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THE IMPACT OF SOLID WASTE MANAGEMENT PRACTICES ON THE ENVIRONMENT: A CASE STUDY OF ROHTAK CITY

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Abstract:

The management of solid waste has become a critical concern due to its potential adverse effects on the environment. This research investigates the impact of solid waste management practices on the environment, focusing on Rohtak City as a case study. The objectives of the study include assessing the current garbage management procedures, quantifying waste generation, analyzing the physical composition of solid waste, and evaluating the impact of waste on soil and water in the vicinity of the municipal dumpsite. A comprehensive study was conducted, involving the collection and analysis of groundwater and soil samples from locations near the municipal dumpsite. The physicochemical properties of the groundwater were analyzed, revealing variations in parameters such as pH, electrical conductivity (EC), total dissolved solids (TDS), alkalinity, hardness, calcium, magnesium, chloride, and nitrate. While certain parameters adhered to recommended limits, elevated levels of TDS, EC, and certain ions indicated groundwater contamination, particularly in proximity to industrial areas. Similarly, soil samples were tested for parameters including pH, EC, total organic carbon, water holding capacity, bulk density, moisture content, and chloride. The results demonstrated that several parameters exceeded permissible limits, signifying severe contamination of soil near the dumpsite. This contamination raises concerns about the safety of using such soil for agricultural purposes, as it could lead to the accumulation of contaminants in the food chain, posing risks to human and animal health. An in-depth review of the collected data underlines the importance of proper waste management practices. It is evident that inadequate waste disposal practices adversely affect both groundwater and soil quality. The research concludes by recommending measures to mitigate environmental impact, such as maintaining a safe distance between human settlements and waste disposal sites, implementing improved waste management methods, and establishing leachate collection systems. Ultimately, these actions are crucial for safeguarding the environment, public health, and the well-being of local communities.

Key Words: Solid Waste Management, Environmental Impact, Groundwater Contamination, Soil Contamination, Waste Disposal Practices, Rohtak City.

Introduction:

Water must exist for the continued existence and advancement of every living thing on Earth. 70% of the water on the globe is accessible at the moment. But as a result of man's activity, industrialization, and fertilisers used in agriculture, the water has become contaminated with numerous dangerous contaminants. It is critical that the quality of drinking water is assessed regularly in order to safeguard human health from water-borne diseases. Due to the contamination of drinking water, humans are susceptible to a range of diseases due to water (Simpi and Patel, 2011). Water is necessary for all living tissues. Animals and plants must have water to survive. The metabolic and growth processes of most living organisms rely on water. Almost all water in the body acts as a nutrient distributor and waste removal agent. Water is a versatile reactant and disperser as well as a versatile solvent. It also plays a crucial role in industrial power generation and navigation. All living creatures, from bacteria to humans, require water in one form or another. Humans have used water as a vital resource since the beginning of civilisation, exerting an immense impact on historical development. Pollution has increased and diminished the quality of air, water, and soil. Humans have played a significant role in damaging the earth and the land on which we stand. In order to survive, man must ensure that the natural environment remains healthy. Human activity-industrial or agricultural is the principal cause of pollution. Without following rules and regulations, materials such as dirt or grime is introduced into the atmosphere from a different location (Inobeme et al., 2014). The main issue brought on by population increase, urbanisation, and industry in low-income nations is the lack of proper cleanliness among rural residents (Musa, 2014). As per the (Ubwa et al., 2013), a lot of waste are generated from man - made activities, which might be beneficial or possibly hazardous to end users, ecosystems, animals, and other living things (humans). Development can thus be hampered by environmental reactions as a result of resources from both industry and anthropogenic activities that have the tendency to be catastrophic factors (Sharma et al., 2014). Depending on environmental circumstances, nature has a finite capacity to hold these contaminants in check. Some toxins may be saved or treated at a prescribed level by one environment, but others may be more severely at danger of such adverse consequences. After being utilised in the home, agriculture, and industry, water can become contaminated. Pollutants are harmful and persistent substances that contaminate the environment. They are the result of our waste products being released into the environment. Water is non-potable and must not be wasted. It must be handled carefully and profitably. Pollution has become a big problem in India since 70% of the nation's groundwater and water supplies contaminated by inorganic, organic, and biological pollutants (Yadav and Kumar, 2011). After being utilised in the home, agriculture, and industry, water can become contaminated. Pollutants are harmful and persistent substances that contaminate the environment. They are the result of our waste products being released into the environment. Water is non- potable and must not be wasted. It must be handled carefully and profitably. Pollution has become a big problem in India since 70% of the nation's groundwater and water supplies contaminated by inorganic, organic, and biological pollutants (Yadav and Kumar, 2011).

