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Assessment of Quality of Water Bodies Surrounding Bhandewadi Landfill Site, Nagpur city

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Abstract - *Explosive population growth and steady pursuit of economic development and development over the past decades Municipal solid waste generation in Nagpur. Backfilling is the most popular method Export of municipal solid waste. Landfill leachate is a major threat Due to high concentrations of toxic substances it enters local aquifers. This study was directed assessing the quality of groundwater resources serving nearby communities from the dump of Bhandewadi in the city of Nagpur. Taking and analyzing groundwater samples Characteristic. The results of the analysis showed measurable impacts of landfills on groundwater qualitative. Increased Na+ and NO3 levels, Cl and heavy metals such as Mn and Fe have been found Measurable levels in groundwater. Ion Ratio Plot Shows Silicate Weathering And anthropogenic activity is the dominant factor determining the main ionic composition in the study area. Na-Cl types of water are associated with high levels of nitrate contamination. Most of The sample is not suitable for domestic use and is significantly increased compared to drinking water standard. For effective study Impact of landfills on the environment and human health. Adequate buffer zone between the landfill and adjacent property lines must be preserved prior to the placement of the new site polygon.*

Key words- *water quality index, landfill impact, pollution, leachate effect.*

1. INTRODUCTION

Rapid population growth, uncontrollable urbanization and industrialization, inadequate hygiene scenarios, and runaway waste disposal are responsible for the major world-class degradation of the arena's surface groundwater, especially in emerging economies. .. Urbanization India prices are fast. It increased from 30.93% in 2010 to 34.93% in 2022. Unregulated Growth For the past years, mainly in urban areas, there was no major infrastructure service for professional collection, transportation, disposal and disposal of household waste Pollution risk and suitability gain.

Most cities in India use urban waste treatment technology. It's fragmented and unscientific.

Site selection is usually primarily geographic as an alternative geological and hydrogeological consideration. The logistics phrase of is high near the site that provides waste. Therefore, it is not uncommon for waste disposal sites to be located internally. It is a common obstacle and is surrounded by residential areas. Groundwater chemistry around landfills is controlled by both natural geochemical processes such as silicate weathering and anthropogenic activities (Deepali marghade et al 2010) [1]. Surface water quality near landfills contains more ions and cations than groundwater samples. During the rainy season, putrefactive waste mixes with rainfall and flows into runoff, contaminating nearby surface waters (Otwoghere asuma et al 2013) [2]. The LWPI can be used to assess water quality variability around landfills. LWPI is a very reliable and useful and effective way to evaluate and evaluate and communicate information about water quality. This is used to estimate the degree of water pollution near landfill and to assess the volatility of different results and compares the results of different places and periods (Isabela A. Talala et al. 2014) [3]. Solid Waste Management The incorrect method and leaching collection system and inappropriate effect of depression or disposition have a great impact on the quality of surface and groundwater. The groundwater cannot accept for drinking water practices and build a sanitary dump properly designed to limit groundwater contamination (ThaAYalnayaki D et al 2019) [4]. The lack of appropriate solid waste management system can be considered a major cause of water quality (Neeli vasavi et al 2020) [5]. The distance from the water source to the landfill does not significantly affect the level of other physicochemical properties (Kofi owusu ansah amano et al 2021) [6].

1.1 Location and Climate

The Bhandewadi landfill (range 21º08` and 21º09` N and longitudes 79º07` and 79º08` E), this is the point of interest of the modern-day observe is located in south east nook of the metropolis. Nagpur metropolis generates approximately 900-1000 MT of waste in line with day; 350-four hundred grams in line with capita in line with day. About 30% of this waste is natural compostable material. The closing 70% includes paper (11.9%); rubber,- leather-based and synthetics (3.02%); glass (0.98%); metals (0.33%) and different inert materials (53%). The landfill accepts officially, non-unsafe strong wastes of domestic, commercial, industrial and institutional origins, however in exercise all

sort of wastes are co-disposed. The weather of Nagpur is semi-arid with minimal temperature of 10 °C in iciness and maximum temperature of 48 °C in summer. The common rainfall is 1200 mm and essential a part of which (70%) takes place for the duration of the south-east monsoon (June to September).

1.2 Geology and Hydrogeology

A geologically important part of the site is protected by the use of unclassified gneiss. The Granite gneiss is represented by purple coarse-grained rock containing plagioclase, Quartz containing a small amount of microcline, biotite and hornblende. In the field study, the spread of groundwater is generally managed with the help of weathered diplomas. The weathered quarter thickness ranges from 1 to 10 meters. Groundwater in a weathered quarter under unlimited conditions. The general slope of the site is close to the circulation along it the northwest corner of the town.

