ISSN (Online) : 2455 - 3662
SJIF Impact Factor :4.924

EPRA International Journal of

Multidisciplinary Research

Monthly Peer Reviewed & Indexed
International Online Journal

Volume: 4 Issue:7 July 2018

Published By :
EPRA Journals

Volume: 4 | Issue: 7 | July 2018 SJIF Impact Factor: 4.924 ISSN (Online): 2455-3662

EPRA International Journal of
Multidisciplinary Research (IJMR)

COMPARATIVE STUDY OF SOIL AND WATER QUALITY IN THE INDUSTRIAL AREA OF ANGAMALY, KERALA, INDIA

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ABSTRACT
In the present study, physicochemical and biological quality of soil in industrial area of Angamaly, in Ernakulam District, Kerala, India was carried out. Dumping of industrial wastes and discharge of industrial effluent without proper treatment enhances the infiltration of harmful compounds to the ground water. Physicochemical parameters of soil and water like pH, Total Hardness, Magnesium Hardness, Calcium Hardness, Chloride content, Dissolved Oxygen, Chemical Oxygen Demand (COD) and Total Dissolved solids(TDS) were determined to find the extend of pollution and the reasons for the ground water problems in the selected area. The water quality parameters were found to be within the permissible limits specified by BIS standards.

KEY WORDS: *Soil quality, Ground water , pH, Total Dissolved Solids, Ca Hardness, Mg Hardness, Total Hardness, Chloride Content, Dissolved Oxygen, Chemical Oxygen Demand*

INTRODUCTION

Soil fertility is the inherent capacity of the soil to provide the essential plant nutrients in adequate amounts and in proper proportions for the plant growth (Rajan Kumar Basak., 2012). Soil characterization of a region is an important aspect in relation to sustainable agricultural production. The macronutrients and micronutrients are important soil elements that control its fertility and enhance the yield of crops (R. P. Singh, Mishra. , 2012; R. P. Singh, et al (2012)). Soil quality may include a capacity for water retention, carbon sequestration, plant productivity, waste remediation, and other functions, or it may be defined more narrowly (SS Kekane ETAL 2015; Ku Smita Tale et al, 2015).

But nowadays, groundwater pollution has emerged as one of the most significant environmental problem. In modern economies there are a large number of industries functioning across the world. With the advancement of it's functioning the environment is

getting more vulnerable to pollution. Dumping of industrial wastes containing large amount of various chemicals enhance the infiltration of harmful compounds to the ground water. Landfills, use of fertilizers, discharge of industrial effluent without proper treatment into nearby water bodies etc. are some human activities threatening the ground water.

Rapid determination of pollutants penetrating into the water is necessary for adequate measures to restrict environmental damages. Hence, there is an immediate need to identify potential water quality and devise appropriate methodologies for long term sustainability. Good quality of water resources depend on large number of physicochemical parameters , the magnitude and source of any pollution load ; and to assess that monitoring of these parameters is essential. Parameters for drinking water qualities are chemical, physical and microbiological. Physical parameters include Total Dissolved Solids, Color, Odor etc. ; chemical parameters include p^H, Dissolved Oxygen(DO), Total Hardness, Calcium Hardness, Magnesium Hardness, Chemical Oxygen Demand(COD), Oxalate Content, Chloride Content, Fluoride Content, Phosphate Content, Sulphate Content, Heavy metals etc. and Microbiological parameters include Biological Oxygen Demand(BOD) MPN index etc. (RanjanaAgrawal 2009, Rajan Kumar Basak., (2012), Sadhana Chaurasia etal 2014).

OBJECTIVES

- To become familiar with the texture of soil in industrial areas.
- Comparison of different soil and water quality parameters in industrial areas.
- Determination of physicochemical parameters of soil and water like pH, acidity, alkalinity, Total Hardness, Magnesium Hardness, Calcium Hardness, Chloride content, Dissolved Oxygen, Chemical Oxygen Demand (COD) and Total Dissolved solids(TDS)

MATERIALS AND METHODS

Study area

The selected area for our study is industrial area of Angamaly, in Ernakulam District, which is located in Kerala State, India. Angamaly has many industries like Silver Star Plastic Industry, K K Industries, Kathir Food Products, Alpha Paints, Associated Rubber Chemicals (Kochi) Private Limited, Malabar Anhydrous Ammonia Industry, Surya Metals Industry, Boxer Company, Thettayil Thread Rubber Industry, Luciya Paper Board Industry etc. In the present study, 20 samples were collected from 5 sampling stations. Manual sampling with a plastic container in acquiescence with established standard norms was adopted. Labels were used to prevent sample misidentification. Sample preservation was done in tune with minimum possible time lapse between collection and analysis.

