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# Characterstics of Municipal Solid Waste and the Landfill Leachates in Nizamabad

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**Abstract**

With the increasing urbanization there has been enormous increase in solid waste. In medium municipalities the condition of solid waste management and its disposal is worst. Unscientific landfills cause hazards to the human health. The leachates have been found to contain increased amounts of pollution parameters. Increased amount of heavy metals describe the threatening impact on water bodies and soil. The present study is focused on the characterization of municipal solid waste and the landfill leachates in Nizamabad area.

**Key Words**: Municipal solid waste, Leachate, Landfills.

## 1. Introduction

Solid waste management and its disposal have been emerging as a global problem. With increasing urban population the problem is becoming worse than worst. Poor resources in the town municipalities and small municipal corporation do not allow them to adopt adequate measures of Solid waste management[1] .Usually the Municipal solid waste is dumped in unscientifically designed landfills, One of the major pollution problems caused by the municipal solid waste landfill is the leachate produced in the landfills. Leachate can be defined as a liquid that is generated when water or another liquid comes in contact with solid waste[2]. It contains number of dissolved and suspended materials. After municipal solid waste landfill site is closed, landfill will continue to produce contaminated Leachate has potential to contaminate ground and surface water and threaten human health as it continues to migrate from the landfill and contaminates surrounding lands and water. Once the leachate enters the water bodies, it is very difficult and expensive to clean up the contaminated water. The Present study is planned to undertake a review of solid waste managent and the characterstics of solid waste and the leachates.

## 2. Study Area

A study on the characterstics of Municipal solid waste and the leachates deposited was carried out at Nizamabad, Telangana State which is 170kms away from greater Municipal Corporation Hyderabad. Nizamabad occupies an area of 40 Sq.kms and it is located at latitude 18.6720 N and longitude78.0940 E with an elevation of 395m. The Godavari River enters into Telangana from Nizamabad district at Kandhakurthi. Nizamabad was founded in the year 1905 when Nizam's Dominion were recognized, where upto it was known as Indur which was supposed to have originated from the name of the King Indradatta who seems to have flourished it

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during the 5th century A.D. Later during the 18th century the Nizams ruled over the Deccan region and the district got its name from him. Nizamabad is a city and a municipal corporation in Nizamabad district of Telangana state, India.It is headquarter of the district It is one of the major urban centre in TS and the third biggest in TS after Hyderabad and Warangal As of 2011 census, the population is recorded as3,11,152, with 66,670 households, by 2014 household survey by Govt of Telangana State recorded the population as 4,87,709 which makes it the third most populous city in TS after Hyderabad and Warangal.

Collection of domestic waste from door to door is collected manually, in the collection vehicle and the commercial waste is also collected manually. Both commercial and domestic solid waste are transport to dumping yard situated at Mallaram was done at regular intervals between 6AM to 10AM and 2.00 PM to 5.00 PM. In Nizamabad Town the Solid waste is generated 175 metric tons per day but an average of 140 metric tons of solid waste is collected per day that means 35 metric tons per day is remained un collected which dumped in open and contaminates the ground and surface water [8-11]. As Urbanization and Modernization continues to take place, the management of solid waste is also becoming a major environmental and public health concern in urban areas of many developing countries. This solid waste is dumped at the un engineered dump yard situated at Mallaram village at a distance of five kilo meters from the city. The surrounding area became densely populated during the last five years. The main source of drinking and potable water in this area is ground water which is much contaminated by these lechates.

## 3. Methods and materials

The solid waste produced in Nizamabad Municipal Corporation has the following major physical components.

**Table 1.categoriesofmunicipalsolidwastesin Nizamabad.**

| S. No | Number ofplaces surveyed | Paper % | Rubber leatherand synthetics % | Glass % | Metal % | Compostable matter % | Inert material % | |
|---|---|---|---|---|---|---|---|---|
| 1 | 12 | 3.45 | 0.58 | 0.36 | 0.13 | 36.57 | 33.59 | |
| 2 | 15 | 3.35 | 0.53 | 0.36 | 0.12 | 30.04 | 38.38 | |
| 3 | 9 | 5.32 | 0.51 | 0.36 | 0.39 | 36.95 | 34.73 | |
| 4 | 3 | 4.27 | 0.58 | 0.38 | 0.49 | 47.57 | 39.07 | |
| 5 | 4 | 6.27 | 0.38 | 0.18 | 0.40 | 20.84 | 43.90 | |

*Note: The remaining percentage of waste collected is considered as solid waste.*

The major characteristics of Municipal solid waste are the Moisture, Organic matter Nitrogen, Phosphorous Potassium and other cations.

Pollutants in MSW landfill leachate can be classified in to four groups:

1. Dissolve organic matter, quantified as Chemical oxygen Demand (COD), Total organic carbon (TOC), volatile fatty acids (that accumulate during the acid phase of the waste stabilization).
2. Inorganic macro components like

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calcium, magnesium, sodium, potassium, ammonium, iron, manganese, chloride, sulphate and hydrogen carbon.

