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Analysis of Contamination of Ground Water Due To Dump Yard: Case Study of Bhandewadi Dump Yard, Nagpur, India

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ABSTRACT: Now a day's solid waste management and its proper disposing is major concern in the developing countries. The general method of disposing the solid waste is by land filling in dump yard. In this method the disposing site should be far away from the residential area. The present study is conducted on the ground water, in the vicinity of Bhandewadi Dump Yard in Nagpur. Urbanization and improper disposal of solid wastes lead to contamination of groundwater and surface water resources in this region. Municipal solid wastes of the city are presently disposed as open landfills at Bhandewadi region near Pardi east Nagpur. The leachate form due to solid waste is directly infiltrate into the ground and contaminate the ground and surface water resources which results into unsuitability of water for drinking and other utility purposes. Hence a detailed study and analysis is carried out on the ground water in the vicinity of this area. For this analysis four sample of different area of varying distances is collected from this study region, and these samples are analyzed for physical, chemical and biological parameters such as pH, Nitrate, BOD, etc. This study is try to analyze the suitability of ground water for drinking, household purpose, etc. by comparing with the standard parameters set by the Bureau of Indian Standard (BIS) and World Health Organization (WHO). The study indicates that the water quality parameters exceed the permissible limits for drinking at many locations leading the water unsuitable for drinking.

I. INTRODUCTION

Since the beginning, human kind has been generating waste, each household generated garbage or waste day in or day out either solid or semisolid form and generally exclude industrial hazardous wastes. Waste is a byproduct of life. High standards of living and ever increasing population have resulted in an increase in the quantity of wastes generated. During the last two decades groundwater quality has emerged as one of the most important environmental issues confronting much of the world's populace. Among the multitude of the environmental problem existing in the urbanizing cities of developing countries, MSW management and its impact on groundwater quality have become the most prominent in the recent years. Ground water contamination is generally irreversible i.e. once it is contaminated it is difficult to restore the original water, degrades water quality producing an objectionable taste, odor and excessive hardness. It is always better to protect ground water first rather than relying on technology to clean up water from a contamination source. Due to lack of efficient solid waste management system and improper dumping of MSW as open landfills, the groundwater and surface water in the Nagpur city is found to be contaminated in various places. The processing and disposal of the MSW generated by Nagpur city with environmentally safe and legally acceptable management is done by company namely Hanjer Biotech Energies Pvt. Ltd. NMC pays 275 Rs. per ton to these firms to treat garbage. Hanjer was allowed to sell the byproducts of treating garbage, which include wet organics, dry organics and plastics. Several studies have been carried out studying the impact of improper solid waste management mainly focused on pollution, health problems, diseases etc. To study the effects of solid waste on health of neighborhood inhabitants, Bhandewadi the only dumping yard of Nagpur city was chosen as primary testing area. It was assumed that the impact of solid waste would be more apparent and prominent at neighborhood settlements of Bhandewadi as these settlements are in proximity and in direct contact with the dumping yard.

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II. LITERATURE REVIEW

1. Kalpana P. Deshmukh (2015): Have identified how much water is polluted and studied the possibility of damages on human health. The objective was to check the impact on water in nearby settlement of dumping yard and try to find out sessional difference between the pollution of water. This study was base on primary data collection, for testing the impact of dumping yard. Nearest six settlements was chosen. Samples were taken in two sessions, rainy and winter session for comparatively study. Sample was tested in laboratory in nine parameters. To test the water 'LTEK' field test kit was used. Water testing results of Bhandewadi proved that underground water of dumping yard Catchment area become pollutes. Hence on test of some parameters, water is safe but it's failed on any one parameter. In seasonal comparison water of rainy season are more safe than winter season. Excess water of rain mixed-up with well water so intensity become reduce. This kind of scope has not in the winter season so water is become concentrated.

