Research Article

# Solid Waste Pollution and Collection in Scrap Houses of Nanded, Maharashtra (India)

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## Abstract

**The present study was conducted on the leachate and groundwater samples collected from the Valmikinagar dumpsite and the solid waste collected from the scrap houses of Nanded city. The study examines basic characteristics of the leachate and groundwater samples near dumpsite. Concentration level of contaminants was studied on daily and monthly basis. Solid waste was also studied with references to collection, sorting and recycling from different areas of the scrap houses of the city. The leachate and groundwater samples were collected from Walmiki Nagar solid waste dumping site. The leachate sample showed slightly acidic pH while groundwater samples showed neutral pH from the solid waste dumping site. The leachate sample showed higher electrical conductivity while groundwater sample showed slightly higher than the permissible limit. The leachate sample falls under very hard category while groundwater sample falls under hard water class. The leachate sample showed very high calcium content than the permissible limit. Similarly, the chloride content of both the samples was higher than desirable limit. The study also had a focus on the glass, paper, plastic, iron, cartoon waste collection, segregation and transportation for recycling.**

**Keywords:** - Groundwater, leachate, scrap house, solid waste

## 1. Introduction

The challenge of managing municipal solid waste (MSW) in an environmentally and economically sustainable manner is bound to assume gigantic proportions as India's urban population slated to increase from current 330 million to about 600 million by 2030. The country has over 5,000 cities and towns, which generate about 40 million tons of MSW per year. Going by estimates of The Energy Research Institute (TERI), this could well touch 260 million tons per year by 2047. Municipal solid waste is solid waste generated by households, commercial establishments and offices and does not include the industrial or agricultural wastes. Municipal solid waste management is more of an administrative and institutional mechanism failure problem rather than a technological one. Until now, MSW management has been considered to be almost the sole responsibility of urban governments, without the participation of citizens and other stakeholders. The Centre and the Supreme Court, however, have urged that this issue be addressed with multiple stakeholder participation. Cities in India spend approximately 20% of the city budget on solid waste services (www.gits4u.com). Proper segregation at the source should be practiced with composting the daily solid waste and reuse–recycle of the non-biodegradable and recycled waste (Kale, et al., 2010).

In Nanded, approximately 70% of municipal solid waste is disposed on open dump site. Municipal solid waste collection (MSWC) has about 85% proportion of the total cost for solid waste management system (Ludwig and Black, 1968). MSWC is the beginning of the process of solid waste management which consists of generation, collection, transfer, treatment and final disposal (Apaydin and Gonullu, 2007). The scrap houses of Nanded City are collecting the solid waste, which is recyclable. In general, one of the major remedies of environmental impacts of solid waste disposed is influence of scrap materials in the waste (Tawach Prechthai *et al*., 2008). Valmikinagar dumpsite is one of the large sites in Nanded City. Leachate is a liquid residue resulting from the various chemical, physical and biological processes taking place within the landfill. Landfill leachate is generated by excess rainwater percolating through the waste layers in a landfill. The leachate produced by waste disposal sites contains a large amount of contaminants which likely to pollutes surface and groundwater (Gunjan *et al*., 2010). With more possibility of oxygen diffusion through the upper layer of dumpsite and with sufficient moisture content, the degradation

rate and the acid buffer capacity of the dumpsite is highly influenced. Under this condition there is a drop in alkalinity, pH and sulfide oxidation, where harmful chemicals are easily available and released (Bozkurt 2000; Matensson *et al*., 1999). These are the harmful pollutants always associated with solid waste dumping sites and contaminate the surrounding environment. The present investigation was conducted on leachate and groundwater samples collected from Valmikinagar dumpsite and the solid waste collected from the scrap houses. The study examines basic characteristics of the leachate and groundwater samples near dumpsite. Study also focuses on the daily, monthly collection, sorting and recycling of solid waste in different areas of the scrap houses of the Nanded City.

