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# STUDY ON THE DOMESTIC SEWAGE AND ITS ANALYSIS

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## ABSTRACT

The city Parbhani is characterized by the fact of majority of households' outlets contains dispose of household sewage, lending to contamination of ground and surface water and a disturbance to the environment. The objective of this study is to protect the water and soil sources from the risk of pollution, reduce pollution, maintain health and domestic sewage water treatment. In this study, analyzed household sewage water from 2 locations for to find out its physical and chemical parameters. The parameters such as pH, DO, $DCO_2$, TDS, Hardness, calcium, magnesium, BOD, COD, Phosphate. The changing characteristics of sewage water, due to discharge of contaminants, are responsible for many changes that are taking place today in the sewage water treatment. This discharge of sewage water to environment caused adverse condition, and this led to the development of intensive methods of sewage treatment.

**KEYWORDS:** *Physico-chemical, Sewage, Environment, Domestic waste water, treatment.*

## INTRODUCTION

Water is a pre-condition for human, animal and plant life on Earth. Deforestation, population, over exploitation of water resources, damage to aquatic ecosystems, climate change and security issues are challenging the sustainability of water systems. Increase in population, economic development, urbanization, and land use or natural geomorphic changes also challenge the sustainability of resources by decreasing water supply or increasing demand (Thomas Wintgens *et al.*, 2016). India is rich in water resources, having a network of as many as 113 rivers and its tributaries and basins to hold plenty of groundwater. India is also blessed with snow-capped peaks in the Himalayan range, which can meet a variety of water requirements of the country. However, with the rapid increase in the population of the country and the need to meet the increasing demands of irrigation, domestic and industrial consumption, the available water resources in many parts of the country are getting depleted and the water quality has deteriorated. In India, water pollution comes from three main sources: domestic sewage, industrial effluents and run-off from agriculture. The most significant environmental problem and threat to public health in both rural and urban India is inadequate access to clean drinking water and sanitation facilities. Almost all the surface water sources are contaminated to some extent by organic pollutants and bacterial contamination and make them unfit for human consumption unless disinfected. The diseases commonly caused by contaminated water are typhoid, cholera, gastroenteritis, bacterial dysentery, hepatitis, poliomycitis, amoebic dysentery etc. It is estimated that 22,900 million liters per day (MLD) of domestic wastewater is generated from urban regions. Govt. of India is assisting the local bodies to establish sewage treatment plants under the Ganga Action Plan and subsequently under the National River Action Plan. Since the task is massive, it may take long time to tackle the treatment of entire wastewater (Trivedi *et al*., 2015). India is amid the world's major manufacturer of textiles and clothes. The Indian national fabric and clothing industries 2 percent of India's Gross Domestic Product that 27 percent of the countries overseas exchange inflows and 13 percent of countries export earnings (Sadhan *et al.*, 2019). Throughout world around 62 percent of sewage water production from textile industries consists of complicated organic and inorganic elements which will be known by human eye by its high color, low degradability and high oxygen demand number. The global freshwater removals are at 3,928 $km^3$ each year. It is noted that an estimated amount of 44 percent of this water is expanded chiefly by agricultural sector, and the remaining 56 percent freed from the variety of industries and municipal effluent water (AQUASTAT).

### Characterization of domestic wastewater

Municipal wastewater is mainly comprised of water (99.9%) together with relatively small concentrations of suspended and dissolved organic and inorganic solids.

Among the organic substances present in sewage are carbohydrates, lognin, fats, soaps, synthetic detergents, proteins and their decomposition products, as well as various natural and synthetic organic chemicals from the process industries. Municipal sewage also contains a variety of inorganic substances from domestic and industrial sources, including a number of potentially toxic elements such as arsenic, cadmium, chromium, copper, lead, mercury, zinc, etc. the contaminants of greatest concern are the pathogenic micro and macro-organisms.

**Environmental Impact of domestic wastewater**

The effects of domestic sewage on the environment are largely negative. The negative impacts of these wastes to aquatic ecosystems and to humans, from harmful substances found in them. Some of these impacts can include death of aquatic life, algal blooms, habitat destruction from sedimentation, debris and increased water pollution. Domestic sewage from coastal cities like Mumbai, Chennai etc. creates another major problem. The ocean pollution by sewage-related waste is the disposal of biosolids, a semisolid byproduct, disease causing microbes are the primary human risk in sewage-contaminated waters, and the main cause of recreational beach closures.