2. Mohammed Asef Iqbal and S.G.Gupta (2009): Have studied on effect of municipal solid waste dumping on ground water quality index values. Recent increase in unplanned urbanization without any adequate provision for issues like waste generation and disposal and treatment by industries, agriculture and domestic users has increased the stress on water reservoirs of getting contaminated. Groundwater can also get contaminated due to such anthropogenic activities of man, if the generated waste is not disposed of in proper manner' the polluting chemicals in the solid waste undergo biological action and their seepage in the groundwater occurs during the rainy season. Hence the municipal solid waste poses a significant threat to the credibility of the groundwater as the safest source of water, For human consumption. The samples were collected at 21 sampling stations inbounding the dumping ground at Naregao. The samples were immediately transferred to the laboratory for the analysis' physicochemical parameters analysed were Dissolved Oxygen, pH, Biochemical Oxygen demand, Temperature, Phosphates, Nitrates and total Solids, additionally for biological status Fecal coliforrns were also analysed. The analysis was carried out as per the standard methods prescribed by APHA (1995). The obtained results were used to determine the Water Quality Index (WQI) using NSFWQI method. The overall index of water qualityin the area is not satisfactory and can graded as bad for consumption. It is also observed that the water quality index is further deteriorating with the time. it was concluded that the open refuse dumping at Naregaon is adversely affecting the portability of the ground water in the area, which a serious of serious concern and immediate action should be initiated to prevent further deterioration of the groundwater sources.

3. P.Vasanthi, S.Kaliappan & R.Srinivasaraghavan (2007): Have studied impact of poor solid waste management on ground water. The leachate produced by waste disposal sites contains a large amount of substances which are likely to contaminate ground water. In this study, the quality of ground water around a municipal solid waste disposal site in Chennai was investigated. Chemical analyses were carried out on water samples collected at various radial distances from the boundary of the dumping yard, at intervals of 3 months and for a period of 3 years. The study has revealed that the ground water quality does not conform to the drinking water quality standards as per Bureau of Indian Standards. The effects of dumping activity on ground water appeared most clearly as high concentrations of total dissolved solids, electrical conductivity, total hardness, chlorides, chemical oxygen demand, nitrates and sulphate. Leachate collected from the site showed presence of heavy metals. The contaminant concentrations tend to decrease, during the post monsoon season and increase, during the pre monsoon season in most of the samples. The study clearly indicates that landfills in densely populated cities should have the ground water monitored on regular basis. Furthermore, ground water in and around the landfill sites shall not be used for drinking purposes unless it meets specific standards. Indiscriminate dumping of wastes in developed areas without proper solid waste management practices should be stopped.

4. Anju Anilkumar, **Dipu Sukumaran**, **Salom Gnana Thanga Vincent (2015):**Have studied the effect of Municipal Solid Waste (MSW) leachate on ground water quality by using water quality index (WQI) in Thiruvananthapuram corporation area, Kerala, India. Ground water samples were collected from dug wells 1 kilometer around the MSW dumping site and control samples from 10 kilometer away from the site both in two seasons (pre monsoon and post monsoon) for analysis of physicochemical and microbiological parameters. The characteristics of leachate of the MSW were also studied. Ground water near the MSW dumping sites were found to be more polluted than the control sites in both seasons. From this study, it is evident that the leachate from the MSW dumping site plays a major role in polluting the ground water in the area. The nitrate (88 mg/l) and total dissolved solids (TDS) (726 mg/l) concentration in ground water is in alarming state that should be taken into consideration before using for drinking purpose. The ground water

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near the MSW dumping site was also contaminated by fecal coliform (8 CFU/100ml) which makes unsuitable for drinking purpose.

5. Nitin Kamboj and Mohrana Choudhary (2013): Have studied the impact of domestic wastes disposal on ground water quality at Delhi, India. The samples of ground water were collected and analyzed for various 1195 hysic-chemical parameters viz. conductivity, total dissolved solids (TDS), alkalinity, total hardness, calcium, magnesium, chloride, sulphate, nitrate, phosphate, fluoride, sodium and potassium. Among these parameters, TDS were found higher. TDS were observed beyond the desirable limits of BIS at all the sampling sites. Maximum value of TDS was found to be 2061 mg/l. Maximum value of chloride was found to be 560 mg/ and rest all other parameters were found within permissible limit. The study concluded that the chloride and TDS in water samples were above to the desirable limit and below to the permissible limit of BIS and rest all other parameters were within desirable limit.