Municipal Solid Waste (MSW):

Municipal solid waste (MSW) management is one of main issues that cities are now days dealing with (Obirih, 2002; Maity, et al.,2012; Muchangos, et al., 2015; Chaturvedi , Gaurav,2018). Management of municipal solid trash is one of the biggest issues that urban planners encounter globally. The issue is particularly acute in most cities in developing nations, where a combination of factors- including rising urbanisation, inadequate planning, and a lack of sufficient resources- have led to a deplorable scenario for the city's waste municipality. Municipal garbage continues as a serious hazard to the individuals and the ecosystem on a global scale by contaminating land and water resources. The production and makeup of municipal garbage are negatively impacted by levels of urbanisation and modernity (due to a higher percentage of organic matter and heavy metals).

The issue is particularly serious in the majority of developing country cities where poor planning, inadequate funding, and increased urbanization all to the deplorable condition of the municipal solid waste management system (Pandey et al., 2007; Annepu,2012; Bhange et al.,2017). There is a sizable volume of waste disposed of improperly, harming both the environment and the economy. There are thought to be 145626 metric tonnes of solid trash produced daily in nation of India. The trash of garbage produced per individual varies in between 0.2 and 0.6 kilogramme. In between 50% to 90 % of rubbish was collected; the remaining 10 percent was burned in the open on pavments and 10% was collected as municipal trash. According to estimates, the price for urban local bodies to collect, transport, treat, and discard of solid trash per tonnes ranges from Rs.500 to Rs.1500. 60 to 70 percent of this amount, according to the Ministry of Urban Development's 2001 report, is spent on waste collection, 20 to 30 percent on transportation, and only a small portion is used for final waste disposal. The State and municipal governments typically give less budgetary support to this industry since they view solid trash as being of low priority. Another obstacle is the towns' protracted decision-making procedures. . Because there is minimal social, economic, or cultural collaboration between individuals, groups of people, businesses, and local government, managing municipal solid trash is typically an extremely difficult undertaking. Additionally, there is a lack of understanding of the laws and regulations, which has resulted in a chaotic situation [National Environmental Engineering and Research Institute;2010, Air quality Assessments, emissions inventory and sources apportionment studies: Mumbai, New Delhi, India: Central pollution Control Board (CPCB) (Herion et al., 2008;Chavan et al.,2013). Despite the fact that India has created rules governing trash from municipalities, toxic waste, and medical waste, local and municipal adherence to the regulations and knowledge of them lag behind (Meena and Laura, 2018). Municipal administrations are unable to expend or upgrade the facilities needed for proper waste management as trash volume rise. Garbage is left lying around on footpaths and in streets in many towns. Other than the restrained home backyard garbage disposal caused primarily by poor economic position and related to the tradition of the rural areas which linger on even to urban habitation, municipal soild waste disposal is the main method of waste disposal in the municipality. According to estimates from the census of india (2001), India's population would grow at a rate of 1.2% each year. 285 million people reside in cities, compared to 742 million in rural areas. During the previous 60 years, the country's urbanization rate rise from 17.6 to 31.16 percent by the year 2026. Municipal solid waste (MSW) production by India's urban population was estimated to increase from population was estimated to increase from 114,575 tonnes/day in 1996 to approx. 440,461 tonnes/day by the year 2026 (Talyan et al., 2008). The urban population's changing lifestyles, eating habits, and living standards are to blame for the enormous increase in MSW production. However, the collecting effectiveness was under 70 percent (CPHEEO, 2000). Open landfills are typically unhygienic and smelly environments where disease-carrying rodents like rats and flies thrive (Bellebaum, 2005). Methane and other gases are released into the environment when bacteria decompose solid waste, while fires pollute the air with toxic smoke and numerous volatiles. Liquids leak and seep through the solid waste heap until they reach the earth, surface water, and ground water. Heavy metals, pesticides, and hydrocarbons, among other hazardous compounds dissolved in this liquid, regularly contaminate soil and water (Adelekan and Alawode., 2011). Continuous municipal waste disposal on soil, according to (Anikwe and Nwobodo,2001), may lead to an increase in heavy metals in the soil and surface water, which would be hazardous to deep-feeding plants. Heavy metals like arsenic, lead, cadmium, zinc, cobalt, and nickel and mercury are a concern since they can harm the health of soil wildlife, and human beings (Adelekan and Abegunde, 2011). The uncooked mussels are much more detrimental for agricultural usage since they quickly increase the toxicity of the soil. However, these experts also suggest that the soils at municipal garbage disposal sites are suitable for surface feeder plants since they have an adequate amount of biological stuff. (Anikwe And Nowobodo., 2001; Adelekan and Alawode., 2011). According to Brady and Ratta, open dump fields therefore serve the dual purposes of securely disposing of waste while simultaneously increasing the chemical and physical characteristics of soils that make up profitable land for farming. Other studies (Urunmats and Ikhouria, 2005; Asalawalam and Eke, 2006) have demonstrated that dumpsites close to two major cities in Nigeria may be successfully used for residential and agricultural uses without concern for heavy metal toxicity. In light of this, it can be seen that farmers can cultivate vegetables and other surface-feeding crops in old rubbish fields. Consequently, it may be seen that old trash fields offer farmers good grounds for growing vegetables and other surface feeder crops.