It is noted that India generates almost 62,000 million liters of domestic sewage per day in urban areas, but only 37 percent of it is treated, according to a 2015 report released by the Central Pollution Control Board, India.

## MATERIAL AND METHOD

Present study was carried out for analysis of domestic Sewage samples collected from two sites selected on the basis where direct flow of sewage from household outlets enter in the Municipal Corporations *nala* (drainage). The consecutive sites are at a distance of 1 km from each other. The sampling sites were named as (S1) and (S2). Sample testing was carried out during April 2019 to January 2020. The physical parameters like pH, TDS and DO. The chemical parameters such as Hardness, Ca, Mg, BOD, COD and phosphates were studied by incubation method. All parameters were determined by the standard methods suggested by APHA (1995). The observations were compared with the standards prescribed by Central Pollution Control Board, India (CPCB) and World Health Organization.

**Study area:** Parbhani is a city in Maharashtra state of India. Parbhani lies in the latitude/longitude19°15’33’’N 76°46’59’’E. The city is governed by Municipal Corporation and as per provisional reports of Census India, population of Parbhani in 2011 is 307,170. The city having systematic and improved sewage drainage system. The domestic sewage wastewater discharge from across the city show connectivity with the main drainage system.

**Field study:** The sewage wastewater samples were collected from the municipal corporation main drainage system.

**Laboratory studies:** The physico-chemical parameters were analyzed at laboratory. The parameters such as Hardness, Ca, Mg, BOD and COD studied by incubation method at laboratory only. Whereas, pH, color was analyzed at field site.

**Objective of the study**: The objective of the study was to assess and monitor the physico-chemical parameters of domestic sewage from drainage system.

## RESULT AND DISCUSSION

The results of physico-chemical analysis of domestic sewage water during April 2019 to January 2020 are summarized in table.1.

**pH:** The pH of the domestic sewage water was recorded in the range of 6.2 to 7.8. It was slightly acidic to alkaline throughout the dial cycle. Similar, changes in pH was reported by Sandeep Kumar, (2013) and Sonune, (2015). Highest pH was 7.8 was recorded during monsoon season it was 7.8. The recorded average pH in both sites are 6.8 in slightly acidic condition. Similar results were observed by Aditya (2013).

**Total dissolved solids:** Total dissolved solids (TDS) comprise inorganic salts (principally calcium, magnesium, potassium, sodium, bicarbonates, chlorides and sulfates) and small amounts of organic matter that are dissolved in water (WHO). TDS originates from natural sources, sewage, urban runoff and industrial wastewater. Concentration of dissolved solids in water vary considerably in different geological regions owing to differences in the solubilities of minerals. The recorded amount of TDS was ranging from 300 mg/l to 2400 mg/l throughout the analysis period. The recorded average TDS value at both the sites are 1240 mg/l. Due to contamination of domestic wastes the water shows high TDS. Indeed, high concentration of TDS enriches the nutrients status of water body which were resulted into *eutrophication.*

**Dissolved oxygen:** The dissolved oxygen content of water is influenced by the source, raw water temperature, biological processes taking place in the distribution system. It was noted that depletion of dissolved oxygen in water encourage the microbial reduction of nitrate to nitrite and sulfate to sulfide. In the present study the recorded dissolved oxygen level was ranging from 0.6 mg/l to 4.4 mg/l throughout the analysis period. The recorded average value from both sites are 3.18 mg/l. No specific health-based guidelines were provided on presence of dissolved oxygen. Dissolved oxygen levels will fluctuate with temperature, salinity and pressure changes.

**Dissolved Carbondioxide:** In polluted waters the respiration of organisms in low oxygen concentrations is being studied, the presence of acids other than carbonic may also introduce errors in the measurement of pH. The concentration of $CO_2$ is expressed throughout the period recorded in the range from 4.2 mg/l to 8.4 mg/l. The recorded average value of dissolved Carbondioxide from both the sites are 5.8 mg/l.

