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Impact Of Solid Waste In Open Dumping And Its Effects Of Groundwater And Soil

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ABSTRACT

In our study assessed the impact of an open dumpsite on the quality of surface and shallow groundwater within its vicinity. Leachate and groundwater samples were collected from Vendipalayam, Semur and Vairapalayam landfill sites in Erode city, Tamil Nadu, India, to study the possible impact of leachate percolation on groundwater quality. Concentrations of various physicochemical parameters including heavy metals (Cd, Cr, Cu, Fe, Ni, Pb, Fe and Zn) were determined in leachate samples and are reported. The concentrations of Cl^-, NO_3^-, SO_4^{2-}, NH_4^+ were found to be in considerable levels in the groundwater samples particularly near to the landfill sites, likely indicating that groundwater quality is being significantly affected by leachate percolation. The common constraints faced environmental agencies include lack of institutional arrangement, insufficient financial resources, absence of bylaws and standards, inflexible work schedules, insufficient information on quantity and composition of waste, and inappropriate technology.

Keywords: Impact, Solid Waste , Open Dumping, Effects, Groundwater, Soil

1.INTRODUCTION

In most of the developing countries, solid wastes are being dumped on land without adopting any acceptable sanitary land filling practices. Precipitation that infiltrates the solid wastes disposed on land mixes with the liquids already trapped in the crevices of the waste and leach compounds from the solid waste. The leachate thus formed contains dissolved inorganic and organic solutes. In course of time, the leachate formed diffuses into the soil and changes the physicochemical characteristics of water. Leachate from a solid waste disposal site is generally found to contain major elements like calcium, magnesium, potassium, nitrogen and ammonia, trace metals like iron, copper, manganese, chromium nickel, lead and organic compounds like phenols, polyaromatic hydrocarbons, acetone, benzene, toluene, chloroform etc. The concentration of these in the leachate and water depends on the composition of wastes. Some of the pollutants may be adsorbed on to the soil media during the flow of leachate through the soil. Areas near landfills have a greater possibility of groundwater contamination because of the potential pollution source of leachate originating from the nearby dumping site. Such contamination of groundwater results in a substantial risk to local groundwater resource user and to the natural environment. The impact of landfill leachate on the surface and groundwater has given rise to a number of studies in recent years and gained major importance due to drastic increase in population. There are many approaches that can be used to assess the groundwater and surface water contamination. It can be assessed either by the experimental determination of the impurities or their estimation through mathematical modelling. once groundwater becomes contaminated, full restoration of its quality is very difficult and even impossible in some cases.

1.1 Water Pollution

Water pollution is the contamination of water bodies (e.g. lakes, rivers, oceans, aquifers and groundwater). Water pollution occurs when pollutants are directly or indirectly discharged into water bodies without adequate treatment. Water pollution affects plants and organisms living in these bodies of water. In almost all cases the effect damages individual species, populations of species, and also causes harm to the natural biological communities. Surface water and groundwater are interrelated. Surface water seeps through the soil and becomes groundwater. Conversely, groundwater can also feed surface water sources. Landfills are considered as one of the major threats to the groundwater. The scale of this threat depends on the concentration and toxicity of contaminants in leachate, type and permeability of geologic strata, depth of water table and the direction of groundwater flow. Water through rainfall is mixed with the water already present in the solid waste piles which causes the leachate to leave the dumping ground as infiltration in lateral or vertical directions to find its way into the ground water thereby causing the contamination.Municipal landfill leachate is highly concentrated complex effluent which contains dissolved organic matters; inorganic compounds such as ammonium, calcium, magnesium, sodium, potassium, iron, sulphates, chlorides and heavy metals such as cadmium, chromium, copper, lead, zinc, nickel; and xenobiotic organic substances.

It is therefore necessary to check the quality of ground water at regular time intervals to study the danger of its possible contamination which may cause water-borne diseases to human population. The determination of physical & chemical parameters of water samples which also dictate various other life processes should be taken as an environmentally viable study. Landfills are considered as one of the major threats to the groundwater. The scale of this threat depends on the concentration and toxicity of contaminants in leachate, type and permeability of geologic strata, depth of water table and the direction of groundwater flow. Water through rainfall is mixed with the water already present in the solid waste piles which causes the leachate to leave the dumping ground as infiltration in lateral or vertical directions to find its way into the ground water thereby causing the contamination. Municipal landfill leachate is highly concentrated complex effluent which contains dissolved organic matters; inorganic compounds such as ammonium, calcium, magnesium, sodium, potassium, iron, sulphates, chlorides and heavy metals such as cadmium, chromium, copper, lead, zinc, nickel; and xenobiotic organic substances.

