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Characterization of waste water around industrial estate of Surat, Gujarat

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Abstract
The main objective of this environmental research was to determine the effect of waste water sample on the surrounding ecosystem of Kosamba region, Surat. In this regard, waste water samples were collected from various sampling sites around the vicinity of Kosamba region, Surat using polythene plastic containers. These samples were analysed for the estimation of biological oxygen demand (BOD), chemical oxygen demand (COD), nitrate and phosphate levels. From the results, our group observed that waste water sample may showed enhancement in BOD, COD along with nitrate and phosphate content as compared to control water sample. In short, potential avenues are required as well as generated for future research work which may tried to maintain or control (recommended by the Environmental Protection Agency) the level of BOD, COD, nitrate and phosphate content around Kosamba region, Surat.

Keywords: Waste water, Kosamba, ecosystem, environmental

Introduction
Wastewater may be defined as a combination of one or more materials e.g. domestic effluent consisting of black water (excreta, urine etc.) and greywater (kitchen and bathing wastewater); water from commercial establishments and institutions, including hospitals; industrial effluent; agricultural, horticultural along with aquaculture effluent, either in the form of dissolved or as suspended matter [1-4]. Now a day, wastewater treatment is considered as one of the most important services and provides information appropriate for municipal leaders including general public and operators [1-5].

Due to extensive rate of industrialization and increase in population density is reported in urbanized societies where people living all over the world are facing with problems related to the management of wastewater. Normally seen in industries and house hold activities where effluents are generated and constitute as one of the main cause of water pollution and is of course a great burden on water quality as well [6-8]. Due to these effluents, majority of water borne diseases [9] are reported i.e. cholera, typhoid fever, diarrhoea etc. These diseases are normally caused through pathogenic microorganisms which is reported in water. The major pollutants are reported till now i.e. microorganisms, phosphorus and nitrogen, hydrocarbons, heavy metals, endocrine disruptors and organic matter [10-13]. In addition, major contaminant source is reported in wastewater i.e. human along with animal wastes and also showed its existence in higher amount of phosphorus and nitrogen in the form of phosphates and nitrates [10-13], which may also create and disturbed the environmental conditions that may favour the growth of toxin-producing cyanobacteria. Due to the exposure of such type of toxins where organism may cause a host of other type of diseases. In this regard, researchers focused on various limnological parameters related to waste water effluents before discharge into receiving water bodies. In this paper, our group focused on various parameters i.e. phosphates and nitrates along with BOD and COD in waste water which is collected from one of the site of industry.

Materials and methods
Sample Area
Waste water samples were collected from the effluent which is discharged from industrial area. This waste water carries the sewage along with industrial effluents with it. So, this sample was collected properly and sealed in plastic bottles and transported to the laboratory for further analysis.

Estimation of BOD

In this experimental study, two B.O.D tubes were taken which is half fill it with distilled water. Add waste water (polluted water, 3 ml) to the B.O.D tubes with the help of pipette. Thereafter, tubes were filled with distilled water and fix stopper on it. Incubate one set of tubes at 20 °C for 5 days. Thereafter, alkali iodide oxide (2 ml) solution was added and shake well if oxygen is present (otherwise while, colour will be brown). In continuation of this, addition of concentrated sulphuric acid (2 ml) and shake well which gives colour and totally resemblance with mustard oil. Afterwards, solution (200 ml) was taken in a graduated cylinder and then add starch indicator (1 ml) to it which will give a yellowish colour. Finally, graduated cylinder containing solution put below the burette containing sodium thiosulphate standard and note down the initial reading. Similarly, fill dissolved oxygen of the first tube is reported and also find out dissolved oxygen is reported on 5th day in similar fashion. So, B.O.D per ml of sample is calculated by using the formula i.e. BOD = Initial D.O – Final D.O/Initial D.O x volume of sample dilution factor [14].