**Hardness:** Public acceptability of the degree of hardness of water may vary considerably from one community to another. The taste threshold for the calcium ion is in the range of 100-300 mg/l, depending on the associated anion, and the taste threshold for magnesium is probably lower that for calcium (WHO). Hardness was recorded in the range from 220 ppm to 914 ppm during the analysis period. The recorded average value at both the sites are 590 ppm. Similar findings were observed by Aditya (2013). During post-monsoon seasons maximum hardness was measured at both the sites. During this research it was noted that bicarbonate is having strong positive correlation with $Ca^{2+}$ and $K^{+}$. Hence, it was evident that hardness showed of water is mainly due to presence of calcium ions. Also, hardness showed a negative relationship (not significant with pH). Hardness is not specific constituent, but is a variable and complex mixture of cations and anions in water. High values of hardness are probably due to regular addition of sewage and detergents from residential area.

**Calcium:** Calcium is the most abundant ions in freshwater and is important in shell construction, bone building and plant precipitation of lime (Jhingran, 1975). Desalinated water contains lower than usual concentrations of dissolved solids and essential elements such as calcium and magnesium, which are commonly found in the natural waters. Generally, the Mg-Ca ratio varies at both the sites the wastewater of Parbhani does not have a high Mg: Ca ratio. The recorded calcium during the analysis period of ten months was ranging from 1.86 mg/l to 8.86 mg/l. The recorded average value of calcium at both the sites are 5.67 mg/l.

**Magnesium:** Magnesium is present in all type of waters, after sodium, it is the most commonly found cation in waters. Sea water have amount of about 1300 ppm, whereas River contains amount of 4 ppm of magnesium. A large number of minerals contains magnesium, for example dolomite (calcium magnesium carbonate) and magnesite (magnesium carbonate). Magnesium is washed from rocks and subsequently ends up in water. In the present study it was recorded in the range of 1.06 ppm to 6.8 ppm. The recorded average value of magnesium from both the sites are 4.48 mg/l. Hardness caused by calcium and magnesium is usually indicated by precipitation of soap scum and the need for excess use of soap to achieve cleaning (WHO).

**Biological oxygen demand:** This is the amount of oxygen required for the oxidation of a domestic sewage water by microorganisms. It is therefore a measure of the concentration of organic matter in a waste that can be oxidized by microorganisms. It was observed that higher the concentration of organic matter in a wastewater, the biological oxygen demand is more. The strength of water is often judged by its BOD and COD. In the present study the recorded BOD was ranging from 40 mg/l to 86 mg/l. The recorded average BOD value is 65.8 mg/l. Due to high impurities in monsoon season, biochemical oxygen demand (BOD) also observed to increase and then subsidize during post monsoon season (2018). In sewage and polluted bodies of water the more organic matters increase the biological oxygen demand. The BOD is therefore a reliable gauge of the organic pollution of a body of water. Similar finding was observed by Bishnu and Misbah (2018).

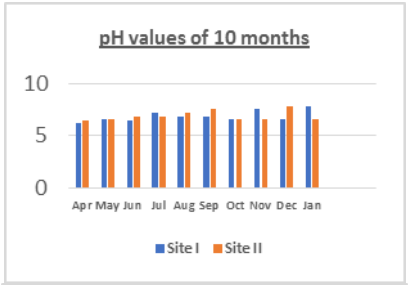
**Chemical oxygen demand:** It is said that higher COD levels mean a greater amount of oxidizable organic material in the sewage water, which will reduce dissolved oxygen levels. A reduction in DO can lead to anaerobic conditions, which is deleterious to her aquatic life. During the ten months analysis period COD ranges from 140 mg/l to 212 mg/l. The recorded average value of COD from both the sites are 170.3 mg/l.