1.2 Aim And Objectives

- Review the concept of water resources management (WRM), the situation of water supply and significance of groundwater resources in the water supply sector of urban areas.
- Review aspects of groundwater quality and the potential for its contamination within the context of sustainability.
- Review the challenges faced by the SWM sector in urban areas of less-developed regions, with more emphasis on leachate generation and its potential for groundwater contamination.
- Analyse the situation of SWM practice in Kano metropolis and assess the locations of SWD sites relative to inhabited areas and groundwater supply sources in the study area.
- Evaluate the physico-chemical characteristics of shallow groundwater sources around SWD sites in urban Areas, with the view of determining possible effects of vertical leachate migration.

2.METHODOLOGY

Figure.1 shows methodology adopted in this study

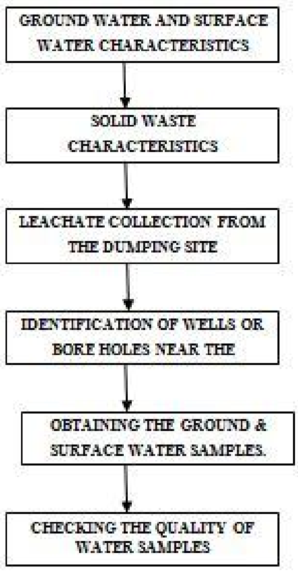

Figure.1 Methodology

4.STUDY AREA

Erode city is the head quarters of Erode District, Tamil Nadu, India which sprawls over 120 km^2 and lies between 11° 17' N and 11° 23' N latitudes and 77° 40' E and 77° 46' E longitudes (Fig-01). The average altitude of the region is about 172 m above the mean sea level. It is situated at the center of the South Indian Peninsula, about 400 kilometres southwest from the state capital Chennai and on the banks of the rivers Cauvery and Bhavani. It is located on the western bank of the Cauvery River, while its twin city, Pallipalayam, is on the eastern bank of the river. Erode in general is characterized with scanty rainfall and a dry climate. Erode has moderate-dry weather throughout except during the monsoon seasons. It also experiences heavy rains primarily during the periods of monsoon with an average annual rainfall of 700 mm. The depth of groundwater table in Erode city varies from 1 to 15 m with respect to ground level.Erode city, with a population of over 1,50,000 is estimated to generate about 75 tonnes of garbage daily. The daily per capita generation of solid waste in Erode city ranges from 100 g to 500 g, which depends upon the economic status of the community involved. The important categories of MSW in the city includes waste from household, industries and medical establishments. The solid waste generation rate also varies from 0.66 kg/capita /day to 0.44 kg/capita/day in rural areas.The earliest landfill was started in Erode in 1963 near Vendipalayam at a distance of 1 km from the city centre. Three landfill sites within the city premises are filled and closed. All of them are unlined and non-engineered landfill sites. At present three functioning landfill sites are located at Vendipalayam, Semur and Vairapalayam (Figure.2.) sites are spread over an area of about 1,12000 m^2. None of their bases are lined, which may result in continuous groundwater contamination. These sites have not been designed systematically before being used for disposal/dumping of waste. Furthermore, no environmental impact assessment (EIA) has been carried out prior to selection of these sites.