Methods for the Determination of Quality Parameters

The standard techniques and methods were followed for different chemical analysis of samples (R. Gopalan etal, 2008; Leo M.L. etal, 2013; Sirkar A G etal, 2007). TDS was determined by gravimetric evaporation method. pH of the water samples are determined with the help of pH meter. Electrical conductance was measured using conductivity meter. The chemical parameters such as Chloride content, Dissolved oxygen, Hardness and Chemical oxygen demand were computed by Argentometry, Winkler's titration method, Complexometry and back titration respectively.

pH of the water samples are determined with the help of pH meter. The chemical parameters such as Acidity, Alkalinity, Chloride content, Dissolved oxygen, Hardness and Chemical oxygen demand were computed by acidimetry, alkalimetry, Argentometry, Winkler's titration method, Complexometry and back titration respectively.

RESULTS AND DISCUSSION

The collected samples were analysed for various physico -chemical parameters like total dissolved solids, p^H, acidity , alkalinity , calcium hardness , magnesium hardness , total hardness , dissolved oxygen, chloride and COD .The chemicals and reagents used for analysis were of analar grade. All the measurements were carried out in the temperature of 30^0C and are expressed in the unit of mg/l. The results are given in Table I.

pH value of the samples vary between 6.1 to 7.6 and is shown in the figure 1. From the table and figure, it is clear that the p^H of the water samples were found to be within the permissible limits of 6 to 8.5.

The total dissolved solids of the samples vary between 70.99 – 255.74 mg/l and were also within the permissible limits of less than 500mg/l . TDS value is an indication amount of soluble salts. This data is supported by the electrical conductance measurement whose value lies between 0.11 -0.79 dSm^{-1} and shown in figures 2 and 3 respectively. Sample 5 shows higher conductance value which contains more dissolved ions than the permissible limit.

Hardness of the samples were determined by complexometric titrations which vary between 43.95 – 223.6 mg/l and is shown in figure 4. The maximum permissible limits of Ca and Mg hardness is 100 mg/l and 30mg/l respectively. All the samples except sample 5 showed hardness within the limits set by BIS as well as WHO standards. But hardness of sample 5 exceeds the permissible limit which in turn showed that the water is hard and can't be used for washing purpose. It can be used after softening process.

Chloride content of all samples never found to be exceeding the permissible limit of 250mg/l in the study area and vary between 12.4 – 189.65 mg/l as shown in the figure 5.

Dissolved oxygen levels indicates the ability of water to purify itself through biochemical process. The permissible levels of DO according to BIS as well as WHO standards is 4-6mg/l. DO of the samples are shown in figure 6 and vary from 2.83 – 4.62 mg/l was less than the permissible levels except for sample 1 and sample 5. The low amount of dissolved oxygen in water indicates the presence of high amount of impurities. In the view of DO, sample1 and sample 5 are polluted.

COD determination is reliable and fast for the determination of organic pollutants as well as for the assessment of the quality of water. The COD of good and palatable drinking water should not be more than 20mg/l. COD of samples vary between 2 -6 mg/l as shown in the figure 7 and is within the permissible limit.

CONCLUSION

In this work, we assessed the quality of soil and water in the industrial area of Angamaly. From the study, it can be concluded that all the parameters such as pH , TDS, and Chloride content of all samples were within the permissible limits set by BIS as well as WHO standards. But sample 5 and sample 1 have low dissolved oxygen content and diminutive COD value. Electrical conductance and hardness of sample 5 is also high. So these need some water treatments before it is used for drinking for reducing health risks. Overall study shows that, from the collected water samples of the studied area, sample 3 is of good quality since all the water quality parameters are within the permissible limits.