1.3 Ground Water Quality

Groundwater is a significant regular asset of drinking water. The compound and natural person of ground water is OK for most purposes however the nature of, ground water is changed because of man's exercises. The normal nature of groundwater modifies as groundwater streams from springs or waterways and re-energize. regions. Groundwater contains most normal broke up mineral substances like sodium, potassium, magnesium, calcium, bicarbonate, chloride and sulfate. The appropriateness of groundwater for different purposes relies upon many factors, for example, disintegrated minerals and natural substances present in ground water in various fixations. A few constituents are innocuous, others are destructive, and a couple might be exceptionally poisonous. Populace development is one of the central point answerable for expanded strong waste. Agribusiness generally affects groundwater quality, where serious practices occur". Urbanization and industrialization essentially affect groundwater quality. In many pieces of earth air conditions likewise change the nature of the groundwater. Groundwater isn't viewed as attractive for drinking assuming that the amount of broken up minerals surpasses from allowable limit. Groundwater in which disintegrated minerals are available then its inclination is saline. Broken down minerals can be risky to creatures and plants in huge focuses. Groundwater that contains a ton of calcium and magnesium is called hard water. The hardness of water is addressed as far as how much calcium carbonate. Lately, the development of businesses, innovation, and populace has expanded the pressure upon water assets. The nature of groundwater has been corrupted.

1.4 Groundwater Contamination

Groundwater defilement happens when man-caused unfortunate items to get into the groundwater and make it become dangerous and ill-suited for human use. Genuine wellbeing impacts might be brought about by sullied groundwater. It has been accepted that foreign substances can either be above or subterranean. Development of groundwater and scattering inside the spring spreads the toxins over a more extensive region. Surface water permeate through soil then it gets minerals, salt, and natural mixtures. The water relocates descending along these lines convergence of disintegrated solids is expanded. In certain areas minerals fixation is sufficient high so that the groundwater is ill suited for drinking and water system reason without treatment.

Whenever the defiled water saturates the dirt and enters a spring it results into ground water tainting, Groundwater pollution comes from point and non-point sources. Point sources defilement comes from explicit area, for example, septic framework, underground capacity tank and landfills yet non-point sources pollution comes from a huge region, for example, from agrarian waste (pesticides and manures) and metropolitan waste.

Whenever the contamination starts from a solitary, recognizable source is known as a point wellspring of defilement. Different sorts of point-source foreign substances found in waters, for example, modern, rural, and of metropolitan sources. Point wellsprings of contamination from agribusiness might incorporate creature squander capacity and cleaning regions for pesticides, manures. City points sources incorporate wastewater treatment plants, landfills". Because of these exercises, perilous substance might remember for the unrefined substance. Non-point sources contamination happens over broad regions.

At the point when water moves over and through the ground it can get regular pollutes, engineered taints storing them into waterways, wetlands, lakes and underground water.

2. METHODOLOGY

This study laid out determination measures preceding information assortment to assist with recognizing appropriate testing locales for groundwater quality evaluation close to landfills. The landfill was high over the ground and tests were brought the hydroelectric bank to gauge the degree of groundwater contamination. Uncovered wells and boreholes that are constantly utilized for examining were chosen.

The uncovered wells and groundwater tests from the wells were put in plastic holders that were pre-washed with refined water. As a component of the quality control gauges, the holders were flushed with groundwater tests preceding filling. Tests for weighty metal investigation were gathered in 1 liter polyethylene bottles and put away with 2 mL of concentrated HNO_3.

Separate examples were taken for essential cation and anion investigation. All examples were put away at 25 ° C and

shipped off the research center for investigation. The physicochemical boundaries of the example were dissected by standard insightful techniques (APHA, 1995). In-situ estimations of pH and electrical conductivity (EC) were performed utilizing a pH and electrical conductivity meter. Calcium (Ca^{2+}) and magnesium still up in the air by titration with standard EDTA arrangement. Chloride (Cl) was find by standard $AgNO_3$ titration, Carbonate (CO_3^{2}) and bicarbonate not entirely settled by titration with HCl. Sodium (Na^{+}) and potassium not entirely set in stone with a fire photometer, Sulfate (SO_4^{2}) and nitrate (NO_3) were estimated with an UV Visible spectrophotometer. Convergences of weighty metals like copper (Cu), iron (Fe), manganese (Mn) and zinc (Zn) were estimated utilizing nuclear ingestion spectroscopy.

Table-1: Analytical data for the groundwater samples in the study area.