Sewage sludge, leftovers from industrial factories, and extensive fertilizers are the most likely sources of soil, water, and plant pollution. In many countries, including India, using industrial or municipal waste water in suburban regions is a popular practices. Using sewage effluents to irrigate agricultural land is a common practices all over the world. The primary problem is the taint and quality of irrigation water, particularly in areas with scarce water supplies. Not only should the water resources in this area be used correctly, but contamination also needs to be avoided. It is particularly prevalent in developing nations where the expense of water treatment is considerable. The use of sewage and other industrial effluents for irrigating agricultural fields is expanding in India while fresh water availability for irrigation is gradually decreasing. Opportunities exist for farms since home sewage effluents are rich as nutrients and also include the major micronutrients. Home sewage effluents present opportunities for farmers since they are high in biological material and contain considerable amounts of both major and micronutrients. Consequently, it is anticipated that continual irrigation with sewage water will enhance soil nitrogen levels. Wastewater and sewage are still regarded as having the highest levels of organic matter and plant nutrients. Sewage water is sold in many cities and towns, providing communities with a good source of revenue. The circumstance has altered, though. Farmers favour sewage irrigation since it is free to neighboring agricultural fields and is enriched with macro and micronutrients necessary for plant growth. This reduces the need for fertilizer and irrigation water. In addition to nutrients, sewage water also contains heavy metals, which causes these metals to bio-accumulate in the crops grown there. Many authors in the Sanganer town area of Jaipur have noted that crops irrigated with sewage water bio-accumulated heavy metals (swapnil et al., 2016).

Cities now have to deal with solid waste management issues. The distributing issue is that one way that soil quality and groundwater quality are lowered is by putting rubbish on the ground. Human health is contaminated by direct human contact, drinking contaminated groundwater and ingestion of garden produce cultivated on or near active or abandoned dumpsites. Because there is little economic, social, and artistic collaboration between households, communities, enterprises, and the municipal the government, managing municipal solid waste is typically an extremely difficult undertaking. The laws and regulations governing municipal solid trash, toxic waste, and biological garbage are also poorly understood, and community and municipal obedience to the laws and comprehension of them lag behind.

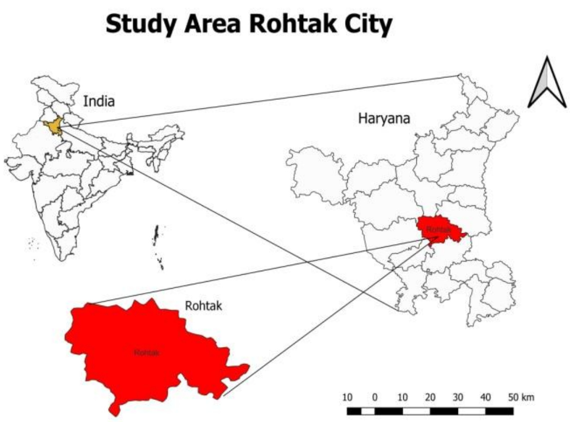
Municipal Solid Waste Generation Sources:

Significant sources of garbage creation include:

- Street sweeping,
- Stable waste
- Trade waste
- Construction and demolition materials,
- Commercial and business establishments and
- Institutions' localities viz. schools, hospitals, vegetables, fish, meat markets, colleges, fruits, restaurants, religious places, community, government buildings, cinema and besides theaters marriage halls & theaters.