6. Gawsia John, Harendra K. Sharma1 & Vikas Vatsa (2014): Have studied theImpact of municipal solid waste dump on ground water quality at Danda Lokhand landfill site in Dehradun city, India.Ground water contamination is generally irreversible i;e, once it is contaminated it is difficult to restore the original water quality of aquifer. Excessive mineralization of ground water degrades water quality producing an objectionable taste, odour and hardness. So keeping in view the importance of ground water and the effect of municipal solid waste dump on ground water. They select the present dump site Danda Lokhand on Sahastradhara road, in Dehradun. The residential areas around this dump site mainly have bore-wells and hand pumps. The depth of these bore-wells & hand pumps around the site varies from 350-450 feet. The purpose of this study was to assess the physico-chemical properties and microbial activity of underground water was evaluated within 3 months. The physico-chemical properties such as temperature, total dissolved solids, pH, electrical conductivity, alkalinity, total hardness, phosphate, chloride, residual chlorine & microbial activities were studied & analyzed. The quality of ground water in various parameters is fair or satisfactory but the overall study has revealed that the ground water quality does not confirm to the drinking water quality standard as per Bureau of Indian standards. The study clearly indicates that landfills in densely populated cities should have the ground water monitored on regular basis. Furthermore, ground water in and around the landfill sites shall not be used for drinking purposes unless it meets specific standards, indiscriminate developing of waste in developed areas without proper solid waste management practices should be stopped.

7. Donal Nixon D'Souza, P.S. Aditya, S. SavithaSagari, Deepanshi Jain and Dr. N. Balasubramanya (2012): Have studied Groundwater Contamination Due to a Dump Yard. The studied was conducted on the ground water, in the vicinity of Vamanjoor dump yard in Mangalore. Twenty eight ground water samples were collected and analyzed for physical and chemical parameters as per standard methods for water and waste water. The results were compared with BIS guideline values for potable water with the view to quantify the extent of ground water pollution, and its impact on health. The sampling and analysis of ground water showed contamination due to landfill leachate, as a result if excessive concentrations of one or more contaminants such as Iron, Nitrate, Cadmium, Total Dissolved Solids and Fluorides. The presence of these contaminants has rendered about 86% of the samples unpalatable. The variation in contamination is mapped using high resolution satellite data, with the help of GIS and Surfer mapping tools.

III. METHODOLOGY OF PROPOSED SURVEY

Sample Collection

In order to analyze the intensity of ground water contamination due to leaching of wastes into ground, nearest five settlements was chosen. From each settlement one ground water source were selected and the water samples were collected to analyze its quality. Five water samples were collected from the study area and analyze for its physical and chemical characteristics as per standard procedure. The detailed inventory survey also carried out and the details such as depth of source and distance of source from the dumping yard are collected. Clean plastic bottles washed with detergent were used for ground water sampling. The sampling bottles were rinsed duly with distilled water before taking the samples and then on field the bottles were rinsed duly by using the representative ground water samples.

Details of Samples

Total five samples of groundwater were collected from different settlements in a sampler of capacity 2 liter. All the details of each sample and source from which the samples were collected is given in table.

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Table no. 8. 1 Washing of Samplers with Detergent

SR. NO.	AREA	SOURCE	DEPTH (ft.)	DISTANCE FROM DUMPING YARD (m)
1.	ANTUJI NAGAR	BORE WELL	80	100
2.	ABBUMIYA NAGAR	WELL	40	200
3.	SANGHARSH NAGAR	BORE WELL	80	300
4.	GURUKRUPA NAGAR	BORE WELL	150	150
5.	CHANDMARI NAGAR	BORE WELL	150	650

Analysis of samples

The ground water samples were collected in field were send to the laboratory on the same day. These samples were tested in laboratory of **Water Resource Department of Government of Maharashtra** in Nagpur for three different Parameters are as follows:

pH

The term pH is a measure of the concentration of hydrogen ions in a diluted solution. It can range from 0 to 14, with 7 denoting a neutral value. Acidic water has a pH below 7; alkaline water, above 7. The health effects of pH on drinking water depend upon where the pH falls within its range. The U.S. Environmental Protection Agency, which classifies pH as a secondary drinking water standard, recommends a pH between 6.5 and 8.5 for drinking water. According to the World Health Organization, health effects are most pronounced in pH extremes. Drinking water with an elevated pH above 11 can cause skin, eye and mucous membrane irritation. On the opposite end of the scale, pH values below 4 also cause irritation due to the corrosive effects of low pH levels. WHO warns that extreme pH levels can worsen existing skin conditions.