## 1.1 Study Area

Nanded district is situated in eastern portion of Marathwada region, which corresponds to Aurangabad Division of Maharashtra state. The
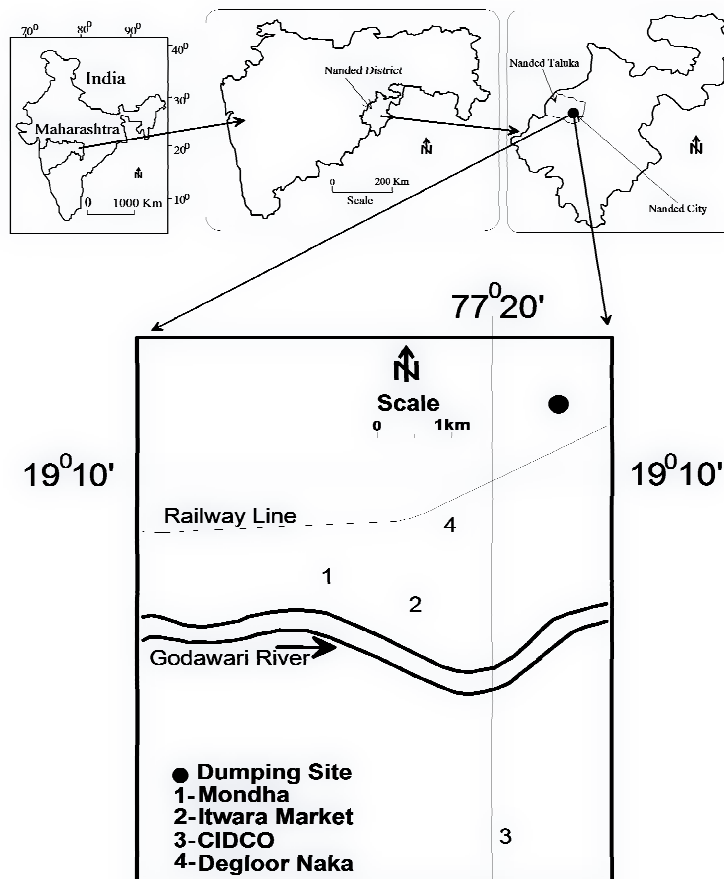
name Nanded is widely believed to have originated from 'NANDI' the Vahan of Lord Shiva, who performed penance on the banks of River Godavari. The district is bounded by Nizamabad, Medak and Adilabad districts of Andra Pradesh on the east, by Bidar district of Karnataka falls on the south, by Parbhani and Latur districts of Marathwada on the west and Yavatmal district of Maharashtra's Vidarbha region in north. The influence of Andhra, Karnataka and Vidarbha can be seen on the language, behaviour and general conduct of the people of Nanded. The district has an area of 10,422 $Km^2$ while according to 2001 census its population is 28, 76,259 of which 23.96% were urban. The average rainfall of Nanded district is 953.8 mm. The study area is shown in fig. 1



**Fig. 1: Study Area with Locations in Nanded City**

## 2. Materials and Methods

### 2.1 Dumpsite

The dumpsite selected in the present study is 40 years old located at Valmikinagar of Nanded city. The total area of dumpsite is about 23,800 m$^2$. The height of the dump is about 3 m above the ground. There is no proper leachate collection system within the dumpsite and accumulated leachate was observed beneath the dumpsite. The runoff leachate is collected through an open pipe system and treated in the stabilization pond situated nearby the site (Tawach Prechthai *et al*., 2008).

### 2.2 Leachate and Groundwater Sampling and Analysis

The representative leachate samples of dumpsite were collected from five selected locations. To prepare sample for analysis, the representative samples collected from each location was mixed and subjected to further analysis. The representative groundwater samples were collected from five selected locations near the dumpsite. The leachate and groundwater analysis was done in triplicates for accuracy following the standard methods for water and wastewater examination (APHA, 1998).

### 2.3 Solid Waste Collection in Scrap Houses of Nanded City

The problem of solid waste is increasing day by day (Grover, 2000). To minimize the problem of solid waste, there is need to carry out proper statistical analysis to identify the extent problem. There are different types of treatment methods to dispose the solid waste, but the technique is chosen on some special characters such as easy availability of materials, cost effectiveness, requires less expertise and easy to understand. Nanded-Waghala Municipal Corporation is collecting the solid waste from different areas of the city. The major areas of the city include New Mondha, Old Mondha, Itwara, Degloor Naka, CIDCO, Doctor lane, Vazirabad and Bus Stop. There are number of scrap houses. For the present study, sites of scrap houses such as Itwara Market, Mondha, CIDCO and Degloor Naka were selected.