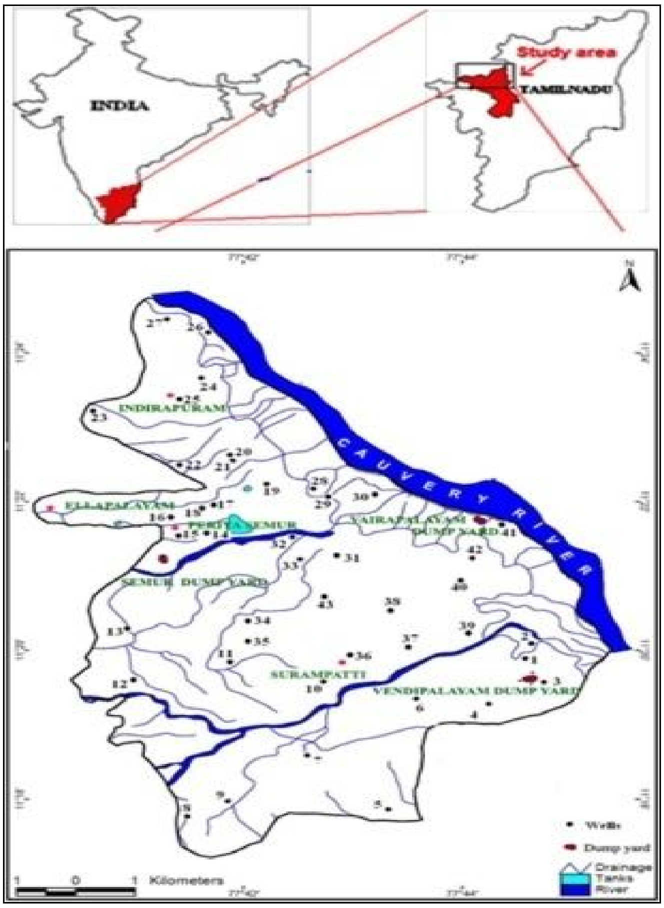

Figure 2 Study area map showing locations of observation wells and solid waste dump yards

3.1 Vendipalayam Landfill Site

The Vendipalayam landfill site started in the year 1963 is still in use. It spreads over an area of approximately 65000 m^2 and is situated in the eastern part of the city. On an average, 45 T/day of waste is dumped and the waste fill height varies from 12 m to 15 m. It contains about 367 pits. The size of the each pit is 12 m × 2.5 m × 1.5m. It is located at the close proximity of the living communities. The waste dumped at this site mainly includes domestic waste such as kitchen waste, paper, plastic, glass, cardboard and clothes. Construction and demolition waste consisting of sand, bricks and concrete block are also dumped. Further, wastes from the adjacent vegetable market, fish market and slaughterhouse are also dumped here.

The site is a non-engineered and low lying open dump yard which looks like a huge heap of waste up to a height of 12–15 m. Trucks and separate vehicles from different parts of the city collect and bring the waste to this site and dump in irregular arrangement. The waste is dumped as such without segregation, except the rag pickers who rummage through the garbage and help in segregating it. They generally collect glass material, plastic and metals and sell this to the recycling units.At this landfill site one bore well is operational, which is used for washing of removal vehicles and maintenance of heavy earth moving equipments.

3.2 Semur Landfill Site

Semur landfill site started in the year 2001, is currently in use. The area of the site is approximately 32,000 m^2. On an average 15 to 20 T/day of wastes are dumped in the site. Mostly the wastes in and around Semur panchayat are dumped at this site. The approximate population contributing wastes to this site is around 55,000. The waste fill height at this site varies from 9 m to 11 m. The waste dumped at Semur site includes kitchen wastes, papers, wood, plastics, cardboard and clothes. Semur landfill site is also a non-engineered open dumping site, which causes various problems to the living community near the site. Trucks from various parts of the Semur municipality collect the waste materials and dump it at the site without any regular arrangement. Semur is located within the corporation limit at a distance of 7 km from the Erode city center.(Table.1)

3.3 Vairapalayam Landfill Site

Table 1 Physico-chemical characteristics of leachates at various landfill sites

Parameters	Concentrations at Vendipalayam landfill site	Concentrations at Semur landfill site	Concentrations at Vairapalayam landfill site
P^H	6.9	6.9	6.7
Tds	25514	22961	24123
Cod	25102	22148	23900
Bod	17552	15478	15691
Na^+	532	462	393
Cd	0.05	0.02	0.05

Table 2 Means Of Transportation

Type	Number	Collection frequency	Capacity	Total capacity
Trucks	2	One Trip/day	≈ 5 tons per truck	10 Tons
Donkey carts	100	One Trip/day	300 Kg per cart	30 Tons

Vairapalayam is a small village located on the right bank of Cauvery River, which forms the northern boundary of Erode city and falls within the Erode corporation limit. Landfill site was started at Vairapalayam in the year 2001, which is also currently in use. This is also a non-engineered municipal solid waste dumping site, which is located in the low lying region of the city. The area of the site is approximately 15000 m^2. On an average, around 20 T/day of garbage is dumped at this site. The site remains submerged in the river water during high flood season, which may also cause pollution to the surface water. The dumping site is located at a distance of 6 km from city center. Wastes collected from the northern part of the city are transported to this landfill site by trucks.