Estimation of COD

Waste water sample (10ml) was collected in three 100 ml conical flask labelled as Test1, Test2, and Test 3. Simultaneously, distilled water is taken in three conical flask (100ml) labelled as Blank 1, Blank 2 and Blank 3. Add potassium dichromate solution (5 ml) in each of the conical flasks (Blank and test). Incubate all six conical flask in water bath at 100 °C (boiling temperature) for 1 hour and allowed all these samples to cool for 10 minutes. Afterwards, add potassium iodide (5 ml) in each of the conical flasks and then add sulphuric acid (10 ml). Now, titrated the contents of each flask with 0.1N Sodium thiosulphate until the blue colour disappear completely. In COD, calculation is based on formula i.e. (A - B) X C X 8,000 / the volume of the sample in ml where A and B represent the titrant used for sample and blank sample which is expressed in ml. In addition, C represents the normality of the ferrous ammonium sulphate and results will be expressed in milligrams per liter [14].

Estimation of nitrates and sulphates

Waste water samples were filtered and collected in conical flask. Take 50 ml of waste water sample and add 1N HCl solution (1 ml) was added and shake thoroughly. In this study, standard curve was generated in order to estimate the percentage of nitrate content using sodium nitrate and sulphates using sodium sulphate [14]. Prepared serial dilution of standard (0.312-10 mg/ml) was prepared.

For nitrates, waste water sample was also collected and taken in different conical flask with similar volume. Afterwards, add 1N HCl solution was taken in all the standards including sample and blank. Finally, spectrophotometric measurement (wavelength, 220 nm) was set for reading of nitrate. Set the blank (distilled water containing HCl) at zero. Absorbance was finally read in all standard solutions including sample and blank at 220 nm. So, standard curve was generated by plotting absorbance due to various nitrate concentrations and blank and estimate the nitrate content in waste water sample.

Similarly in estimation of sulphates, waste water sample was filtered and collected in a conical flask (100 ml) and add 1 ml HCl along with conditioning reagent (1 ml; 5 ml glycerol was mixed with a solution containing 3 ml conc. HCl, 30 ml distilled water, 10 ml 95% ethyl alcohol and 7.5 g sodium chloride) were added and shake well for 30-60 seconds. After 10 minutes of incubation at room temperature, concentration of sulphate in sample was directly measured from the curve using sodium sulphate. Repeat steps as mentioned above for determining its absorbance at 220 nm.

Statistical analysis

The difference between control and waste water sample treatment is determined through one way ANOVA test (Bonferroni multiple comparison test).

Results

BOD levels in waste water samples

The results from these studies which clearly indicates the higher content of BOD level in waste water sample collected from industrialised area as compared to control sample (Fig. 1). On day 0, higher content of BOD level was reported. Similarly again, same waste water sample test was reported on day 5 (Incubate at 20 °C) and showing less amount of BOD content as compared to day 0 testing sample.

COD levels in waste water samples

The results from these studies which clearly indicates the higher amount of COD level is reported in waste water sample collected from industrialised area as compared to control sample (Fig. 2).

Estimation of nitrates and phosphates

The results from these studies which clearly indicates the higher amount of nitrates and phosphates is reported in waste water sample as compared to control sample (Fig. 3).

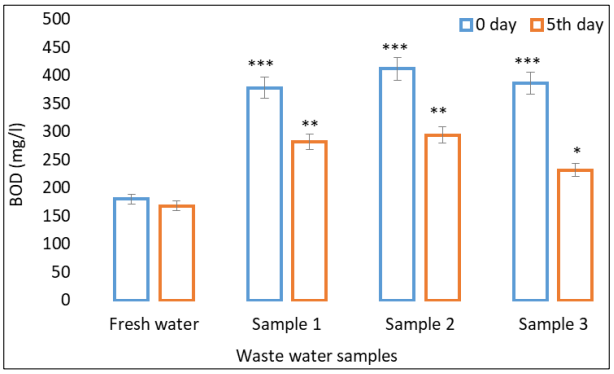

Fig 1: Estimation of BOD content. Values are expressed as mean ± S.E. The difference between fresh water and samples (1, 2 and 3) were determined through Bonferroni multiple comparison test. **P*<0.05; ***P*<0.01; ****P*<0.001