## 3. Results and Discussion

Household waste, commercial waste, hazardous waste and industrial waste are the solid wastes coming out of the city. It is usual practice in the city that few groups of the people collect the wastes and store in scrap houses for resale. There are four major sites in the city where more number of scrap houses are located these mainly includes Itwara market, Mondha, CIDCO and Deglur Naka. In all these areas mainly glass wastes are collected and are transported to Shrirampur wine factory located in, Ahamadnagar district for recycling. The paper and cartoon waste is transported to Nagpur and Hyderabad for recycling. Concerning to the analysis, the leachate and groundwater samples were collected from Walmiki Nagar solid waste dumping site. The analysis of leachate and groundwater samples from solid waste dumping sites of Nanded city is shown in figure 2.

The daily solid waste collection in scrap house of Nanded is shown in Table 1. The leachate sample showed slightly acidic pH and groundwater showed neutral pH from collected the solid waste dumping site area. The pH of leachate and groundwater sample was 5.96 and 6.63 respectively. The leachate sample showed very high EC and groundwater sample showed slightly higher EC than the permissible limit. The electrical conductivity of leachate and groundwater sample was 11,686 µS and 1686 µS respectively. The hardness of leachate and groundwater sample was 4,400 mg/l and 200 mg/l respectively. The leachate sample falls under very hard category and groundwater sample fall under hard water class. The leachate sample showed very high calcium content than the permissible limit. The calcium content of the leachate and groundwater sample was 1,280 mg/l and 32.06 mg/l respectively. The total alkalinity of leachate and groundwater sample was 2,200 mg/l and 215 mg/l respectively while chloride content of leachate and groundwater sample was observed to be 1,207 mg/l and 1,420 mg/l respectively. The chloride content of both samples was observed to be very high than the maximum desirable limit as suggested by World Health Organisation (WHO).
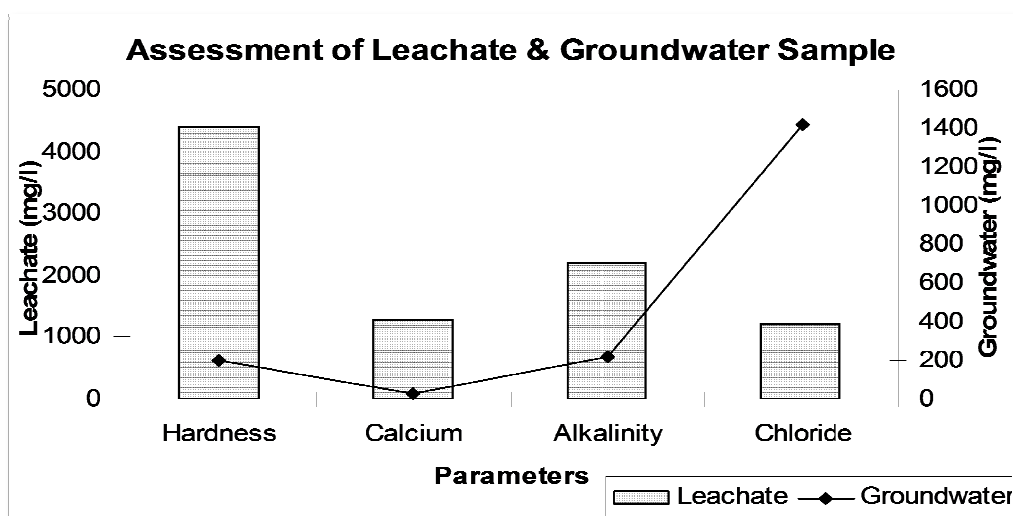
**Fig. 2: - Physico-Chemical Analysis of Leachate and Groundwater Samples**