Study Area:

Rohtak city is the fast growing urban centre in Haryana state. The tiny city of Rohtak is situated in the Gangetic region in India's northern part. The population of Rohtak city is 4.77lakhs (census of India, 2011). Rohtak, the fourth-largest city in the state of Haryana, constitutes one among eight regional hubs of the national capital region. The city of Rohtak stands in Haryana's southern and eastern regions. The average elevation of Rohtak City above mean sea level is 219 Meter. The city of Rohtak is situated within the longitude range of 76°31'47.764" to 76°42'43.071" and the latitude range of 28°49'53.354" to 28°56'33.819". On National Highway No. 10, Rohtak is positioned 250 kilometers away from the capital city of Chandigarh and 70 kilometers to the northwest of New Delhi. Rail & vehicles connections are excellent. The subtropical monsoon, moderate and dry winter, hot summer, and sub-humid climates can all be categorized. 592 mm of rain falls annually on average. The average maximum temperature each year is 40.50 degrees Celsius (in May and June), while the average minimum temperature is 70 degrees Celsius (in January) 17. In 1951, there were 71902 people living there. However, after 50 years, the population significantly rose, reaching 2.9 lac in 2001 and 3.74lac in 2011. Its population is growing at a pace of 3 to 4% annually. The municipality limits which were 30.95 km2 in 2007 but were increased to 104.10 km2 in 2010 due to population growth and urbanization, were also expanded. Due to the municipal corporation's inclusion of nine neighboring villages in 2012, the municipality's boundaries expanded to 139.4 km2 and housed 4.8 lac people (MCR, 2013). Solid garbage in the city gets gathered, shifted and disposed of by the municipal government. There are more than 512469 people living in the city, and 250 MT of solid trash are thought to be produced there every day. Each person produces about 0.22 kg of rubbish, which is greater over CPHEEO. (Central Public Health and Environment Engineering Organization) norms.



Sanitary Landfill Site of Rohtak:

The municipal solid waste dumpsite is located at village sunariyan in Rohtak, Area of site is approximately 25 acre.

- Nearly 500 metres separate the location from that of the Rohtak - Bhiwani route.
- Rohtak city is 5km north east from the site.
- NH 0 is 4.5 km north to the site.
- Rohtak railway station is 5.8km north east.

The dumpsite used to be in an open area without any boundaries or walls before 2014. Be aware that RMC (Rohtak Municipal Corporation) is modernising the dumpsite and that NBCC assisted in building the waste processing plant. The gathering, shifting, and discard,of the city's solid waste were handle by the Rohtak, Municipal-Corporation. An average of 0.5 kilogramme of waste is thought to be produced daily by each inhabitant of the.

Objectives:

- To examine quantities of solid waste generated in Rohtak City.
- To examine the current solid waste management procedures of Rohtak City.
- To examine the physical composition of solid waste in Rohtak City.
- To explore impact of solid waste disposal practices on both groundwater and soil quality near the dumpsite.

Methodology:

The current investigation is supported by secondary information. Government, semi-government, non-government, and commercial publications were used to gather secondary data. The background data was gathered from the District Census Handbook and the Census of India and connected to the region, demographic traits, level of urbanisation, and socioeconomic profile. The Municipal Corporation of Rohtak city provided the necessary information and detailed statistics, as well as any published materials relevant to municipal solid waste management in spatiotem-poral context.

Sampling of Groundwater:

Following the collection of water from hand pumps at the Rohtak Municipal Solid Waste Dumpsite in February 2023, total 10 water-samples was analysed for their chemical, & physical characteristics. In 1L plastic water bottles that had already been sanitised, groundwater samples were taken. Bottles need to be well-sealed.

