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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- ***In developing countries and modern cities, generation of waste is increasing day by day due to modernization in lifestyle of people. Proper collection of waste and its management, treatment and disposal is a measure concern in many developing countries. For the proper and safely disposal of waste, the disposal site should be far away from the residential area. Nagpur city is the 3rd largest city in Maharashtra and 2nd capital of Maharashtra. This city generates about 1000 MT of solid waste per day collected from different sources of waste like household waste, industrial waste, etc. the whole waste collected from different sources is dispose at Bhandewadi dumping site which is 8 km away from Nagpur. But due to urbanization and rapid growth of the city and low cost of land in Bhandewadi region, this area becomes a home for many families. The leachate from the dumping site gets infiltrated into the ground and contaminates the ground water. As the people residing in this region are all dependent on the ground water only for their domestic uses like drinking, bathing, etc. So this contaminated water which is use by the people is dangerous to their health. For analyzing the effect of dumping yard on ground water and its intensity with respective to the radial distance from the dumping yard, five samples where collected from five different settlements with varying distances and were sent to laboratory to analyze the water for parameters like pH, Nitrate and Biological Oxygen Demand (BOD). The results of these samples will be compared with the standard permissible limits 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.***

Keywords— Ground Water Contamination, Leachate, Biological Oxygen Demand (BOD),

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.

II. OBJECTIVES

Analysis of quality of ground water

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Try to find out the intensity of contamination of ground water due to dumping yard with respect to radial distance

III. STUDY AREA

Nagpur is a city in the central part of India. In Maharashtra State Nagpur district is located between 21*45 N to 20*30 N and 78*15 E to 79*45 E, which essentially indicates that Nagpur district is located in the Deccan Plateau. It is situated at elevation 319 meters above sea level. Nagpur has a population of 2,228,018 making it the 4th biggest city in Maharashtra. The adjoining districts are Bhandara on the east, Chandrapur on the south, Amravati and Wardha on the west and in the north shares the boundary with Madhya Pradesh. It is practically at geographical

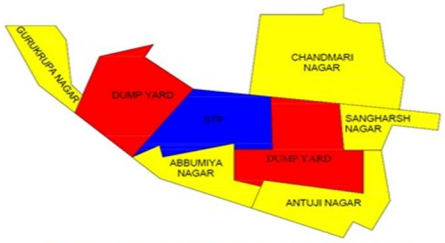

FIGURE: 3 MAP OF STUDY REGION, BHANDEWADI

IV. SOLID WASTE AND ITS DISPOSAL IN NAGPUR

Nagpur City generate 1000 tones and above garbage per day. All these waste is collected and disposed into the landfill located at Bhandewadi at a distance of 8km from the city head quarter Nagpur. The dumping yard has an area of 22.0 hectors which is poorly managed. Bhandewadi has greater importance due to passing of national highways like Jabalpur highway (NH06), Mumbai-Varanasi highway (NH07) and railway rout of Nagpur-Nagbid. It also having a landmark like Swaminarayana Temple. The main waste generated is from homes, markets from agricultural products, retail and commercial markets, slaughter houses and industries.

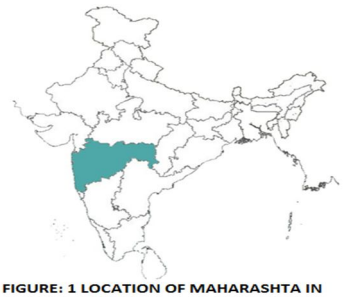

FIGURE: 1 LOCATION OF MAHARASHTA IN INDIA

This dump yard was started in the 1994. This dump yard has not only been a source of air pollution but also has contaminated the ground water in the vicinity. There are close to 3000 families which live within a proximity of 500m from the dump yard. Leachate percolation has resulted in ground water turning black and smelling foul in areas like Abbumiya Nagar, Gurukrupa Nagar, Chandmari, Antujinagar and Sangharsh Nagar, which are in the vicinity of Bhandewadi. This effect is compounded during the winter. Respondents in the study area reported loss of appetite, vomiting and giddiness. Hence, the intention behind this study is to evaluate the extent of pollution in the area and identifying individual pollutant concentrations, and thereby the impact of landfill on groundwater contamination.

Table 1: CLASSIFICATION OF WASTE

TYPE OF WASTE	SOURCES
Domestic waste	Glass bottles, rags, vegetable parts, residues etc.,
Commercial waste	Polyethylene bags, egg shells, cans, bottles, etc.
Agricultural waste	Vegetable parts and residues
Construction waste	Rubbles, wood, concrete, etc.

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V. MATERIALS AND METHODS

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 is collected. Clean plastic bottles washed with detergent was 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. The ground water samples were collected in field were send to the laboratory on the same day. After collection of these five water samples, these samples were tested in laboratory for three different Parameters i.e. pH, Nitrate and BOD.