The daily collected Glass waste in Itwara Market, Mondha, CIDCO and Deglur Naka was 3, 0.2, 0.02 and 2.5 tons respectively and total collected waste in Nanded city was 5.72 tones. Glass waste was collected more in Itwara Market area and the least collection was observed in CIDCO area. The daily collection of paper waste in Itwara Market, Mondha, CIDCO and Deglur Naka was 0.5, 0.112, 0.1 and 0.6 tons respectively. Total paper waste collected in Nanded city was recorded by 1.312 tons. Paper waste collection was maximum in Deglur Naka area and least in CIDCO area. The daily collected plastic waste in Itwara Market, Mondha, CIDCO and Deglur Naka was 3, 0.11, 0.05 and 3 tons respectively while total plastic waste in Nanded was recorded by a value of 6.16 tons. Plastic waste was collected more from Itwara Market and Deglur Naka while least from CIDCO area. The daily collected iron waste in Itwara Market, Mondha, CIDCO and Deglur Naka was 8, 2.5, 0.1 and 1 tons respectively while total iron waste collected from Nanded was 11.6 tons. Iron waste was collected more from Itwara Market and very less from CIDCO area. The daily collected cartoon waste in Itwara Market, Mondha, CIDCO and Deglur Naka was 0.2, 1.5, 0.075 and 1.2 tons respectively and total cartoon waste collection in Nanded City was recorded to 2.975 tons. Cartoon waste was collected more in Mondha area and least in CIDCO area as compared to other selected locations.

**Table 1: - Daily Solid Waste Collection (Tones) in Scrap Houses of Nanded City**

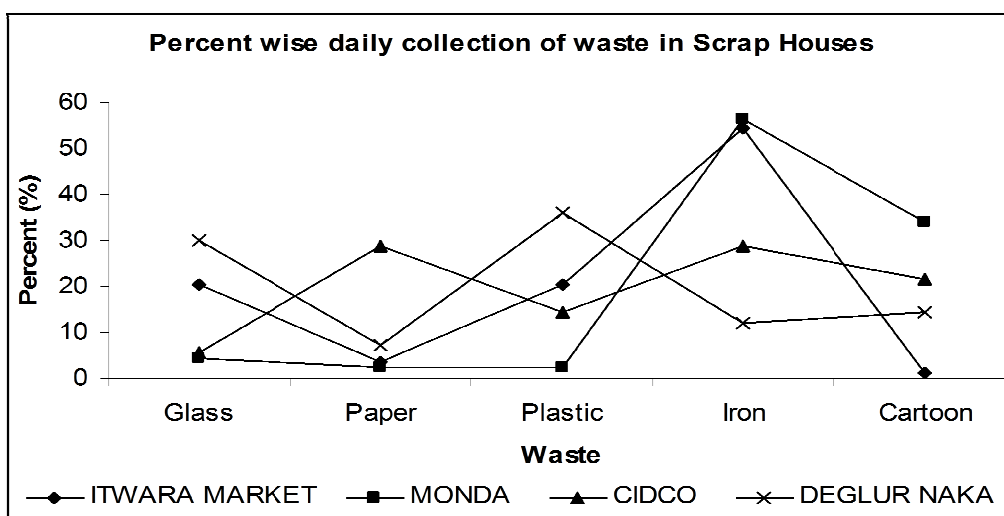| Waste Type ▶ | Glass | Paper | Plastic | Iron | Cartoon |
|---|---|---|---|---|---|
| Area ▼ | Generation in Tones | | | | |
| Itwara Market | 3.0 | 0.5 | 3.0 | 8.0 | 0.2 |
| Mondha | 0.2 | 0.112 | 0.11 | 2.5 | 1.5 |
| CIDCO | 0.02 | 0.1 | 0.05 | 0.1 | 0.075 |
| Deglur Naka | 2.5 | 0.6 | 3.0 | 1.0 | 1.2 |
| Total | 5.72 | 1.312 | 6.16 | 11.6 | 2.975 |