3.4 Daily Dumped Volume

Trucks are major mode of transportation of solid waste from houses, parks, commercial areas etc. to the authorized dumping site. Beside donkey carts, there are two trucks used for this purpose.(Table.2). Among 100 donkey carts, 38 have been hired on monthly charge of Rs.1100/= per cart, while the remaining work as volunteers. Volunteer carts sell the saleable items from the waste and dispose off the rest. Table-32 shows the estimated waste quoted by the Municipal Staff of Town-III dealing with collection and disposal of solid waste from Erode. The actual weight of the garbage taken by a donkey cart was measured on computerized weighing machine came to be 720 Kg. However, it seems that the amount of waste taken by the majority carts working as volunteers are very low and they are also selective in choosing the area. They mostly operate in those areas, where they can get maximum load of saleable items. Only 38 hired donkey carts carry 720 kg/cart garbage to the dumping site. Total dumped waste by these hired donkey carts are about 28 tons/day. This figure is very close to the estimated dumped waste per day by donkey carts given in Table.

Every day these donkey carts collect the waste by going door to door from their nominated areas and then separate on spot saleable and non-saleable items.

4.GROUND WATER AND SURFACE WATER

4.1 Ground Water

Groundwater (or ground water) is the water present beneath Earth's surface in soil pore spaces and in the fractures of rock formations. A unit of rock or an unconsolidated deposit is called an aquifer when it can yield a usable quantity of water. The depth at which soil pore spaces or fractures and voids in rock become completely saturated with water is called the water table. Groundwater is recharged from, and eventually flows to, the surface naturally; natural discharge often occurs at springs and seeps, and can form oases or wetlands. Groundwater is also often withdrawn for agricultural, municipal, and industrial use by constructing and operating extraction wells. The study of the distribution and movement of groundwater is hydrogeology, also called groundwater hydrology. Groundwater is often cheaper, more convenient and less vulnerable to pollution than surface water. Therefore, it is commonly used for public water supplies. For example, groundwater provides the largest source of usable water storage in the United States, and California annually withdraws the largest amount of groundwater of all the states. Underground reservoirs contain far more water than the capacity of all surface reservoirs and lakes in the US, including the Great Lakes. Many municipal water supplies are derived solely from groundwater.

Polluted groundwater is less visible, but more difficult to clean up, than pollution in rivers and lakes. Groundwater pollution most often results from improper disposal of wastes on land. Major sources include industrial and household chemicals and garbage landfills, excessive fertilizers and pesticides used in agriculture, industrial waste lagoons, tailings and process wastewater from mines, industrial fracking, oil field brine pits, leaking underground oil storage tanks and pipelines, sewage sludge and septic systems.

4.2 Surface Water

Surface water is water on the surface of the planet such as in a river, lake, wetland, or ocean. It can be contrasted with groundwater and atmospheric water. Non-saline surface water is replenished by precipitation and by recruitment from ground-water. It is lost through evaporation, seepage into the ground where it becomes ground-water, used by plants for transpiration, extracted by mankind for agriculture, living, industry etc. or discharged to the sea where it becomes saline. Surface and groundwater are two separate entities, so they must be regarded as such. However, there is an ever-increasing need for management of the two as they are part of an interrelated system that is paramount when the demand for water exceeds the available supply (Fetter 464). Depletion of surface and ground water sources for public consumption (including industrial, commercial, and residential) is caused by over-pumping. Aquifers near river systems that are over-pumped have been known to deplete surface water sources as well. Research supporting this has been found in numerous water budgets for a multitude of cities.Response times for an aquifer are long. However, a total ban on ground water usage during water recessions would allow surface water to better retain levels required for sustainable aquatic life. By reducing ground water pumping, the surface water supplies will be able to maintain their levels, as they recharge from direct precipitation, surface runoff, etc. Surface water supplies, primarily river runoff, are about 300 cubic miles. That means we have about $1/10{,}000^{th}$ of 1% to use! Conservation is important. Surface runoff plays an important role in the recycling process. Not only does it replenish lakes, streams, and groundwater; it also creates the landscape by eroding topography and transporting the material elsewhere. A stream typically transports three types of sediment- dissolved load, suspended load, and bed load. Chemical weathering of rocks produces ions in solution (examples- Ca^{2+}, Mg^{+}, and HCO_3^{+}). Hence, a dissolved load. High concentrations of Ca^{2+} and Mg^{+} are also known by another name - hard water. Some of you may be very familiar with hard water! Take a look at some water chemistry**.** Suspended sediment makes water look cloudy or opaque. The greater the suspended load, the muddier the water. Bed load (silt- to boulder-sized, but mostly sand and gravel) settles on the bottom of the channel. Bed load sediment moves by bouncing or rolling along the bottom. The distance that bed load travels depends on the velocity of the water.