Factors influencing the value of pH:

- The pH of a body of water is affected by several factors. One of the most important factors is the bedrock and soil composition through which the water moves, both in its bed and as groundwater. Some rock types such as limestone can, to an extent, neutralize the acid while others, such as granite, have virtually no effect on pH.
- Another factor which affects the pH is the amount of plant growth and organic material within a body of water. When this material decomposes carbon dioxide is released. The carbon dioxide combines with water to form carbonic acid. Although this is a weak acid, large amounts of it will lower the pH.
- A third factor which determines the pH of a body of water is the dumping of chemicals into the water by individuals, industries, and communities.

Nitrate (NO_3)

Nitrate is an inorganic compound that occurs under a variety of conditions in the environment, both naturally and synthetically. Nitrate is one of the most common ground water contaminants in rural areas. It is regulated in drinking water primarily because excess levels can cause methemoglobinemia, or "blue baby" disease. Although nitrate levels that affect

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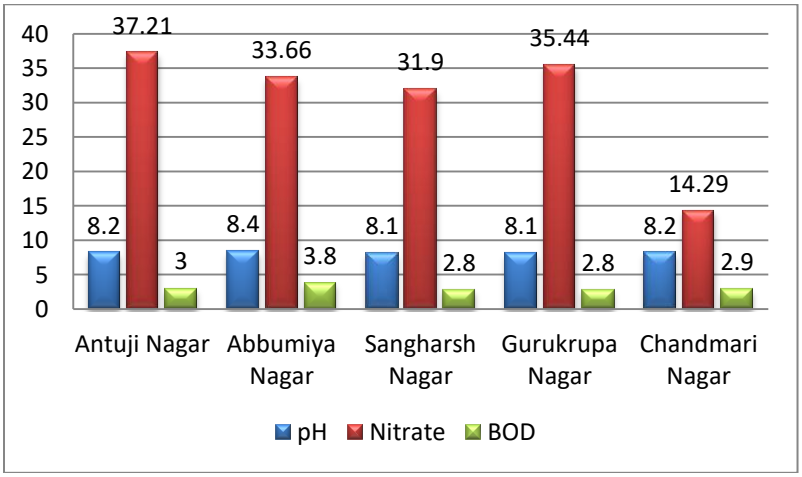
infants do not pose a direct threat to older children and adults, they do indicate the possible presence of other more serious residential or agricultural contaminants, such as bacteria or pesticides.
Nitrate in drinking water is measured either in terms of the amount of nitrogen present or in terms of both nitrogen and oxygen. The federal standard for nitrate in drinking water is 10 milligrams per liter (10 mg/l) nitrate-N, or 45 mg/l nitrate-NO3.

Biological oxidation Demand (BOD)
BOD represents the quantity of oxygen which is consumed in the course of aerobic processes of decomposition of organic materials, caused by microorganisms. The BOD therefore provides information on the biologically-convertible proportion of the organic content of a sample of water. BOD indicates the amount of putrescible organic matter present in water. Therefore, a low BOD is an indicator of good quality water, while a high BOD indicates polluted water. Dissolved oxygen (DO) is consumed by bacteria when large amounts of organic matter from sewage or other discharges are present in the water.

IV. RESULT & DISCUSSION

For analyzing the ground water in the vicinity of Bhandewadi dumping yard five water samples were tested in the government laboratory of water resource department on the basis of three parameters pH, Nitrate and BOD. The results obtained are as follows.



Graphical Representation of pH, Nitrate, BOD Value on the Basis of Region

pH
The pH of the above sample is found within permissible limits but it is very near to the permissible limits. The pH value of Abbumiya Nagar water sample is highest than all the five samples and it is very close to permissible with the difference of 0.1 value this is the indicates that this region is highly susceptible to contamination on the basis of pH value.