3. Heavy metals like chromium, cadmium, lead, iron, nickel, zinc, copper.
4. Organic compounds originated from household or industrial chemicals and present in relatively low concentrations. The municipal solid waste leachate sample was collected in the month of April from the dumping site. Glass bottles were used to collect leachate samples for chemical analyses, whereas, samples preserved for BOD and COD tests were collected in polyethylene bottles covered with aluminium foils. A few drops of concentrated nitric acid were added to the leachate sample collected for heavy metals analysis to preserve the samples. The samples were then transported in cooler boxes at temperature below 5°C, and transported immediately to the laboratory.Sample of leachate were stored in refrigerator at 4°C before proceeding for the analysis. The analysis is carried out according to standard methods for examination of water and wastewater unless otherwise stated, APHA.

## 4. Results And Discussion

**Table 2.Chemicalcharacteristicsofmunicipalsolidwastesin Nizamabad.**

| S.No | Number of placessurveyed | Moisture % | Organic matter% | Nitrogenastotal nitrogen % | Phosphorous as$P_2O_5$% | Potassiumas $K_2O$% | |
|---|---|---|---|---|---|---|---|
| 1 | 12 | 35.81 | 27.09 | 0.5 | 0.33 | 0.63 | |
| 2 | 15 | 29.52 | 15.14 | 0.4 | 0.36 | 0.59 | |
| 3 | 9 | 36.98 | 16.89 | 0.4 | 0.42 | 0.52 | |
| 4 | 3 | 11.03 | 15.6 | 0.3 | 0.59 | 0.58 | |
| 5 | 4 | 28.72 | 29.07 | 0.3 | 0.42 | 0.32 | |

Table3 shows the results the chemical characteristics of the leachate from Mavallipura landfill. As for metals, high concentrations of iron in the leachate, followed by zinc, nickel were observed. The concentrations of chromium, copper, cadmium and lead were low.

**Table 3**

| Details | Leachate | pH | 7.4 |
|---|---|---|---|
| Colour | Dark black | Odour | Medium |
| Temperature,°C | 29 | Conductivity, | µS/cm4120 |
| Turbidity (NTU) | 23.08 | TS, mg/l | 4087 |
| TDS, mg/l | 2027 | COD, mg/l | 10400 |
| BOD3 , mg/l | 1500 | Sulphate, mg/l | 40 |
| Chloride, mg/l | 660 | Calcium, mg/l | 400 |
| Hardness, mg/l | 20000 | Alkalinity, mg/l | 11200 |
| Iron, mg/l | 11.16 | Copper, mg/l | 0.151 |
| Silver, mg/l | 0.035 | Chromium, mg/l | 0.021 |
| Cadmium, mg/l | 0.035 | Lead, mg/l | 0.3 |
| Zinc, mg/l | 3 | Nickel, mg/l | 1.339 |
| Sodium, mg/l | 3710 | Potassium , mg/l | 1675 |
| Nitrate,mg/l | 22.36 | Total Phosphorus, mg/l | 26.29 |

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**pH**

pH value of leachate sample of the landfill site was 7.4. pH is controlled principally by a series of chemical reactions. The important reaction is the degradation of organic materials to produce carbon dioxide and small amount of ammonia. These dissolve in the leachate to form ammonium ions and carbonic acid. The carbonic acid dissociates with ease to produce hydrogen cations and bicarbonate anions. Which influence the level of pH of the system. Additionally, leachate pH is also influenced by the partial pressure of the generated carbon dioxide gas that is contact with the leachate

**Colour**

Colour in leachate is caused by metallic substance like salts of iron, manganese, humus materials,tannins, peat, algae, weeds, protozoa, industrial effluents from paper and pulp, textile,tanneries...etc actually, colour in water is due to dissolved substances and substances present as fine colloids. As leachate first emerges it can be black in colour, anoxic and may be effervescent with dissolved and entrained gases. As it becomes oxygenated it tends to turn brown or yellow because of the presence of Iron salts in solution and in suspension. It also quickly develops a bacterial flora often comprising substantial growths of Sphaerotilus [15].

**Turbidity**

Turbidity value of leachate samples of the landfill site is 23.08 NTU. Turbidity is due to the colloidal, extremely fine suspension such as clay, slit, finely divided matters (organic and inorganic) micro-organisms like plankton...etc.

**Temperature**

Temperature has an effect on the biological activity of bacteria present in leachate and also affects the solubility of gas in leachate. The normal temperature of landfill leachate is generally slightly higher than the temperature of water because of generation of heat \during the utilization of water.

**Alkalinity and Hardness**

Alkalinity causes by bicarbonate, Carbonate and Hydroxyl ions. It is important in treatment of waste water: coagulation, softening, evaluating buffering capacity of water. However, for landfill leachate total alkalinity values are often found to be significantly higher than natural waters. This is because of the biochemical decomposition and dissolution process occurs within a landfill and disposal sites. The biodegradation processes of organic matter within the waste mass produce a significant amount of bicarbonate, which represents dissolved carbon dioxide and is also the major components of alkalinity. In this investigation, the leachate sample was
found to have significantly high alkalinity values.The high alkalinity observed in this study reflects the level of biodegradation process taking place within the disposal sites. The presence of significant amounts of ash and slag is from the combustion of wood, agricultural residues and peat in landfill sites. These components are known to increase alkalinity in leachtesgreatly.The high hardness is due to carbonate and bicarbonate of calcium and magnesium.