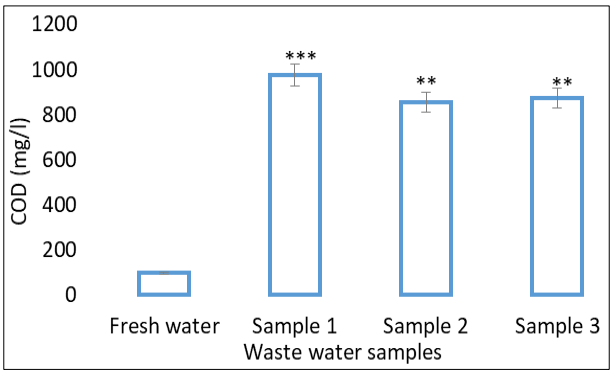

Fig 2: Estimation of COD content. Values are expressed as mean ± S.E. The difference between fresh water and samples (1, 2 and 3) were determined through Bonferroni multiple comparison test. **P*<0.05; ***P*<0.01; ****P*<0.001

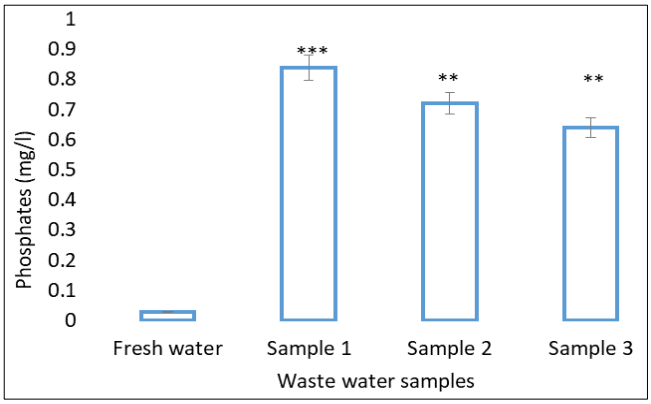

Fig 3: Phosphates estimation. Values are expressed as mean ± S.E. The difference between fresh water and samples (1, 2 and 3) were determined through Bonferroni multiple comparison test. **P*<0.05; ***P*<0.01; ****P*<0.001

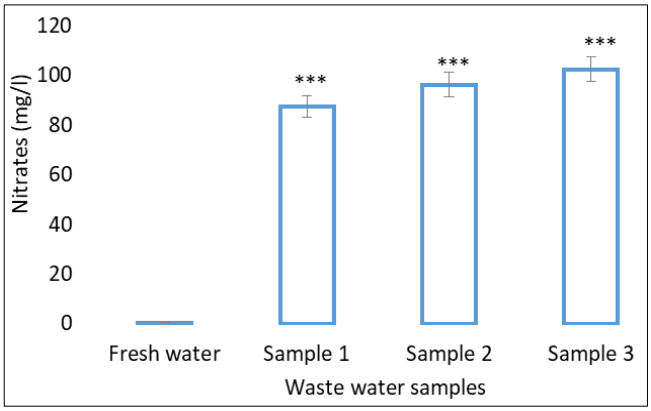

Fig 4: Estimation of BOD content. Values are expressed as mean ± S.E. The difference between fresh water and samples (1, 2 and 3) were determined through Bonferroni multiple comparison test. **P*<0.05; ***P*<0.01; ****P*<0.001