Table 1: Labeling of water Samples

Sample	Latitude	Longitude
Sample 1	28.8750798	76.5439461
Sample 2	28.8721515	76.5291331
Sample 3	28.8570736	76.5425010

Sample 4	28.8582101	76.5396108
Sample 5	28.8858093	76.5489369
Sample 6	28.8873132	76.5518937
Sample 7	28.8859549	76.5489954
Sample 8	28.8873132	76.5518937
Sample 9	28.8859549	76.5489954
Sample 10	28.8859182	76.5489888

The following details, which must be written legibly and permanently on each identifying label, must be attached to each sampling bottle:

- Sample No.
- Data
- Source

Labeling of Soil Sample:

The Global Positioning System (GPS) was utilised to capture the coordinates of sampling points in and around the municipal dumpsite in Rohtak. A total of 13 samples has been collected from the different location sites within 2 km area of municipal dumpsite in Rohtak. The samples were collected in the polythene bags from different location. It was ensure that the soil samples satisfy the following requirements.

- Free from any kind of garbage.
- Polybags should be air tight so that samples do no affected by atmospheric air.
- The samples should be collected from 15cm depth.

Table 2: Location of Soil Sample

Sample	Longitude	Latitude
Sample 1	28.8617647	76.5818737
Sample 2	28.8798820	76.5531195
Sample 3	28.8778191	76.5392495
Sample 4	28.8798784	76.5531223
Sample 5	28.8873132	76.5518937
Sample 6	28.8765732	76.5410559
Sample 7	28.8798123	76.5531196
Sample 8	28.8798823	76.5531196
Sample 9	28.8582101	76.5396108
Sample 10	28.8721515	76.5291332
Sample 11	28.8570736	76.542501
Sample 12	28.8869566	76.5522086
Sample 13	28.8750789	76.5439461

Following the collection, specimens were right away transported to a laboratory and kept there in a cold chamber at (4°C). All the samples were analysed for selected relevant physicochemical parameters.

Various physicochemical parameters examined in groundwater samples include, temperature, pH level, electrical conductivity(EC), total alkalinity(TA), total hardness(TH), calcium(Ca +), magnesium(Mg2+), total dissolved solids(TDS) chloride(CI), fluoride(F), sulphate(SO 2-), nitrate (NO3), and phosphate (PO3). Within 10 to 12 hours: pH, EC, TDS.

1. Waste Generation:

In the Rohtak city region, offices, institutions, and commercial/market districts are the main sources of MSW. About 126 tonnes per day of trash were produced in Rohtak City in 2013– 2014. The amount of MSW produced in Rohtak from various sources is approximated and is shown in a table.

Table 4: Municipal Solid Waste Generation in Rohtak City Zone

Zone	Total No. of Households	Total Population	Waste Generation (Tonnes/Day)
1.	37761	169434	46
2.	10074	40442	10.7
3.	12021	35515	9.50
4.	14757	66636	17.7
5.	27246	104442	27.7
6.	11213	53862	14.4
Total	**113072**	**376,331**	**126**

Sources: Rohtak City Municipal Corporation, 2014

Figure depicts the distribution of solid waste in terms of precent form various sources, with the majority of waste coming from households (around 80%), hospitals (5%), shops (3%), commercial establishments (3%), institutional waste (3%), and vegetable and fruit waste (3%). Additionally, 4% of waste comes from construction and demolition activities, and 2% of waste comes from other sources.