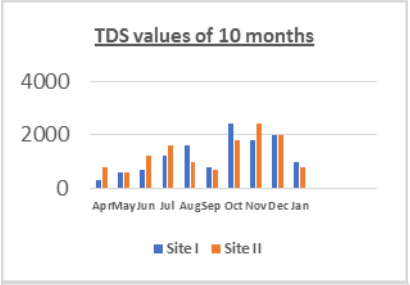
**Phosphates:** Phosphate is one of the limiting factors responsible for phytoplankton productivity because of geochemical storage of phosphate in domestic sewage basin. In animals' phosphate is necessary for the formation of bone and teeth and building block for several important substance. The amount of phosphate recorded in the domestic sewage was ranging from 1.8 mg/l to 3.8 mg/l with an average value 266 mg/l at both sites. Similar findings were observed by Aditya (2013). Phosphate occurs in drinking-water at concentrations well below those of health concern. Phosphates considered nutrients, high concentration can disturb the balance of an aquatic environment, causing plants, such as algae, to grow rapidly.

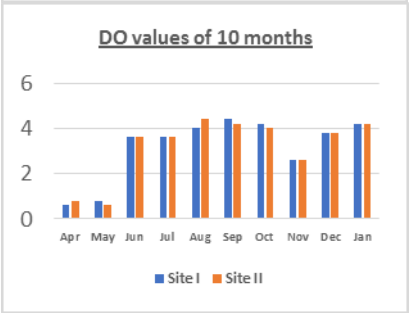
**Table 1: Physico-chemical parameters of domestic sewage water.**

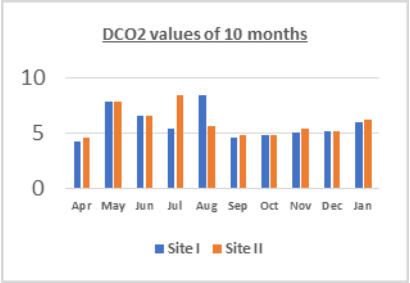
| Parameter | Site I | | | Site II | | | Permissible limits by CPCB |
|---|---|---|---|---|---|---|---|
| | Min | Max | Ave | Min | Max | Ave | |
| pH | 6.2 | 7.8 | 6.8 | 6.4 | 7.8 | 6.8 | 6.5-8.5 |
| TDS | 300 | 2400 | 1240 | 308 | 1590 | 1240 | 500-2000 |
| DO | 0.6 | 4.4 | 3.18 | 0.6 | 4.2 | 3.18 | 5-9.5 |
| $CO_2$ | 4.2 | 8.4 | 5.8 | 4.8 | 7.8 | 5.8 | |
| TH | 220 | 914 | 590 | 228 | 900 | 590 | 400-600 |
| Ca | 1.86 | 8.86 | 5.67 | 1.86 | 8.40 | 5.67 | 75-200 |
| Mg | 1.06 | 6.8 | 4.48 | 1.06 | 5.8 | 4.48 | 100 |
| BOD | 40 | 86 | 65.8 | 48 | 72 | 65.8 | 30-100 |
| COD | 140 | 212 | 170.3 | 168 | 200 | 170.3 | 200-600 |
| $PO_4^{3}$ | 1.8 | 3.8 | 2.66 | 2.0 | 3.2 | 2.66 | 0.5-0.15 |
| *All values in mg/L, except otherwise indicated* | | | | | | | |

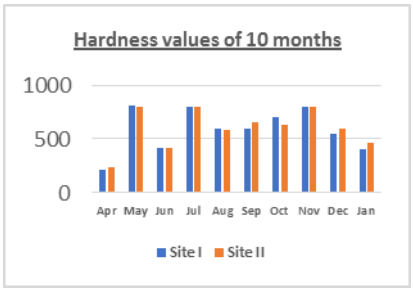
**Graphical presentation of analyzed parameters**