5.MATERIALS AND METHODS

5.1 Study Area

Erode city is the head quarters of Erode District, Tamil Nadu, India which sprawls over 120 km^2 and lies between 11° 17' N and 11° 23' N latitudes and 77° 40' E and 77° 46' E longitudes (Fig-01). The average altitude of the region is about 172 m above the mean sea level. It is situated at the center of the South Indian Peninsula, about 400 kilometres southwest from the state capital Chennai and on the banks of the rivers Cauvery and Bhavani. It is located on the western bank of the Cauvery River, while its twin city, Pallipalayam, is on the eastern bank of the river. Erode in general is characterized with scanty rainfall and a dry climate.

5.2 Vegetation And Soils

The vegetation consists mainly of coastal-savanna grass- lands, shrubs and some few mangroves in isolated areas. Market gardening is practiced in few places particularly along major waterways where irrigation is possible to support all-year round farming. Vegetables like pepper, okra, cabbage, lettuce, onion and cereals like maize are the main crops cultivated. The geological formations consist mainly of the Pre- cambrian Dahomeyan schist, granodiorites, granites gneiss and amphibolites and the Precambrian Togo series. The underground water table ranges between 4.80 metres to 70 metres. The main soil types include; Drift materials from wind-blown erosion, alluvial and marine mottled clays, residual clays and gravels from weathered quartz- ite, gneiss and schist rocks and lateritic sandy clay soils.

5.3 Water

Sample Collection, preservation and analysis were done as per the standard methods[2]. Water samples were taken at each station. Three water samples were collected at different locations at Joy Nagar. The polyethylene sample containers cleaned by 1 mol/L of nitric acid and left it for 2 days followed by thorough rinsing of distilled water. Two litres of samples were collected for the analysis. The generally suitable techniques for the preservation of samples followed as per Indian standard methods. The pH, Electrical conductivity, Total alkanity, hardness and chloride test were done at the site. Total suspended solids. nitrate, phosphate and sulphate were analysed as soon as possible. The samples for trace metal analysis were acidified with concentration HNO_3 to bring pH < 2.

5.4 Soil Samples

Sample collection, preservation and analysis were done as per the standard methods. The representative soil samples were collected as per standard methods. The sampling of soil was done using hand augur. The augur was used to bore a hold to the desired depth and then withdrawn. The samples were collected directly from the augur. The sampling area first to be cleaned and first six inches of surface soil was removed with the radius of 6 inches around the drilling location. Begin auguring, periodically removed and deposited accumulated soil onto the plastic sheet. After reaching the desired depth slowly and carefully removed the augur from the hole and the samples were directly from the augur. The composite samples collected and they were kept in the suitable labeled container. The collected soil samples were protected from sunlight to minimise any potential reaction. The dry soil samples for various tests were prepared as per the indian standard method**.** The received soil samples dried in sun or air and the pulverization was done. The pulverised soil was passed through the specified sieve and taken for various analysis.

5.5 CD, PB, ZN, MN, AND CU Measurements By AAS

Determination of metals in the acidified filtered (0.45 μm Millipore filter) water samples were carried out in accordance with standard methods. The concentra- tions of Cd, Pb, Zn, Mn and Cu in the samples were respectively estimated by comparison with either the re- spective calibration curve or by the standard addition technique.

5.6 Physical And Chemical Measurements

Temperature, pH and dissolved oxygen were measured in-situ and recorded at the sampling sites. Nitrates, phosphates and physical parameters such as Biochemical Oxygen Demand (BOD5), turbidity and suspended solids were also determined using standard methods.