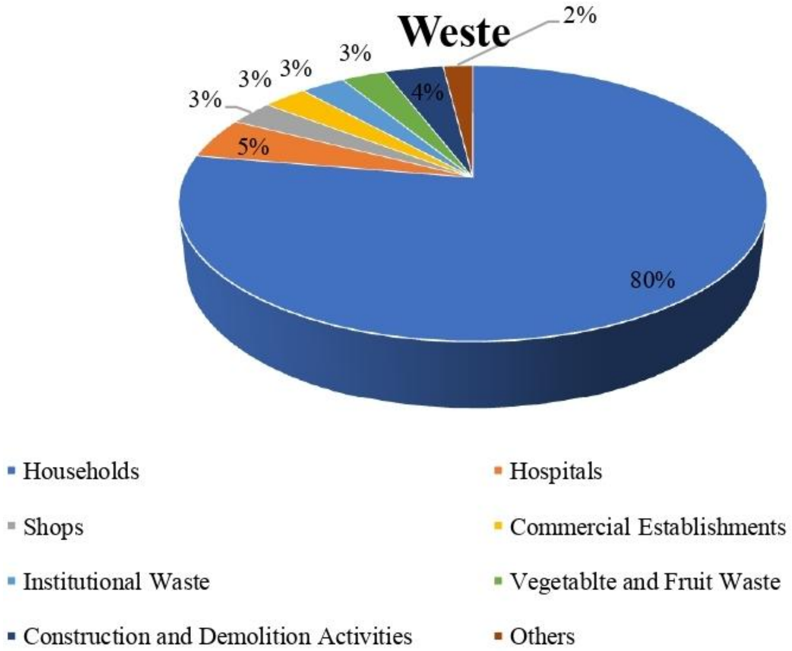


Figure 2: Source-Wise Solid Waste Generation per day in Rohtak City

Municipal Refuse's Physical Assets:

In addition to varying from municipality to city, waste qualities can also change within one location because to a variety of variables, such as the local events, eating patterns, social norms, socioeconomic considerations, seasonal variations, and climatic circumstances. The preferred frequency of collection, safety considerations to be taken during transportation, and techniques for processing and disposal are all determined by the physical makeup of municipal garbage.

2. Rohtak City's Current Garbage Management Procedures:

There is only one municipal corporation in the city of Rohtak. In this region, the municipal corporation's solid waste management operations were divided into four categories: sweeping, collecting, storage, transportation, and disposal. MSW from households and the streets is collected as part of street cleaning and collection in urban areas. As a result, the trash is thrown into one of the about 30 collection locations. Then, the municipal solid garbage is loaded into trucks and tractor-trolleys, which transport it to the disposal site. The only method currently being employed in Rohtak City to control MSW is open dumping. The majority of Rohtak's municipal solid trash is produced in the city's parks, streets, and commercial, institutional, and residential sectors. The garbage produced is kept in dumpers and dustbins. The overall quantity of trash cans vary from one part of the city to another. Vehicles owned by the municipal corporation of Rohtak gather and carry solid trash that is contained in bins to the open dump area.

3. Municipal Solid Waste's Physical Composition:

Parameters	In Percentage (%)
Inert	20
Recyclable	12
Combustible	14
Bio-Digradable	54

Sources: Rohtak City’s 2014 Municipal Solid Waste

According to the table, 54 percent of biodegradable garbage-including food waste, grass/leaves, rags, and paper-is now created in Rohtak City. Fine earth, glass/ceramics, and stone/brick bats make about 20% of the inert garbage generated. Furthermore, the city produces 12 percent recyclable garbage and 14 percent combustible waste (paper/cardboard, wood, rubber/leather, and plastic). The amount of biodegradable is extremely high, making it an excellent raw material for the processes of composting and bio-gasification. Municipal garbage, however, typically has a high organic content (more than 50%) and a low energy value in emerging cities. This is why biological treatment methods for waste management in cities, such composting and bio- gasification, are ideal.

4. Impact on Soil and Water Quality:

Utilising the analytical results for groundwater & soil sample analysis, the chemical features of groundwater and soil have been researched around 2km area of municipal dumpsite at rohtak. To ascertain whether the research area's groundwater was suitable for drinking and soil quality was suitable for land use like agriculture and other purpose, its quality was evaluated. Certain safety requirements established by the World Health Organisation (WHO), the Bureau of India Standards or the American Public Health Association (APHA) standards for the soil are necessary. The parameters that affect the potability of water for human consumption include pH, EC, TDS, TH, total alkalinity, Ca, Cl, etc. The standards provided by the BIS, WHO, and APHA are used to compare all data. These parameters' results are:

pH:

The pH, value of all water samples, was within the permissible limit from 6.4(sample1) to 7.6(sample7) except sample1 which was 6.4 slightly basic.This shows that the groundwater of the studied area ranged slightly alkaline. 88.8% samples were found within the permissible limit recommended by BIS.

Electrical Conductivity (EC):

A solution's electrical conductivity (BC) is used to determine how much electric current it can carry. Electrical conductivity can be used to quickly measure the quantity of ions or salts that dissolve in soil, sources of water, fertilisers solutions, and chemical solutions. Electrical conductivity values range from 1792 uS/1 to 3650 uS/1. All samples had electrical conductivities that are higher than the allowable limit, with W5 having the greatest and W3 having the lowest in case of water while in soil S3 have high value with9550 us/1 whereas S13 has lower with 1109 us/1 value

TDS:

The TDS amount range from 6252.31 (sample 5) to 2172 (sample 3). The maximum permissible limit for TDS in drinking water given by BIS, 2012, is 500mg/l. the TDS value of all the samples were found above the permissible limit.