VI. RESULTS AND DISCUSSIONS

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.

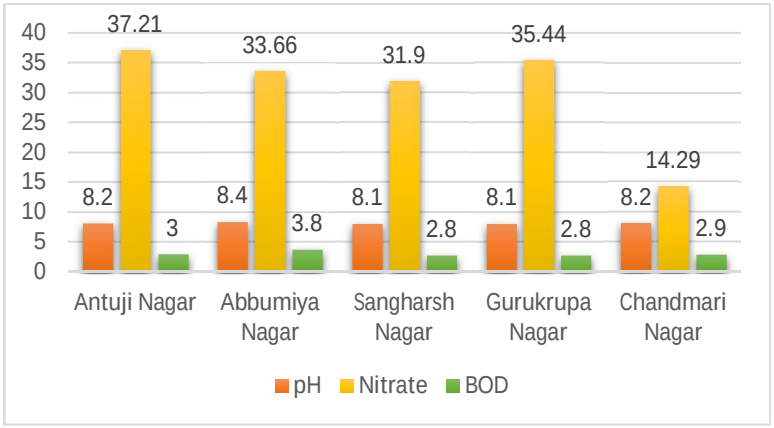

figure: 4 graphical representation of ph, nitrate, bod value on the basis of region

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.

Table 2: Result Of Ph Test

	Name of the Area	pH Value	Required (Acceptable Limit)	Result
1	Antuji Nagar	8.2	6.5-8.5	Acceptable
2	Abbumiya Nagar	8.4	6.5-8.5	Acceptable
3	Sangharsh Nagar	8.1	6.5-8.5	Acceptable
4	Gurukrupa Nagar	8.1	6.5-8.5	Acceptable
5	Chandmari Nagar	8.2	6.5-8.5	Acceptable

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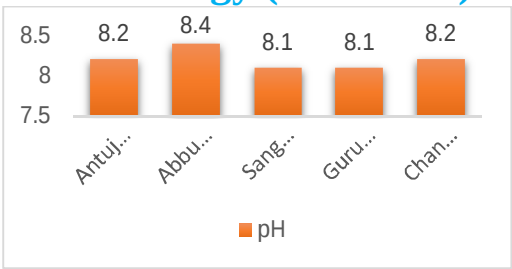

Figure: 5 Graphical Representation Of Ph Value On The Basis Of Area

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.

A. 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 groundwater 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 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.

Table 3: Result Of Nitrate Test

Sr. No.	Name of the Area	Nitrate Value (mg/L)	Required (Acceptable Limit)	Result
1	Antuji Nagar	37.21	45 Max.	Acceptable
2	Abbumiya Nagar	33.66	45 Max.	Acceptable
3	Sangharsh Nagar	31.90	45 Max.	Acceptable
4	Gurukrupa Nagar	35.44	45 Max.	Acceptable
5	Chandmari Nagar	13.29	45 Max.	Acceptable

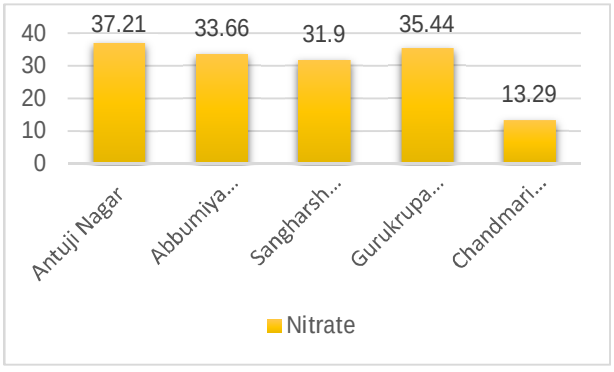

Figure: 6 Graphical Representation Of Nitrate Value On The Basis Of Area

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 Nitrare value of Chandmari nagar's water sample is very less which is 13.29 mg/l and the source is located aboute 1000m away from the dumping yard. Hence the value of Nitrate is

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decreases as we move away from the dumping yard and found very high in the near regions.

B. BOD (Biochemical Oxygen Demand)

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.