Discussion

As per the literature, wastewater is mainly composed of organic (70%; e.g. carbohydrates, proteins, fats) and some sort of inorganic (30%; heavy metals, nitrogen, phosphorus, toxic compounds etc.) compounds including various gases (hydrogen sulphide, methane, ammonia, oxygen, carbon dioxide and nitrogen) dissolved in waste water [1-6]. In addition, waste water contains various micro-organisms and these are classified or present in the form of protista (bacteria, fungi, protozoa, and algae), plants (ferns, mosses, seed plants and liverworts) and animals (Invertebrates and vertebrates). In terms of wastewater treatment, various parameters especially COD, BOD, nitrates and phosphates were taken into consideration because wastewater produced many pathogenic organisms which originates from humans and considered them as one of the carrier of particular disease [5-8]. In this regard, limnologic studies of waste water samples were conducted. For these studies, waste water samples were collected from university campus which is generally helped the researcher in the evaluation of wastewater treatment. After studying the basic parameters (i.e. BOD, COD, nitrates and phosphates) of wastewater, it can be concluded that wastewater containing a large number of pollutants that may alter the natural environment. For the determination of waste water, these parameters were taken into further consideration.

The major objective related to wastewater treatment plants in order to determine the BOD in the effluent which is directly or indirectly discharged in natural waters. In contrast, COD is not be able to differentiate between availability of biological material along with inert organic matter. This is generally measured the total quantity of oxygen that is available in order to oxidize all the organic material which is converted into carbon dioxide and water. Generally, COD values are always higher as compared to BOD values, but COD measurement should be measured with in few hours while BOD measurement almost take five days [15]. In other words, BOD which requires 5 days analysis time and showed the presence of nitrification inhibitors that are generally added into the samples, which normally requires for suppressing the degradation of nitrogen based compounds. In short, BOD is only a time-delayed information which generalized some knowledge about waste water pollution and this estimation is normally required for the biodegradability of waste water products. On the other hand, COD is finally measured under acidic conditions using one of the strong oxidant (e.g. potassium iodate). So, known quantity of the oxidant is normally added into the waste water sample. Once the oxidation process is completed pertaining to measure the amount of oxidant in solution using organics concentration with in the sample. This is calculated by measuring the amount of oxidant which is present with in the solution. This is usually done by titration, using an indicator solution. COD is expressed in mg/L, which indicates the mass of oxygen consumed per liter of solution [15].

Whilst polluted water from industrial site is collected and analysed for COD and also applied to analysed the waste water solution containing inorganic substances. However, inorganic substances containing phosphates and nitrates may varied considerably. In general, COD test is applied in almost all of the aqueous sample which is considered as one of the index of pollution. The result of a chemical oxygen demand test indicates the amount of water-dissolved oxygen (expressed as parts per million or milligrams per liter of water) consumed by the contaminants. Now a day, there is significant enhancement in pollution rate through discharging large quantity of various chemicals along with various substances of different types of matter which may directly entered into the aquatic system. So, BOD values alone does not showed the picture of various toxicant which is present with in the waste water sample. In this regard, various toxicants in the waste water sample may severely checked its validity of BOD test. So, COD test is one of the accurate method for measuring organic matter which is totally time saving process.

As per the literature, several reports are already available for its removal of nitrate and phosphate content from waste water [11-13] through physicochemical methods. In addition, nitrate and phosphate content is reported in waste water bodies which may ultimately favour the growth of aquatic plants and also create some negative effect on its water quality which may enhanced the growth of various constituents e.g. algal clump. Such type of conditions which create some problems in its use for recreational along with aesthetic purposes. In this regard, similar type of results were reported, there is enhancement in nitrate and phosphate content in waste water sample as compared to control water sample.

Conclusion

The results from these studies may suggest the presence of waste water samples near industrialised areas in kosamba region, Surat are required various methods in order to control its reduction of BOD, COD, phosphate and nitrate content.

Future Work

One of the most significant and possible avenue for future research related to waste water sample which may be detected its presence of contaminants through some more sensitive instruments and also developed new methods or protocols in order to control the burden of various contaminants which are present with in the water sample.

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