Moisture Content:

According to APHA permissible limit for moisture content for soil, 3% to 10% moisture content containing soil is very sandy soil (sample no. 1, 2, 4, 7, 10 and 12). Below 5% the coarse sand (sample no. 1 and 7), fine sand (sample no. 5, 8 and 13), sandy clay loam (sample no. 6).

Total Alkalinity:

Alkalinity is a chemical marker of water's ability to neutralise acids. Alkalinity can also be used to determine a water's capacity to endure pH changes brought on by the addition of both acids and bases. Bicarbonate, which is created when atmospheric carbon dioxide is split up and carbonate in rocks and soil weathers, is the main source of alkalinity in natural water. There may also be minute amounts of weak acid salts made of borate, silicates, ammonia, phosphate, and organic bases made of naturally occurring organic molecules. High alkalinity can affect things like water's taste, even if it has no detrimental impacts on health. The total alkalinity of the current sample varies from 3000 mg/l to 11,400 mg/l. With 11,400 mg/l of alkalinity, W5 has the highest level. A conventional intended limit for alkalinity in groundwater is 200 mg/l, while a maximum permissible level is 600 mg/l. Alkalinity in the sample is greater than allowed in 100% of the cases.

Water Holding Capacity:

The value of Water Holding Capacity ranged from 72% (in sample 12) to 90% (in sample 5).

Bulk Density:

The value of bulk density ranged from 1.32916 g/cm3 (in sample 8) to 1.91216 g/cm3 (in sample 7). Whereas the permissible limit OD is as per BIS, 2012 is ranges in 1.3 g/cm3 to – 1.985 g/cm3. There are many sample which exceed the permissible limit recommended by BIS for Soil

Total Hardness:

Total hardness is defined as the sum of calcium and magnesium hardness, given in mg/l as CaCO. Based on similar CaCO3 concentration. High quantities of hardness may lead to cardiac issues as well as kidney stones. To treat hard water, reverse osmosis and ion exchange softeners are utilised. The reading falls between 40.0mg/l to 362.5 mg/l. Six samples have hardness levels over the permitted range, whereas only 4 of samples have hardness levels within it. The sample with the highest hardness was W3.

Calcium Hardness:

The range of calcium concentration in water samples was 4.058mg/l to 12.032 mg/l. 75% of the samples have calcium level within the permissible limit. Sample had the highest calcium content value. The BIS specifies a calcium standard of 200 mg/l.

Magnesium Hardness:

The main source of magnesium in groundwater is the dissolving of carbonate minerals, although silicate weathering can also provide a significant quantity of magnesium. Magnesium in natural water comes from a variety of minerals and industrial wastes. Magnesium concentrations range from 4.864mg/l to 82.688mg/l. 82.688mg/l is the highest value obtained from all samples in sample 3 and with 4.864mg/l sample no. 1 has the lowest value.

Chloride:

One of the most prevalent inorganic ions in freshwater and wastewater is chloride, which is chlorine ionised. Chloride concentration in freshwater is hardly less than 10 ppm. An efficient approach for determining chloride levels is the potentiometric method of chloride analysis by silver nitrate titration. Chloride causes stomach pain and eye and nose irritation. A 1000 mg/l overabundance of chloride salt makes the water taste salty. Chloride concentration in the sample under study ranged from 383.4 mg/l to 2940 mg/l. The highest concentration value is seen in sample W8. According to ISO 2012, the standard level of chloride is 250 mg/l and acceptable limit is upto 1000mg/l

The chloride concentration in the soil samples varied from 355mg/l (in sample 5) to 8520 mg/l (in sample 12). According to BIS, 2012, the permissible limit for chloride concentration in soil should range from 250mg/l to 1000mg/l. The chloride concentration of only 4 samples were found within the permissible limit otherwise all samples exceed permissible limit whereas sample no. 12 has the highest value. The sources of chloride in soil include intrusion of salt water, pollution from dumpsites, efflutents discgarge from industries and residence as well as the source of aquifer charge.