5.7 Determination Of Biological Characteristics

Total coliforms and Faecal coliforms were determined by membrane filtration method using M-Endo-Agar at 37°C and on MFC Agar at 44°C ± 0.5°C for 48 hours, respectively. All species of helminth eggs in water samples were quantified using the concentration method. The identities of the specific helminth eggs were established using the World Health Organization (WHO) bench aid for the diagnosis of intestinal parasites.

6. IMPACT ON SOLID WASTE IN WATER QUALITY

6.1 Groundwater Degradation Problems

Groundwater degradation occurs where there is Excessive exploitation, for example where groundwater levels fall too fast or to unacceptable levels. This not only

- Reduces available water resources and borehole yields but can result in other serious and potentially costly side effects including saline intrusion and subsidence. Inappropriate or uncontrolled activities at the land surface, including disposal of waste and spillage of chemicals.
- Which contaminate the underlying aquifer. This can arise from diffuse sources, which results in widespread but generally less intense contamination, or from a point source, which causes more intense but localized problems; Major change of land use, for example in southern Australia, the removal of natural vegetation led to water.

- Logging and salinisation problems. The nature of the aquifer will also influence the scale of the contamination problem. Thus, in a highly fractured aquifer where groundwater flow is easy and relatively rapid, contamination may become more widely dispersed in a given time than where flow is inter granular, especially if the strata have only a modest permeability. Important issues when considering degradation are the use of water, the availability of alternative sources and the scale of impact on different users. Degradation of groundwater often affects the poor most, as they are least able to afford alternative water supplies or to cope with changes in livelihood that deterioration may force upon them.

6.2 Groundwater Chemistry

6.2.1 Physicochemical Characteristics

The groundwater of the study area is mainly used for domestic purposes. It is also used for irrigation purposes in many places. Therefore it is essential to assess the suitability of groundwater for drinking and irrigation purposes. Table presents the summary of analytical results of the groundwater samples and the comparison of groundwater quality parameters with Bureau of Indian Standard. The comparison highlights that some of the chemical constituents exceed the permissible limit for drinking. The pH variation indicates that the groundwater of the study area is slightly alkaline in nature. EC values in the study area ranged between 410 and 3830 μmhos/ cm. It was noticed that groundwater samples collected near the landfill sites contain more soluble salts. Most of the groundwater samples in the study area were within the maximum permissible limit for drinking as per the BIS and WHO standards, except some samples. Groundwater chemistry of a region may also be influenced by complex contamination sources and geochemical processes. The contamination levels are high in the wells near to the landfill sites. The statistical variation of all the samples have been plotted using Box-Whisker plot, which gives the maximum, minimum and median values for the ionic concentrations. The values of 75 percentile and 25 percentile of various ions can also be obtained through this plot, which gives an idea about the statistical variation of different parameters for the analyzed samples.

6.3 Solidwaste Characteristics

The waste generation rates ranged from 0.66 kg/cap/d in urban areas to 0.44 kg/cap/d in rural areas as opposed to 0.7-1.8 kg/cap/day in developed countries. The waste generation rate is typical of low income towns. The rate of waste generation is highly influenced by the population income. In Nigeria 25 million tonnes of municipal solid waste are generated annually. Table 1 shows the waste generation rates and breakdown density for urban and rural areas in Nigeria. Waste densities and moisture are much higher in developing countries which require different technology and management systems. The density of solid waste in Nigeria ranged from 250 kg/m3 to 370 kg/m3 higher than solid waste densities found in developed countries. Density defines the number of capacity of waste storage and collection facilities required. High density reduces the effectiveness of compaction vehicles for waste transfer.

6.3.1 Solid Wastes Composition

The composition of composite solid waste sample is shown in the Figure below. From The Figure, it was found that the percentage of paper, textiles, plastic, metals and rubber were 5%, 8% , 12%, 0.2 % and 2 % respectively.

6.3.2 Leachate Composition

As a highly contaminated solution, landfill leachate comprises both organic and inorganic components that originate directly from deposited solid waste materials. It is known generally to contain significantly more contaminant loads than raw sewage or many industrial wastes. The relative quality of leachate varies widely depending on a series of complex but interrelated factors.

Table 2 Leachate parameters

CONSTITUENT GROUP	PARAMETERS
Physical	P^H, Redox potential, Electrical conductivity, Colour, Turbidity, Suspended solids, Total dissolved solids, Temperature, odour.
Organic	Chemical oxygen demand, Total organic carbon, Phenols, VolatileAcids, Tannis, Lignins, Organic nitrogen, Ether soluable.
Inorganic	Chloride,Sulphate,Phosphate,Nitrate-N, Ammonia –N, Heavy metals.
Biological	Biological oxygen demand, Coliform Bacteria, Faecal streptococci.