(Physical properties)

Location of sample taken	pH	EC	TDS	TH
Bidgaon	7.8	2590	1426	410
Ambe nagar	7.7	2580	1231	350
Pawan Shakti nagar	7.6	2650	1687	350
Symbiosis university	6.4	1840	993	490
Radha Krishna nagar	7.1	1960	1088	255
Navin nagar	7.5	1857	1207	320
Devi nagar	7.3	1749	1108	270

Table-2: Analytical data for the groundwater samples in the study area.

(Chemical properties)

Location of sample taken	Na +	K +	Ca^{2+}	Mg^{2+}	Cl^{-}	Fe	Mn	Zn
Bidgaon	388	68	58	64.6	415.3	0.60	0.22	0.44
Ambe nagar	356	81	65	63.7	333.9	0.03	0.58	0.13
Pawan Shakti nagar	379	99	36	47.5	404.5	0.45	1.00	0.56
Symbiosis university	169	87	85	68	429.7	0.02	2.23	0.09
Radha Krishna nagar	41	89	69	8.5	223	0.1	0.0	0.8	9	3	10
Navin nagar	413	77	49	45	166.3	0.87	0.52	0.34
Devi nagar	389	79	18	66.8	291.8	0.26	0.23	0.77

2.1 Sampling Methods

To survey the degree of groundwater pollution, Sampling of groundwater is done from hand siphons also, bore wells situated in private and farming regions, according to the standard methodology. Great quality limited mouth screw-covered polypropylene jugs of one-liter limit were utilized to gather the test. Bottles previously washed with weaken nitric corrosive than threefold with DM water (Demineralized).

Previously test assortment bottles were washed threefold with water to be inspected and afterward tests were gathered.

2.2 Sampling Sites

Seven sites from near bhandewadi within 2km area of bhandewadi Nagpur, so that drawn test address the genuine groundwater nature of the area.

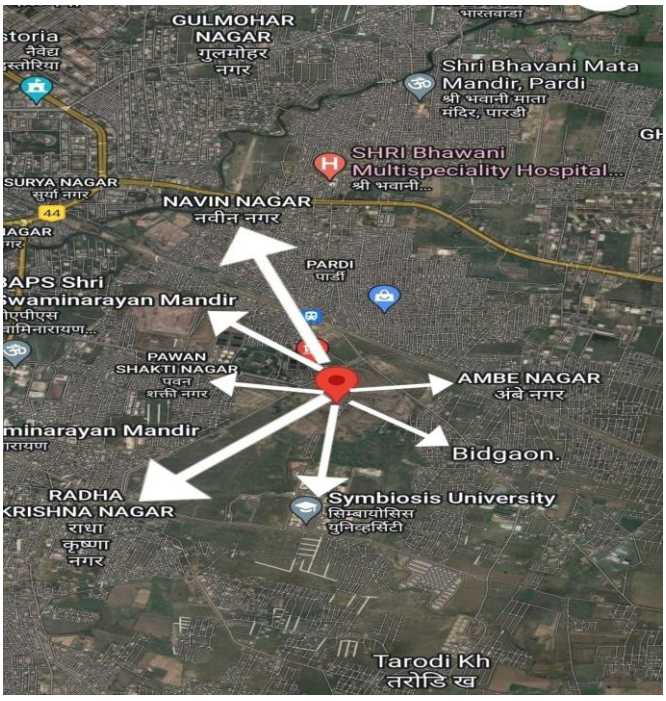


Figure1. Location map of study area showing sampling points.

2.3 Labelling of the samples

Each example was coded satisfactorily and mark code on examining bottles by indelible marker at two places, recorded all the data in regards to name of the examining area, source and date of assortment in field book to keep away from any confusion and error.

2.4 Collection of samples

Before collection of test the pipeline of bore wells/hand siphons were flushed for an adequate period of time, so genuine example can be gathered which addresses the real nature of groundwater. The tests were gathered from seven spot and afterward combined as one. Test bottles were washed threefold with the water to be gathered and afterward filled totally to keep away from infringement of air bubble. Test bottles screw-caped firmly and brought to the research center. The examples were protected in cooler at 40^0C. The investigation of pH was made in field with the assistance of syntonic make compact pH meter.

2.5 Examination of Samples

Groundwater tests of different areas were dissected for assurance of level of contamination with regard to the accompanying physicochemical boundaries and weighty metals decided on examination.