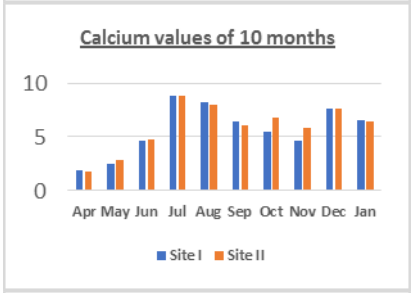


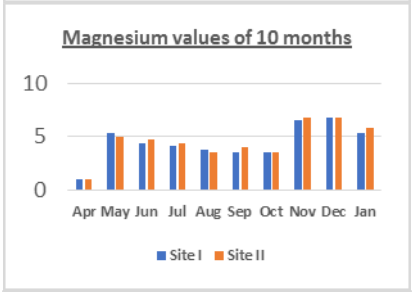



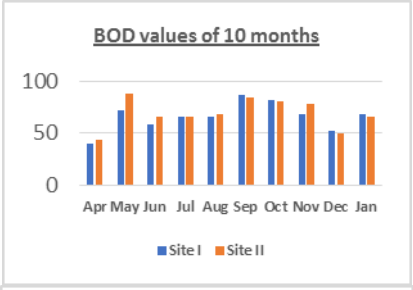



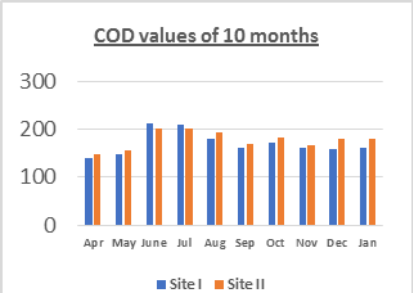



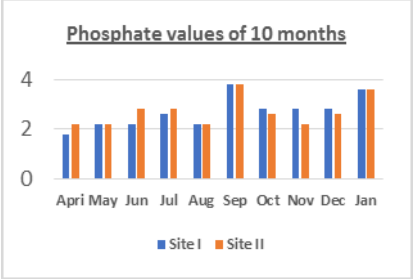

Hardness values of 10 months
1000
500
0
Apr May Jun Jul Aug Sep Oct Nov Dec Jan
Site I
Site II

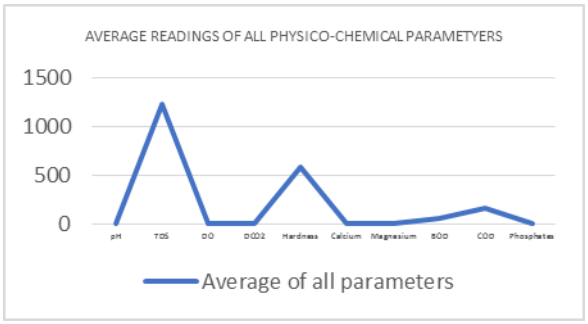

Calcium values of 10 months
10
5
0
Apr May Jun Jul Aug Sep Oct Nov Dec Jan
Site I
Site II


Magnesium values of 10 months
10
5
0
Apr May Jun Jul Aug Sep Oct Nov Dec Jan
Site I
Site II


BOD values of 10 months
100
50
0
Apr May Jun Jul Aug Sep Oct Nov Dec Jan
Site I
Site II


COD values of 10 months
300
200
100
0
Apr May June Jul Aug Sep Oct Nov Dec Jan
Site I
Site II


Phosphate values of 10 months
4
2
0
Apri May Jun Jul Aug Sep Oct Nov Dec Jan
Site I
Site II




**Average of all parameters during assessment period.**

## CONCLUSION

The main stream of drainage sewage water critically analyzed. On the basis of above discussion, it is concluded that the sewage from household areas was within the permissible ranges' standards of CPCB, India, but it is important to make some proper strategies which treat the sewage from its disposal point for beneficial of the environment. Due to growing population varieties of household sewage generated and are directly outlifted into main drainage systems. The physico-chemical characteristics of sewage water from the study area shows that, the sewage water is light brown in colour, pH average shows acidic nature, TDS, DO, Hardness, Ca, are the parameters which are in controlled manner so far. Except phosphates and magnesium which crosses the limits. Phosphates shows high amount due to increased emphasis on cleanliness of household detergents, soaps etc. in our country. Due to excess presence of phosphates uncontrolled algal growth creates imbalance and destroys other life forms and produce toxins. So, it is important for municipal corporation to conduct regular analysis and recycle treatment of this sewage water for its reuse. It is advocating that sustainable management of freshwater, which is key for global progress, the planets health and the survival of future generations. In India rivers and other surface sources of water drying up and, more specifically to India, interstate water disputes are what usually dominate the discourse. What gets less attention is the treatment/management of sewage and wastewater.

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