It is a cause for concern that, despite the advances in modern landfill technology in terms of managing leachate generation and migration [that exist mostly in the more developed countries, leachate often moves out of landfill areas and percolates to the groundwater aquifer or overflows to the vicinity of the disposal sites in many parts of the world.

6.3.3 Heavy Metals
Many studies have confirmed that the concentrations of heavy metals in leachates are usually very low. However, they may constitute a significant environmental threat, even when very low concentrations (μg/l) are leached into surface water or groundwater resources. Although their relative abundance in leachate also differs between different landfills, the typically reported heavy metals in leachates include: Cd, Pb, Zn, Ni, Cr, and Cu.

6.3.4 Dilution
Although the process of dilution reduces concentrations of contaminants by distributing them across larger volumes of water, it results in a significant increase in volume of the impacted groundwater. This process of interaction between leachate and groundwater flow within an aquifer is responsible primarily for the development of leachate plume. All leachate constituents are subjected to dilution as they move from the landfill to form a leachate plume. This is especially true in the case of conservative species, such as chlorides, where dilution represents its only attenuation mechanism.

6.3.5 Degradation
Degradation in leachate plume occurs when dissolved organic matter undergoes a microbially-mediated oxidation process to form benign end-products. Largely, this process establishes redox conditions in the leachate plume, which influences significantly the other mechanisms of attenuation within the plume.

6.4 Landfill
Solid waste landfills are a necessity in modern-day society, because the collection and disposal of waste materials into centralized locations helps minimize risks to public health and safety. Solid waste landfills, which are regulated differently than hazardous waste landfills, may accept a variety of solid, semi-solid, and small quantities of liquid wastes. Landfills generally remain open for decades before undergoing closure and postclosure phases, during which steps are taken to minimize the risk of environmental contamination. Municipal solid waste (MSW) landfills accept nonhazardous wastes from a variety of sources, such as households, businesses, restaurants, medical facilities, and schools. Many MSW landfills also can accept contaminated soil from gasoline spills, conditionally exempted hazardous waste from businesses, small quantities of hazardous waste from households, and other toxic wastes. Industrial facilities may utilize their own captive landfill (i.e., a solid waste landfill for their exclusive use) to dispose of nonhazardous waste from their processes, such as sludge from paper mills and wood waste from wood processing facilities.

6.5 The Concern Over Landfill Impacts
Although landfills are an indispensable part of everyday living, they may present long-term threats to groundwater and also surface waters that are hydrologically connected. In the United States, federal standards to protect groundwater quality were implemented in 1991 and required some landfills to use plastic liners and collect and treat leachate . However, many disposal sites were either exempted from these rules or grandfathered (excused from the rules owing to previous usage).Although the federal rules marked a significant improvement in the management of solid waste, some think that these rules do not go far enough. There is an increasing belief among solid waste experts that unless further steps are taken to detoxify land filled materials, today's society will be placing a burden on upcoming generations to address future landfill impacts. Much of the concern revolves around leachate, the watery solution that results after water passes through a landfill.

6.6 Leachate Generation And Composition
The precipitation that falls into a landfill, coupled with any disposed liquid waste, results in the extraction of the water-soluble compounds and particulate matter of the waste, and the subsequent formation of leachate. The creation of leachate, sometimes deemed "garbage soup," presents a major threat to the current and future quality of groundwater. (Other major threats include underground. storage tanks, abandoned hazardous waste sites, agricultural activities, and septic tanks.) Leachate composition varies relative to the amount of precipitation and the quantity and type of wastes disposed. In addition to numerous hazardous constituents, leachate generally contains nonhazardous parameters that are also found in most groundwater systems (see above table). These constituents include dissolved metals (e.g., iron and manganese), salts (e.g., sodium and chloride), and an abundance of common anions and cations (e.g., bicarbonate and sulfate). However, these constituents in leachate typically are found at concentrations that may be an order of magnitude (or more) greater than concentrations present in natural groundwater systems. Leachate from MSW landfills typically has high values for total dissolved solids and chemical oxygen demand , and a slightly low to moderately

low pH . MSW leachate contains hazardous constituents, such as volatile organic compounds and heavy metals . Wood-waste leachates typically are high in iron, manganese, and tannins and lignins. Leachate from ash landfills is likely to have elevated pH and to contain more salts and metals than other leachates.