**Fig. 3: - Percent wise daily collection of solid waste in Scrap houses of Nanded City**

Solid waste is collected on daily basis in Itwara Market, Mondha, CIDCO and Deglur Naka scrap houses of Nanded City. In Itwara Market the glass, paper, plastic, iron and cartoon waste collection was recorded as 20.40, 3.42, 20.40, 54.44 and 1.34 % respectively. In this area Iron waste was collected maximum than other waste type while Cartoon waste was collected less as compared to other waste. Glass, Paper, Plastic, Iron and Cartoon waste collection in Mondha area was 4.52, 2.54, 2.49, 56.53 and 33.92 % respectively. In this area Iron waste was collected to a maximum than other type of waste while plastic waste was collected very less than the other waste. In CIDCO area the collected Glass, Paper, Plastic, Iron and Cartoon waste was 5.80, 28.98, 14.50, 28.98 and 21.74 % respectively with maximum collection was observed in case of Paper and Iron waste than other waste. In Degloor Naka area Glass, Paper, Plastic, Iron and Cartoon

waste collection was 30.12, 7.23, 36.14, 12.04 and 14.46 % respectively with maximum collection of Plastic waste than any other type of waste (fig. 3). The monthly solid waste collection in scrap house of Nanded City is shown in Table 2.

The monthly collection of Glass waste in Itwara Market, Mondha, CIDCO and Deglur Naka was 81, 5.6, 0.6 and 86 tons respectively and total solid waste collected in Nanded City was 173.2 tons. Glass waste was collected more in Degloor Naka and less in CIDCO as compared to selected areas. The monthly collection of Paper waste in Itwara Market, Mondha, CIDCO and Deglur Naka was 15, 3.4, 3 and 16 tons respectively with total collection of paper waste in Nanded was 37.4 tones. Paper waste was collected more in Degloor Naka with least in CIDCO.

**Table 2: - Monthly Generated Solid Waste Collection in Scrap House of Nanded City**

| Waste Type ▶ | Glass | Paper | Plastic | Iron | Cartoon |
|---|---|---|---|---|---|
| Area ▼ | | | Generation in Tones | | |
| Itwara Market | 81 | 15 | 73 | 197 | 5.6 |
| Monda | 5.6 | 3.4 | 3.5 | 66 | 45 |
| CIDCO | 0.6 | 3 | 1.5 | 3 | 2 |
| Deglur Naka | 86 | 16 | 75 | 29 | 35 |
| Total | 173.2 | 37.4 | 153 | 295 | 87.6 |

Monthly collected Plastic waste in Itwara Market, Mondha, CIDCO and Deglur Naka was 73, 3.5, 1.5 and 75 tons respectively with total collected plastic

waste in Nanded was 153 tons. Plastic waste was collected to a maximum in Degloor Naka and least in CIDCO. The monthly collected Iron waste in Itwara Market, Mondha, CIDCO and Deglur Naka was 197, 66, 3 and 29 tons respectively with total collected iron waste was 295 tons. Iron waste was collected more in Itwara Market area and less in CIDCO as compared to any other selected areas. The monthly collected Cartoon waste in Itwara Market, Mondha, CIDCO and Deglur Naka was 5.6, 45, 2 and 35 tons respectively and total collected Cartoon waste in Nanded was 87.6 tons. Cartoon waste was collected more in Mondha and very less in CIDCO than other area.

In Itwara Market area the collected Glass, Paper, Plastic, Iron and Cartoon waste was 21.8, 4.04, 19.64,