TABLES & FIGURES

Table 1 Physico – chemical quality parameters

SampleNo.	pH	TDS (mg/l)	Electrical conductance (dSm^{-1})	Calcium Hardness (mg/l)	Magnesium Hardness (mg/l)	Total Hardness (mg/l)	Dissolved Oxygen (mg/l)	Chloride (mg/l)	COD (mg/l)
1	6.1	70.99	0.11	39.83	4.12	43.95	2.83	12.4	4
2	7.5	203.94	0.54	48.94	5.91	54.85	4.62	159.17	6
3	7.3	129.23	0.25	43.25	5.52	48.77	4.18	14.33	2
4	7.6	165.97	0.48	51.22	6.21	57.43	4.55	43.98	3.8
5	7.6	255.74	0.79	202.94	20.72	223.66	3.63	189.65	3.5
IS 10500: desirable limit	6-8.5	500	0.5	100	30	300- 600	4-6	250	20

Figure 1 pH of samples

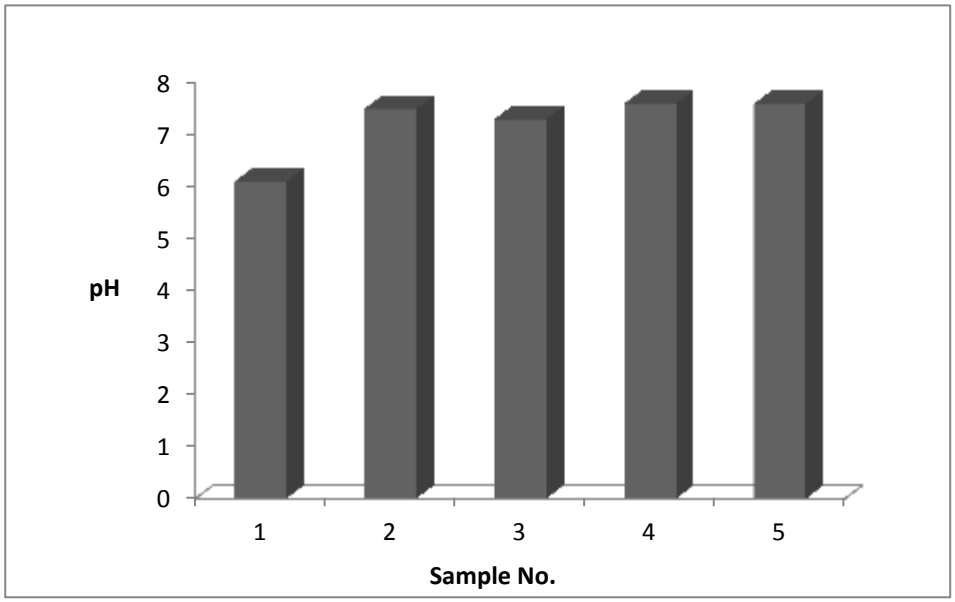


Figure 2 TDS of samples

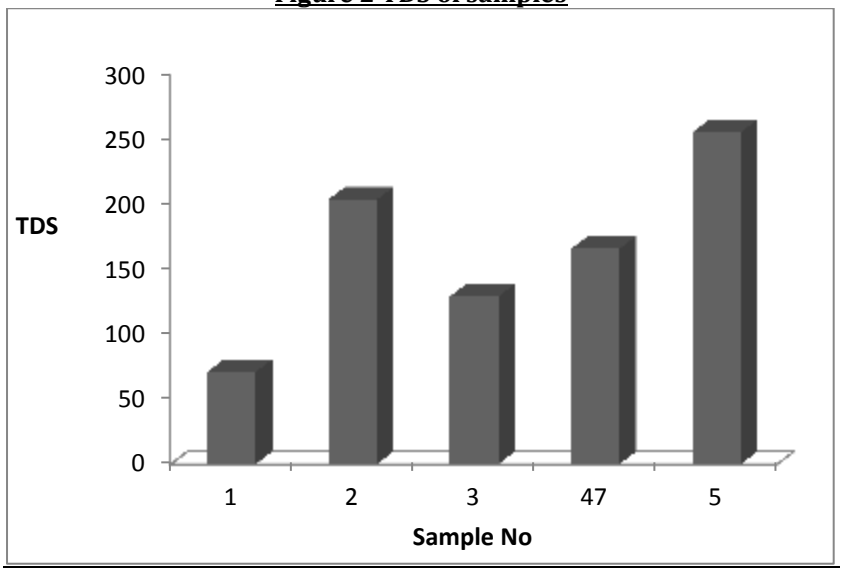


Figure 3 Electrical conductance of samples

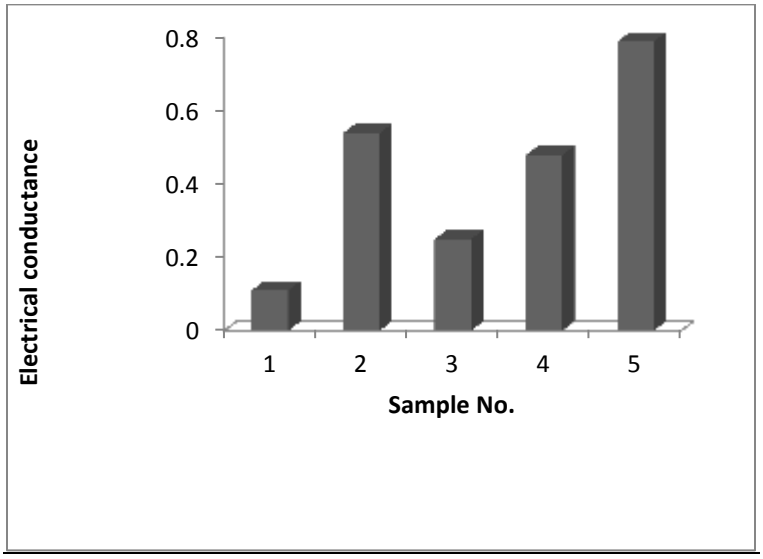


Figure 4 Hardness of samples

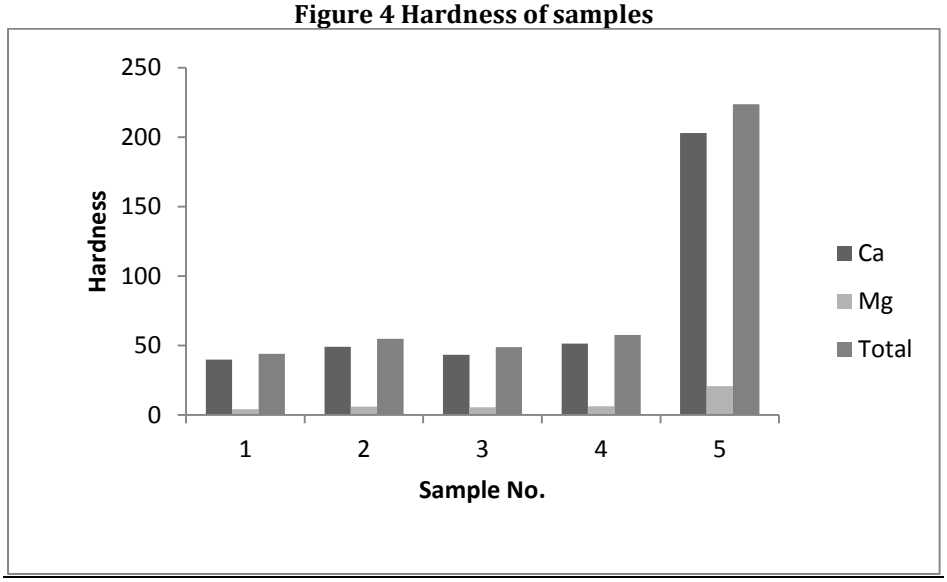