7.SUGGESTIONS AND REMEDIAL MEASURES

To prevent mixing of the leachate at the bottom of the Vendipalayam yard with the ground water source, number of bore wells should be drilled vertically over the entire dumping yard. The wells could be constructed and installed with slurry pump set for pumping of leachate. The leachate at the bottom of the yard could be pumped out either for recirculation or for collection and treatment. The leachate samples should be collected during pumping and analyzed to look into the permissible limits of standards prescribed in the regulations and then discharged into municipal drains. In order to prevent accumulation of storm water and rain water over the landfill an appropriate peripheral drain should be provided. For designing of new disposal site, the bottom and sides of landfill should be provided with liners along with leachate collection and treatment facility so that the leachate generated would have minimum impact on water sources.

7.1 Integrated Waste Management

In order to handle growing volumes of wastes in developing countries and to prevent environmental pollution, proper policies need to be enacted and implemented. Integrated waste management approach consisting of a hierarchical and coordinated set of actions that reduces pollution has to be enforced. Integrated waste management consists of the waste minimization techniques, waste prevention, reuse and recycling. Waste prevention seeks to reduce the amount of waste that individuals, businesses and other organizations generate. Once the waste prevention program has been implemented, the next priority in an integrated waste management approach, is promoting the reuse of products and materials. After the reuse of materials and products, recycling comes next in the integrated waste management hierarchy. Recycling is the recovery of materials for melting them, repulping them and reincorporating them as raw materials. It is technically feasible to recycle a large amount of materials, such as plastics, wood, metals, glass, textiles, paper, cardboard, rubber, ceramics, and leather. These waste minimization techniques would reduce the load in the landfills and also extend the life of the landfills.

7.2 Composting, Incineration

Considering the high proportion of organic matter in the waste generated in third world cities composting can also be an option to reduce the amount of wastes that are land filled, thus extending their lifespan. In an Integrated waste management approach, incineration occupies the next to last priority, after waste prevention, reuse, recycling and composting have been undertaken.

7.3 Sanitary Land Filling

Sanitary landfills require significant investments and they often present political obstacles for their construction due to local opposition. Extending the life of landfills and diverting as much as possible by waste prevention, reuse, recycling and composting can make economic sense. Diverting materials from landfills can also create jobs, reduce poverty, improve economic competitiveness, reduce pollution and conserve natural resources. Sanitary landfills are necessary for final disposal of the wastes that could not be prevented, reused, recycled or composted. Ideally, sanitary landfills should be used primarily for non-reusable, non-recyclable and non-compostable residues. Sanitary landfills constitute a dramatic improvement over disposal of wastes in open dumps. Sanitary landfills greatly reduce pollution, risks to human health and the environment compared to open dumping.

8.CONCLUSION

The objective of this study is to assess the impact of waste dumpsite on the shallow groundwater and surface water quality. The low contamination observed may be attributed to a high compaction level observed in most of the weathered overburden of the soil underlying this area which could act as an impervious, protective layer. Assessment of water quality in relation to the bacteriological analysis is encouraged to complement the hydrochemical results. As there is no natural or other possible reason for high concentration of these pollutants, it can be concluded that leachate has significant impact on groundwater quality in the area near to all the three landfill sites. The quality of the groundwater was found to improve with the increase in depth and distance of the well from the landfill site. There is a significant effect on pH, BOD, COD, Ca, Mg and other physio-chemical as well as biological properties are severely effected. The surface water or rainwater percolating in the ground through the open landfill sites which may also be known as non-engineered landfills absorbs harmful chemicals and heavy metals which when join the water table greatly effects the quality due to addition of Hg, Cd, As, Zn, Ni, Cr, etc and other harmful compounds present in wastes.

Preventive Measures: Proper methods of waste disposal have to be undertaken to ensure that it does not affect the environment around the area or cause health hazards to the people living there. At the household-level proper segregation of waste has to be done and it should be ensured that all organic matter is kept aside for composting, which is undoubtedly the best method for the correct disposal of this segment of the waste. In fact, the organic part of the waste that is generated decomposes more easily, attracts insects and causes disease. Organic waste can be composted and then used as a fertilizer.

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