53.01 and 1.51 % respectively. In this area Iron waste was collected more than the other waste and Cartoon waste was collected to a less proportion than the other waste. In Mondha area the collected Glass, Paper, Plastic, Iron and Cartoon waste was 4.54, 2.75, 2.83, 53.44 and 36.44 % respectively with Iron waste collection to more extent and Paper waste collection to least extent. In CIDCO area the collected Glass, Paper, Plastic, Iron and Cartoon waste was 5.94, 29.7, 14.85, 29.7 and 19.81 % respectively with Paper and Iron waste was collected more than the other waste and Glass waste with least collection. In Degloor Naka area the collected Glass, Paper, Plastic, Iron and Cartoon waste was 35.69, 6.64, 31.12, 12.03 and 14.52 % respectively. In this area Glass waste was collected more than other waste and Paper waste was collected to least percentage than the other waste (fig. 4).
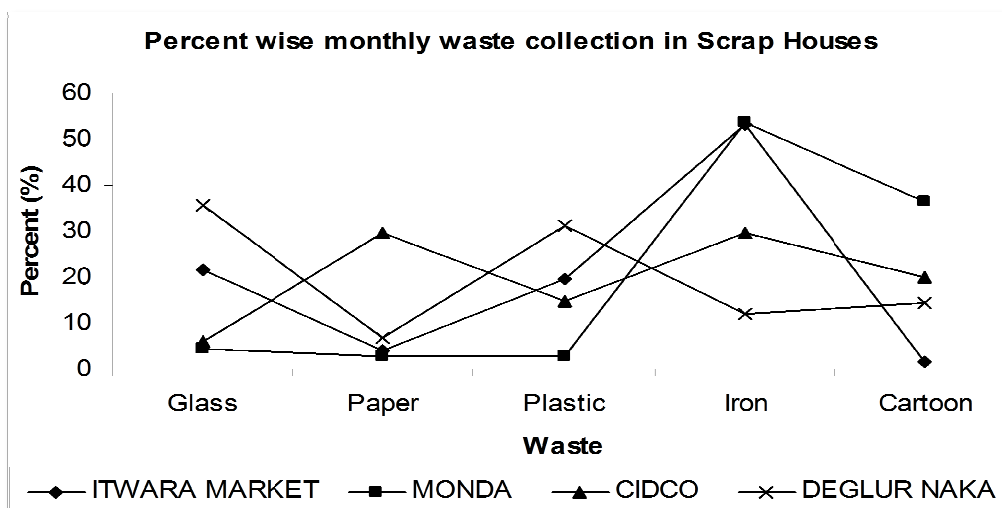


Fig. 4: - Percent wise monthly collection of solid waste in Scrap houses of Nanded City

## 4. Conclusion

Solid waste type of Nanded includes household waste, commercial waste, hazardous waste and industrial waste. There are four major sites in the city, where more number of scrap houses are located, mainly Itwara market, Mondha, CIDCO and Deglur Naka. The leachate and groundwater samples collected from Walmiki Nagar solid waste dumping site showed slightly acidic pH and groundwater showed neutral pH from the solid waste dumping site area. The leachate sample showed very higher

EC while groundwater sample showed slightly higher EC than the permissible limit. The extremely high

values for EC are attributable to high levels of anions and cations present in the liquid leachate of the area and may cause groundwater pollution to greater extent. The leachate sample fall in very hard category and groundwater sample fall in hard water class. The leachate sample showed very higher calcium content than the permissible limit. The chloride content of both the samples was also higher than maximum desirable limit. Glass waste was collected more in Itwara Market area and less from CIDCO. Paper waste was collected more in Deglur Naka area and with least percentage was observed in CIDCO. Plastic waste was collected more from Itwara Market and Deglur Naka and less from CIDCO as compared to other areas. Iron waste was

collected more from Itwara Market area and least from CIDCO. Cartoon waste was collected more in Mondha and less in CIDCO. Glass waste generated in these areas is collected and transported to Shrirampur wine factory, Shirdi road, Ahamadnagar for recycling while the paper and cartoon waste collected and transported is send to Nagpur and Hyderabad for recycling.

The solid waste problem is very severe. All solid waste is not collected for recycling purpose. It is general observation that the collected, recycled solid waste is only half of the total generated recycled waste. The Municipality gives some subsidies to the scrap house owners to collect and transfer solid waste for recycling. This is helpful for minimizing the solid waste pollution. The 3-R principle approaches (reduce, reuse and recycle) is an appropriate methodology for solid waste management and also for the abatement of leachate induced groundwater pollution. Reduction of solid waste generation at source may be achieved by various awareness campaigns in residential societies. We recommend that proper collection, segregation, treatment and transportation of biodegradable, non-biodegradable and recycled wastes should be carried out to stop the further to the natural environment.

## 5. Acknowledgement

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