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

Table 4: Result Of Bod Test

Sr. No.	Name of the Area	BOD Value (mg/L)	Required (Acceptable Limit)	Result
1	Antuji Nagar	3.0	---	Unacceptable
2	Abbumiya Nagar	3.8	---	Unacceptable
3	Sangharsh Nagar	2.8	---	Unacceptable
4	Gurukrupa Nagar	2.8	---	Unacceptable
5	Chandmari Nagar	2.9	---	Unacceptable

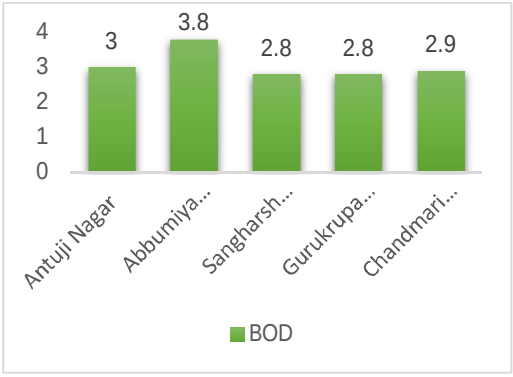

Figure: 7 Graphical Representation Of Bod Value On The Basis Of Area

Permissible limit and hence water in these regions is prohibited for drinking purpose.

VII. CONCLUSION

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 standared parameters specified by Indian government for drinking purpose.

This study shows that the ground water is highly contaminating day by day due to leachate percolation through dump yard. An necessary action is to be taken to stop this pollution of ground water.

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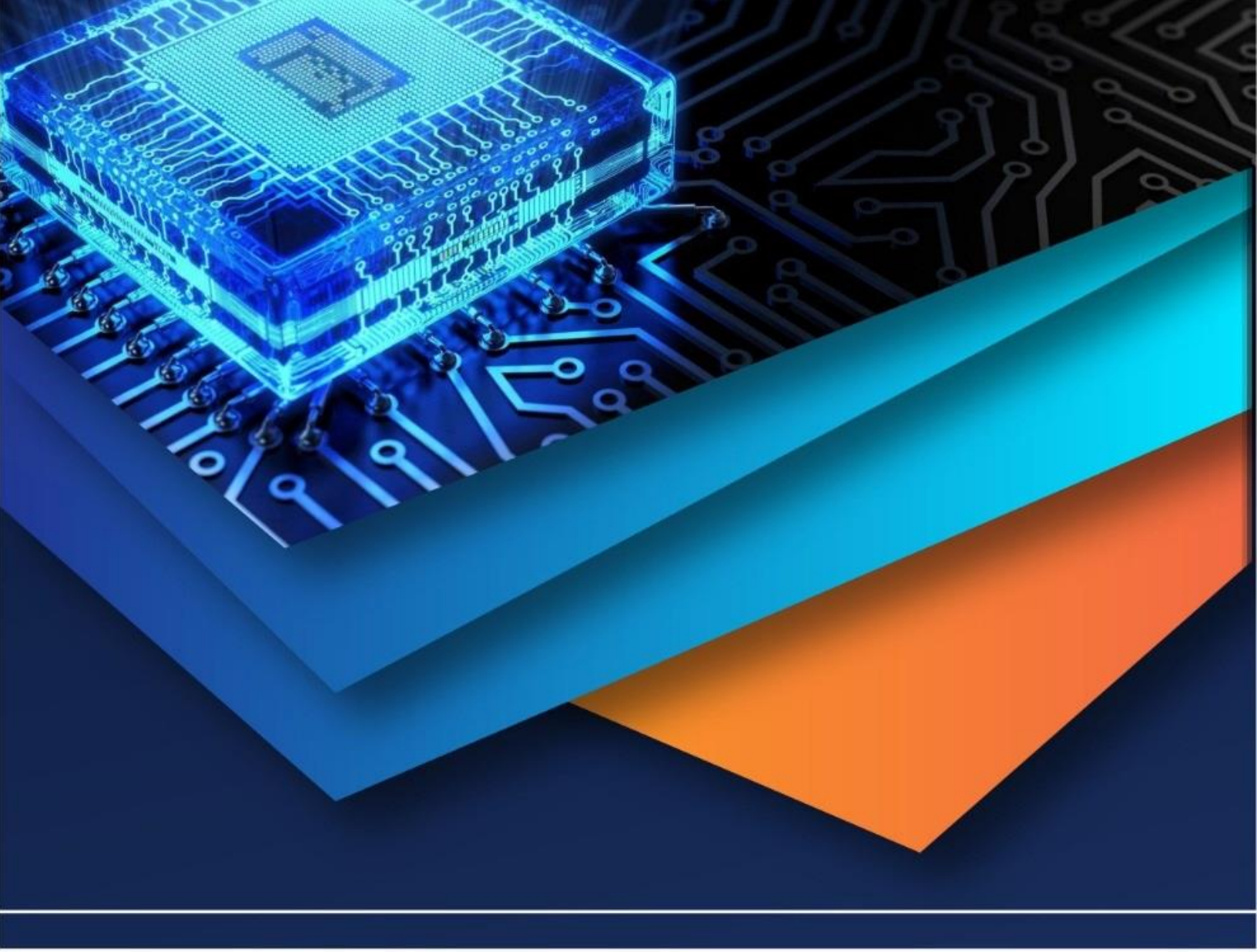

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