Table no. 8. 3 Samples Collected from Different Settlements (Areas)

SR. NO.	NAME OF THE AREA	PH VALUE	REQUIRED (ACCEPTABLE LIMIT)	RESULT
1	ANTUJI NAGAR	8.2	6.5-8.5	**PORTABLE**
2	ABBUMIYA NAGAR	8.4	6.5-8.5	**PORTABLE**
3	SANGHARSH NAGAR	8.1	6.5-8.5	**PORTABLE**
4	GURUKRUPA NAGAR	8.1	6.5-8.5	**PORTABLE**
5	CHANDMARI NAGAR	8.2	6.5-8.5	**PORTABLE**

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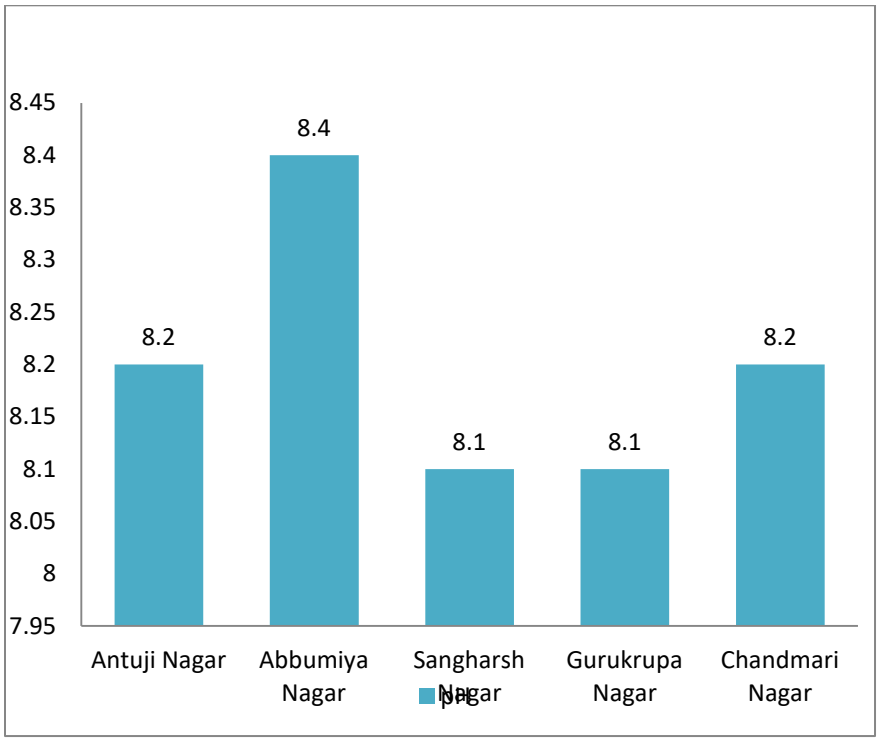

Nitrate (NO_3)

Nitrate content found in above five samples is high but lower than the permissible limits, as specified in BIS 2012 IS10500:2012. But it is very near and increases in the rainy seasons as proved in previous studies. In Antuji nagar it is found to be 37.21 which is very high and the source located 100m away from dumping yard. While the Nitrate value of Chandmari nagar's water sample is very less which is 13.29 mg/l and the source is located about 1000m away from the dumping yard. Hence the value of Nitrate is decreases as we move away from the dumping yard and found very high in the near regions.

SR. NO.	NAME OF THE AREA	NITRATE VALUE (MG/L)	REQUIRED (ACCEPTABLE LIMIT)	RESULT
1	ANTUJI NAGAR	37.21	45 MAX.	**PORTABLE**
2	ABBUMIYA NAGAR	33.66	45 MAX.	**PORTABLE**
3	SANGHARSH NAGAR	31.90	45 MAX.	**PORTABLE**
4	GURUKRUPA NAGAR	35.44	45 MAX.	**PORTABLE**
5	CHANDMARI NAGAR	13.29	45 MAX.	**PORTABLE**

