of 3rd week was found to be increased than 1st week.

Hardness

It is produced in waste water due to various reasons by multivalent metallic cations. Such ions are capable of reacting with soap to form precipitates and with certain anions present in the water to form scale, the divalent calcium, magnesium, strontium, ferrous iron, and manganous ions and derived largely from contact with soil and rock formation.

Chemical Oxygen Demand

COD determines the amount of oxygen required for chemical oxidation of organic matter using a strong chemical oxidant, such as potassium dichromate under reflux conditions.

Biochemical Oxygen Demand

BOD has been used as a measure of the amount of organic materials in an aquatic solution which support the growth of microorganisms. BOD determines the strength or polluting power of sewage, effluents and other polluted waters and provides data on the pollution load in natural waters. Higher values of BOD indicate a higher consumption of oxygen and a higher pollution load. The BOD values. No significant variation in BOD was observed between other sites

Summery & Conclusion

The sample collection procedures for characterizing the effluent loadings specified was found to be effective in quantifying the loadings from various. If the suspended solids are greater than 300 mg/L, the concentrations of parameters associated with suspended solids should be determined from the mean of grab samples. Although many of the measured parameters were less than detection limits, the list should still be used in the initial characterization. The parameter list can be amended in subsequent characterization measurements to exclude parameters that were found near detection limits (five times the MDL). The sampling program must be site specific and therefore site visits before the sampling program is as an important component of the characterization process. In the bioassay component of the characterization, it was found that it did not matter whether the acute and chronic toxicity procedures were carried out on grab or composite samples as the results for both types of samples were identical.

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