Figure 5 Chloride content of samples

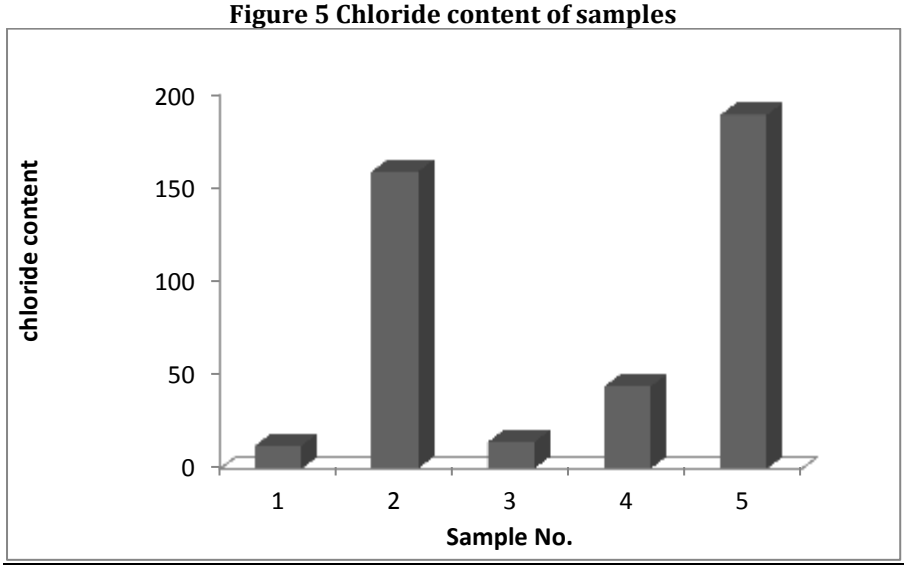


Figure 6 Dissolved oxygen of samples

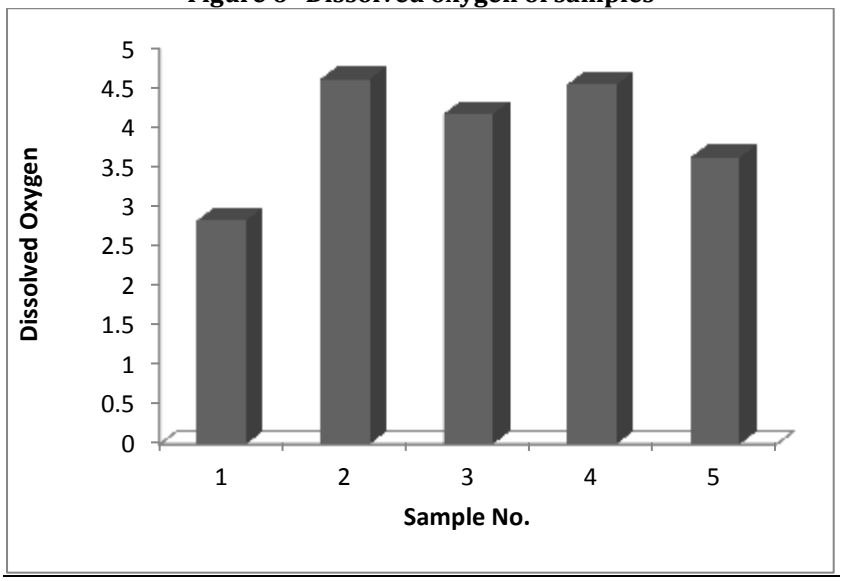
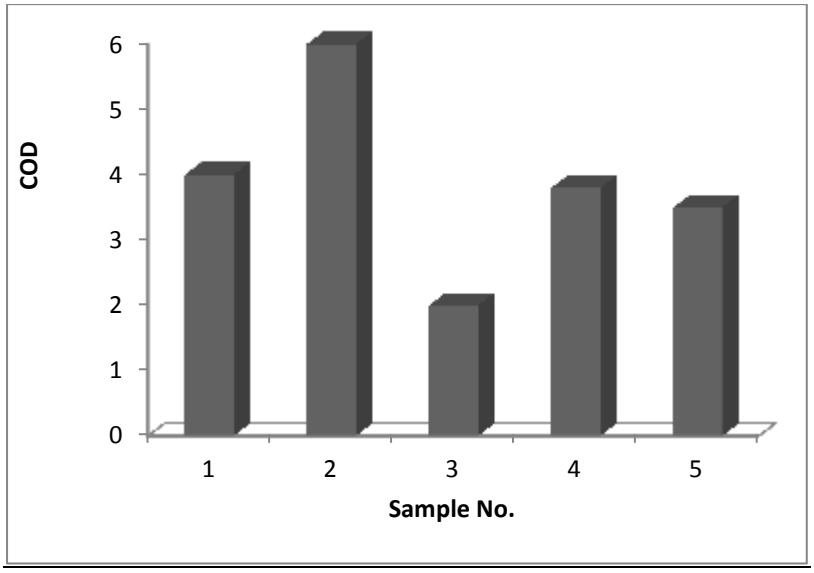


Figure 7 COD of samples



ACKNOWLEDGEMENT

The author wishes to express sincere thanks to University Grants Commission for the financial support for doing the minor research project.

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