Total Organic Carbon:

The value of organic carbon ranged from 1.28% to 3.55%. Whereas the permissible limit of organic matter is as per BIS, 2012, is ranges from in 0.5% to 3%. There are no. of samples which exceed the permissible limit recommended by BIS for soil whereas with 3.55% sample no. 1 having maximum value and with 1.28% sample no. 5 has the lowest value.

Nitrate:

Inorganic ions called nitrate are ones that are prevalent in our surroundings naturally. Ammonia is produced when organic matter in soil breaks down. This ammonia underwent oxidation to produce nitrate. Manufacturing facilities for chemicals and fertilisers, animal waste, wilting vegetables, home waste, and industrial emissions all produce nitrate. UV spectrophotometers are used to measure the amount of nitrate. Methemoglobin can be produced when nitrate is present in the blood. Blood and urine tests can also be used to identify nitrate levels. Nitrate ranges in concentration from 0.24 mg/l to 45.8 mg/l. Nitrate levels should not exceed 45 mg/l.

Conclusion:

The results reveal the physicochemical characteristics of the groundwater in the vicinity of Rohtak's municipal dumpsite. 10 samples were collected at various locations. Tests were performed on the samples for a number of physicochemical properties. The samples were found to have values for pH, EC,TDS, total alkalinity, total hardness, calcium, magnesium, chloride, and nitrate that were, respectively, 100%, 0%, 0%, 0%, 53.6, 75%, 100%, 11%, and 96.43% within the BIS-recommended permissible ranges (BIS-10500:2012). High levels of TDS, EC, total hardness, calcium ion, and magnesium ion in the groundwater close to industrial regions are signs of groundwater contamination. A substantial positive correlation between a number of important measures, including TDS, EC, chloride, hardness, and phosphates, is further supported by the correlation analysis, which provides evidence that leachate is moving into groundwater.

The results show the physicochemical parameters of the soil around Rohtak’s Municipal Dumpsite area. A total 13 sample were collected from different location. The samples underwent tests for a variety of physicochemical parameters. The pH , EC, Total Organic carbon, water holding capacity, bulk Density, moisture content and chloride were tested for soil analysis. The pH , EC, TOC, WHC, BD, Moisture content and Chloride of 100%, 55.5%, 25%, 100%, 11%, 100%, and 20% respectively were found within of permissible limit(BIS,2012). Soil contaminated is indicated by high levels of various parameters in the soil near municipal dumpsite area. This leads to the conclusion that the soil samples were taken near the municipal dumpsite are unsafe for agriculture use and are categorized as severly contaminated. The micronutrients and other contaminants enter into human body through channels of food chain and it could be harmful for human, animals’ health. By this experimental study we are conclude that improper soil waste management by Municipal Corporation effects the ecosystem.

In this review study, surface soil samples and ground water samples from the vicinity of municipal garbage disposal sites were analysed. The results of the various research investigations demonstrate that the pH levels of different water samples were generally within acceptable ranges, although a few of them were over the acceptable ranges of the water quality criteria set by BIS and WHO. Numerous physicochemical parameters, including Total Hardness, Electrical Conductivity, Total Alkalinity, TOC, Bulk Density, Water Holding Capacity, Moisture Content, Chloride, and Calcium and Magnesium, had concentrations that were higher than what was permitted by the WHO and the Indian Standard for Drinking Water and for soil use(BIS-10500:2012). The presence of inorganic material in the samples is indicated by the TDS values, which are relatively high. Nitrate concentrations can be used as a marker for groundwater contamination. The quality of the water and soil at various places was deemed to not meet BIS,(2021) and WHO criteria based on the discussion above. The results of the investigation clearly show that the sampling sites close to landfills had high pollutant concentrations. It is advised that all human settlements be kept at least 500 metres away from MSW disposal sites. Conclusion: The poor waste management practises used at Municipal Solid Waste Dumping Sites in various States and the lack of a leachate collection system have a significant negative influence on the quality of the ground water and soil. The gathered solid waste needs to be separated, handled, and disposed of in a way that doesn't harm the environment. It is advised that in order to ensure the safety of the local populace, the environment, and public health, the responsible authorities take serious action to manage ground water and soil contamination by providing a base of cement concrete. It was discovered that the quality of the groundwater increased with depth and that agricultural land usage should be avoided close to waste sites since the soil quality can also improve with distance. It is advised to regularly employ improved methods for managing solid waste, collecting leachate, and monitoring ground water.

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