**Conductivity and Total dissolved solids**

These parameters are generally influenced by the total amount of dissolved organic and inorganic materials present in the solution, and are used to demonstrate the degree of salinity and mineral contents of leachate. Total mineral content further reflects the strength and overall pollutant load of the leachate. The salt content in the leachate is due to presence of potassium, sodium, chloride, nitrate, sulphate and ammonia salts. The leachate sample seems to be high values (EC=4210µS/cm) due to the effects of the concentration of salts as a consequence of degradation of organic matter

**Major anions**

The level of inorganic elements present in leachate is dependent principally on the ease of leaching the inorganic constituents present in the municipal solid waste materials and the stabilization process in the landfill. In this investigation, The landfill leachate sample was found to have considerably high

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concentrations of all the major anions like chlorides, nitrates, sulphate as reflected in concentration of chloride is highest, while sulphate concentration is the lowest. The high chloride content in the leachate sample reflects the significant presence of soluble salts in the municipal solid waste materials of the study area. The high chloride content in leachate sample is attributed to the large amount of sewage, agricultural and other animal waste deposited in the site. Prior anaerobic activity taken place in sample sulphate is converted to sulphide and metal sulphide precipitated in leachate sample Sulphate in landfill leachate is sourced primilarly from the decomposition of organic matter, soluble waste, such as construction wastes or ash, synthetic detergents and inert waste, such dredged river sediments Nitrates represent the most oxidized form of nitrogen found in natural system. It is often regarded as an unambiguous indicator of domestic and agricultural pollution. In leachate sample it is formed primarily as a result of oxidation of ammonium to nitrite and subsequently, to nitrates by nitrification process.

**Major Cations**

The constituents Calcium, Magnesium, Sodium and Potassium are considered generally to be major cations typically present in leachate. Derived from the waste material through mass transfer processes,concentration of these cations in leachate is specific to the composition of the waste mass and the prevailing phase of stabilization in the landfill [16].In leachates, these are sourced usually from the degradation of organic materials and the dissolution of inorganic wastes such as concrete, plaster and tiles. Sodium and potassium are both present at considerably high oncentrations in theentire samples of this investigation. The sodium and potassium are not affected significant by microbiological activities within the landfill site.These ions play an important role in plant physiology and are most likely derived from vegetable residues and domestic wastes. Ncreased concentration of potassium in ground water is often considered as an indicator of leachate pollution [6]. Main source of potassium is weathering and erosion of potassium bearing minerals such as feldspar, leaching of fertilizer, sea water in areas susceptible to salt water intrusion. It can adversehealth effects from exposure to increased potassium in drinking water are unlikely in healthy people and it cause diseases like kidney failure,heartdisease,coronaryarterydisease,hypertensions, diabetes.

Sodium is an essential nutrients and adequate levels of sodium are required for good health, too much sodium is one risk factor for hypertension.Sodium is used for water softening. The sodium and potassium are not affected significant by microbiological activities within the landfill site.Indications from BOD and COD values The BOD/COD ratio indicates the age of the waste fill [7]. Also the changes in the amount of biodegrable compounds in the leachate. Any waste water, having its BOD5/COD ratio more than 0.63,can hence, be considered to be quite controlled to biological treatment, since it does not contain non- biodegrable organics [10].

**Heavy Metals**

Heavy metals appear in the municipal solid waste like Batteries, consumer electronics, ceramics, light bulbs, house dust and paint chips, lead foils such as wine bottle closures, used motor oils, plastics, and some inks and glass can all introduce metal contaminants into the solid waste stream. Concentration of heavy metals in a landfill is generally higher at earlier stages because of higher metal solubility as a result of low pH caused by production of organic acids. It is now recognized that most trace elements are readily fixed and accumulate in soils, and because this process is largely irreversible, repeated applications of amounts in excess of plant needs eventually contaminate a soil and may either render it non- productive or the product unusable. Although plants do take up the trace elements, the uptake is normally so small that this alone cannot be expected to reduce appreciably the trace element [09].

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## 5. Conclusion

It is concluded that the municipal solid waste and its leachate sample contain high concentration of organic and inorganic constituents. Heavy metals concentration was in trace amount as the waste in domestic in nature. Leachate is found to have significantly high salinity and alkalinity as reflected in their values for conductivity, TDS, alkalinity and pH. Municipal Corporation must adopt scientific methods for collection, segregation and disposal of solid waste. Municipalcorporations mustaccommodate adequate infrastructure, manpower and urgent stepsinthisdirectionto reducethewater,air,soilpollutionsandhealthhazards.Itwillimprovethequalitylifeof people in NizamabadMuncipalRegion.

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