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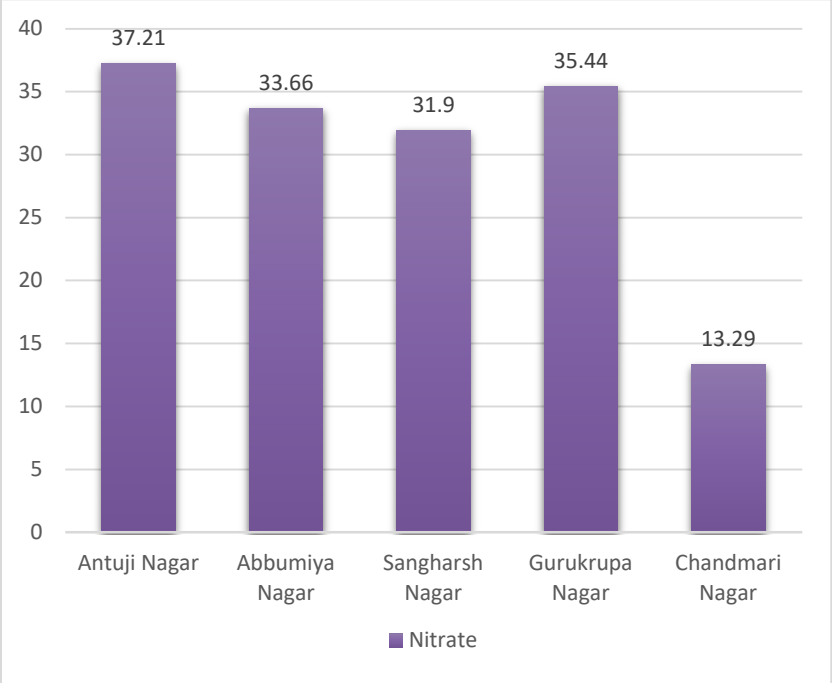

BOD (Biochemical Oxygen Demand):

In above water sample analysis results it is found that while moving away from the dumping yard the value of BOD is reduces. Only the exception of Abbumiya nagar, it may be due the Abbumiya nagar is locate, in between both the dumping yard. The value of BOD according to BIS is should be zero but in the analyzed water sample is found to be 2.8-3.8 mg/l. Which is higher than the permissible limit and hence water in these regions is prohibited for drinking purpose.

SR. NO.	NAME OF THE AREA	BOD VALUE (MG/L)	REQUIRED (ACCEPTABLE LIMIT)	RESULT
1	ANTUJI NAGAR	3.0	---	**NOT PORTABLE**
2	ABBUMIYA NAGAR	3.8	---	**NOT PORTABLE**
3	SANGHARSH NAGAR	2.8	---	**NOT PORTABLE**
4	GURUKRUPA NAGAR	2.8	---	**NOT PORTABLE**
5	CHANDMARI NAGAR	2.9	---	**NOT PORTABLE**

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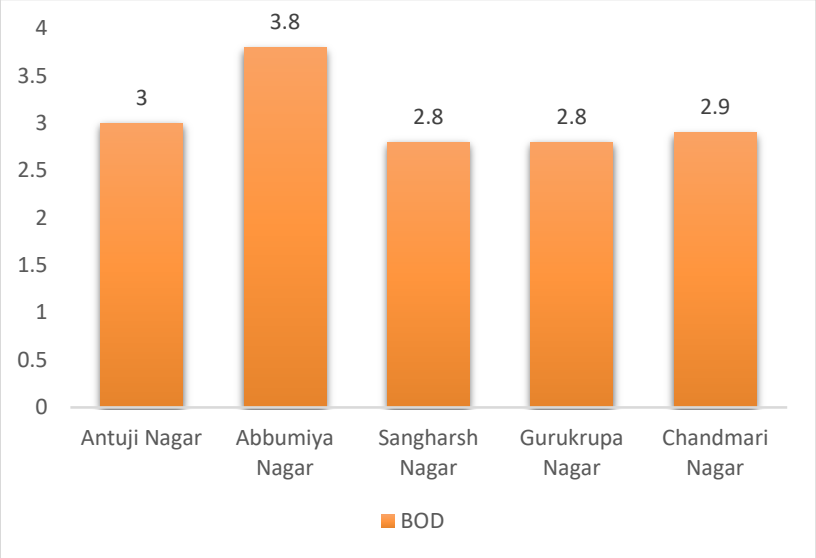

V. CONCLUSION AND FUTURE WORK

As the parameters such as pH and Nitrate is found to be in permissible range, but the value of BOD is crosses its limit and found more than its permissible limit as specified in **BIS:2012, IS-10500:2012**. Hence the water samples collected from the vicinity of Bhandewadi dump yard is from different regions is found unsuitable, as it fails on the standard parameters specified by Indian government for drinking purpose. The samples were collected and analyzed in the winter season and only one parameters is found to be beyond the permissible limit, it can also be concluded that the intensity of dumping yard in rainy season will be high that of in winter season. This study shows that the ground water is highly contaminating day by day due to leachate percolation through dump yard. A necessary action is to be taken to stop this pollution of ground water. Indiscriminate dumping of wastes in developed areas without proper solid waste management practices should be stopped

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