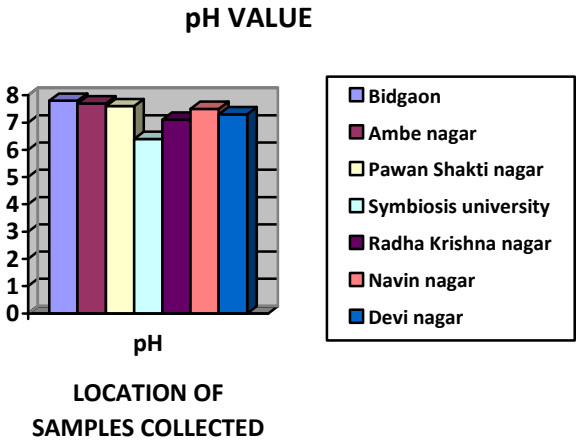
RESULTS AND DISCUSSION

In the present study the collected groundwater samples nearby dumping yard are free from odor and colour. The groundwater is only used for drinking and domestic activities.

The acceptable and permissible limit of the water quality parameters for drinking water recommended by World Health Organization and Bureau of Indian Standards (IS 10500-2012) are shown in the Table-3.

Table-3: Water Quality Standard

Parameters	BIS Standards (IS 10500-2012)		(WHO) (2002)
	Acceptable Limit	Permissible Limit	
Colours	5	15	-
Odor	Agreeable	Agreeable	-
pH	6.5-8.5	No Relaxation	6.5-9.2
Taste	Agreeable	Agreeable	-
Turbidity	1	5	-
Total Dissolved Solids	500	2000	250
Chloride	250	1000	200
Fluoride	1	1.5	1.5
Iron	0.3	No Relaxation	0.3
Sulphate	200	400	50
Total alkalinity as calcium carbonate	200	600	500
Total hardness	200	600	300
magnesium	30	100	200
calcium	75	200	150
Zinc	5	15	5



Hydro-chemical Parameters and Groundwater Quality

The consequence of the substance examinations of delegate groundwater tests of review region and their correlation with the WHO rules is given in Table 3. The groundwater is antacid with pH differing somewhere in the range of 6.4 and 8.4. EC and all out broke up solids (TDS) imply the inorganic heap of any water body. The TDS worth of groundwater tests from the review region shifts from 981 to 2927 mg/l.

As the distance of inspecting locales from landfill builds, TDS content abatements. Greater part of the groundwater tests of the review region goes under saline water class. The review shows that no example is under 500 mg/l of TDS which can be utilized for drinking with no gamble. EC values goes from 1422-3750 µS/cm. Such a high EC can be ascribed to high saltiness and impact of landfill site on groundwater system. The complete alkalinity (TA), as CaCO3 in groundwater of study region goes from 120 to 530 mg/l. The high alkalinity grants water with horrendous taste, and might be hurtful to human wellbeing. The all-out hardness (TH) of groundwater differs from 55 to 1490 mg/l. The greatest reasonable constraint of TH for drinking design is 500 mg/l and as far as possible is 100 mg/l (WHO-2002).

Heavy Metals

Heavy metals are ordinarily connected with molten and transformative rocks, and specifically, with metal bodies.

Enduring of these stones, including oxidation and draining, may bring about raised follow metal levels in groundwater.

In the current review, Fe, Cu, Mn and Zn content are broke down in the groundwater tests (Table 1&2). Estimated upsides of Fe in groundwater goes from 0.025 to 6.949 mg/l. Around 53.8% of tests show grouping of Fe over the rule worth of 0.3 mg/l (WHO-2002). In the greater part of the examples Cu is beneath perceptible breaking point. Estimated worth of Cu in groundwater goes from 0.01 to 0.11 mg/l. Mn focus shifts somewhere in the range of 0.02 and 2.44 mg/l. Centralizations of Mn in abundance of 0.2 mg/l makes water tacky to drink with no particular harmful impacts. Around 38% of tests show Mn fixation above rule worth of 0.1 mg/l (WHO, 2002).

CONCLUSIONS

Groundwater analysis in both deep bore wells (BW) and shallow dug wells (DW) aquifers along the slopes of the Bandewadi landfill provides strong evidence of groundwater pollution. The aquifer along the landfill slope has high concentrations of Na^+, Cl and NO_3, suggesting that the landfill contributes to groundwater pollution. Given the current concentrations of Na^+, Cl, and NO_3 in groundwater, there is a risk of increased groundwater pollution in the landfill area. Approximately 83% of groundwater samples contain more than 45 mg / l NO_3, making them unsuitable for drinking. The Cl concentration currently observed in groundwater samples is so high that it is not suitable for drinking water. 41.5% of the samples have higher manganese levels than the guidelines, and almost half of the tested samples have higher iron levels than the WHO recommended guidelines. Very high heavy metal concentrations were not detected in groundwater in study area. Household waste with few heavy metals is transported to landfills.

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