Experience of Tehran in Improving Integrated Waste Management- Focus on MBT Methods

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Abstract

The daily production of solid waste in Tehran is 7500 tons which according to analyses almost %65 is organic materials which can be composted (wet waste) %35 is dry waste. This study focuses on solid waste management in Tehran and the strategies for gaining to the best result with focus on BMT systems. As the MBT is the most important system in Tehran solid waste management hence there are different technologies that are more used in waste management. This paper proposes methodological approach for combination of above mention systems. The results show BMT adopts with Tehran waste characteristics carefully. Mean while, the MBT methodology has been applied for Solid waste management in Tehran.

In the other hand, According to our experience in solid waste management, the Tehran municipality is playing a vital role in protecting the environment by some achievements listed as below:

Build and operation of waste processing units according to MBT methods

- Compost production
- RDF Production
- Methane Gas extraction
- Reclamation of old landfill
- Construction of lechate treatment system
- Construction of sanitary landfill

Keywords*:* Waste Management, compost, MBT Methods, CDM

1 Introduction

The daily production of solid wastes in Tehran is 7500 tons (min 4000 – Max 11000 t/d) which according to analyses almost %65 is organic materials which can be composted (wet wastes) %32.5 is solid wastes and %2.5 is special household waste and the healthcare waste as almost 40 tons daily. As the waste decays fast it is collected once in 24 hours from the production sources. This method is based on a three years plan. Presently the collection is mechanized by implementing this project the 2 millions point of waste reduced to 70.000 bins which has a good effect on reducing the air pollution.

2 Materials & Methods

The proposed 4000 tone per day windrow composting operation at Kahrizak has been designed to treat municipal solid waste from the Municipality of Tehran on a 22 ha site in the present location of three waste screening plants located in the south section of Arad Kooh Compost Plant. The plant is designed to:

- to reduce the waste flow to the landfill;
- produce a safe and high quality compost;
- reduce the methane emissions at the landfill and to capture carbon credits for these emission reductions; and
- Meet international environmental and health and safety standards.

The design concept is based on the use of the least cost windrow technology for composting, use of robust and reliable equipment, availability of spare parts, local know how and intimate knowledge of the workings of the Tehran solid waste management system. Equipment such as mobile windrow turners will be purchased from abroad because of their high reliability and quality and low maintenance requirements. Equipment like destoners, shakers and related equipment has been avoided due to their high investment and maintenance costs. Glass and pebbles are mostly found in the screened compost fraction in the size range between 10 and 20 mm. The process flow sheet for the proposed composting facility is shown in Figure 1.

The input waste to the plant will be supplied from selected districts in Tehran, delivered to the plant in 20 tone semi-trailers, weighed and then unloaded at the reception area in front of the Sorting Halls. Bulky items like tires and broken furniture pieces will be collected at the reception hall and transferred to the landfill. The next stage of sorting involves drum screening with a mesh of 70 mm to produce an underflow which has a very high fraction of biodegradable organic waste suitable for composting. The overflow from the drum screens with recoverable recyclables is discharged onto a manual sorting conveyor belt. Major sorting activities to recover these recyclables will take place on both sides of the sorting conveyor belt and separated items will be dropped into chutes and collected in wheeled bins under the elevated sorting lines.

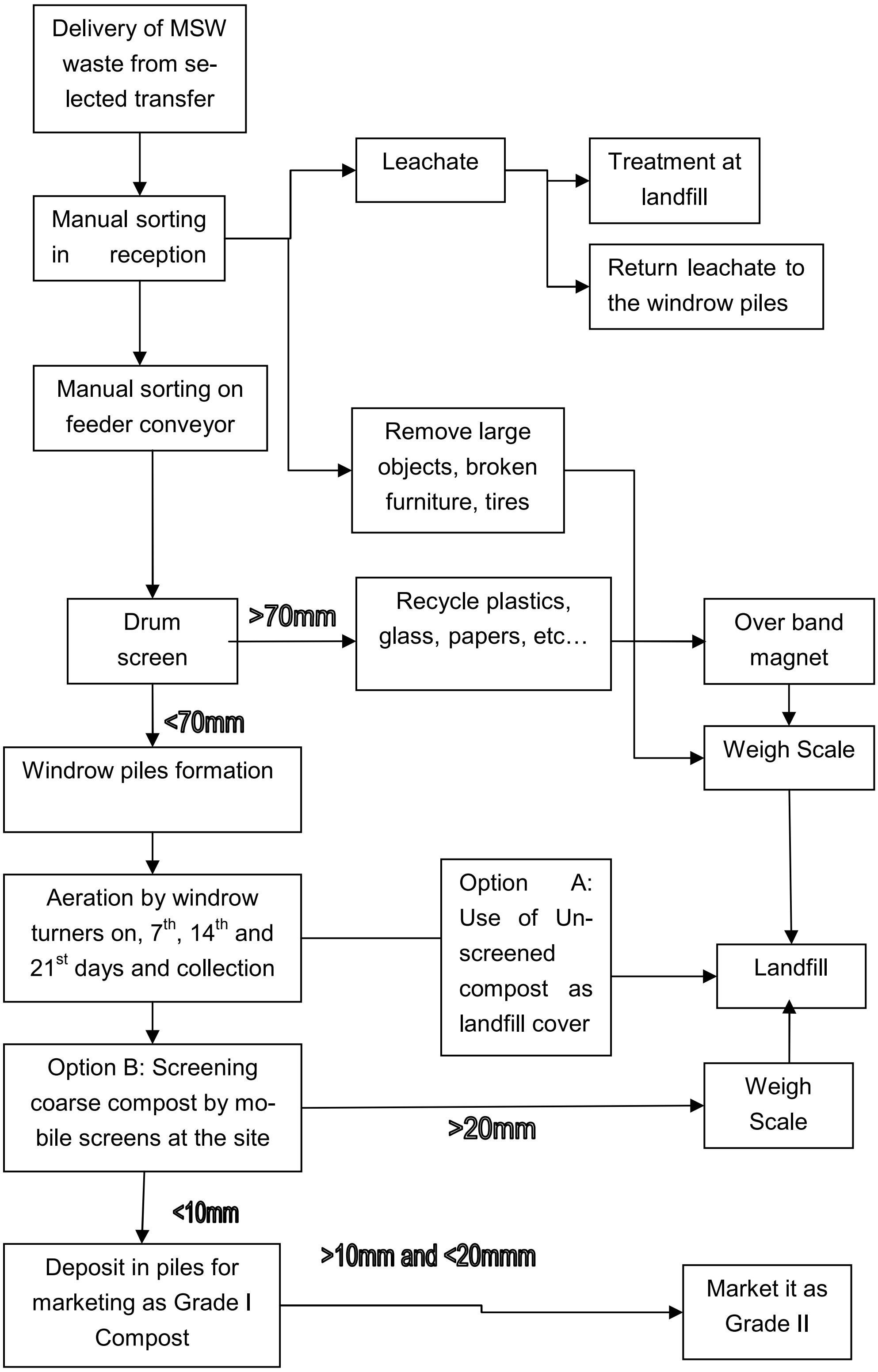

Figure 1 Process Flow sheet for the 4000 tpd Windrow Compost Plant

From here they will be taken to the baling area to compress items like plastics and cardboard to reduce the volume ready for collection and transport. Non-recyclable materials will discharge off the end of the sorting conveyor directly into pressing system and transported directly to the landfill after weighting.

3 Results & Discussion

The daily production of solid wastes in Tehran is 7500 tons which according to analyses almost %65 is organic materials which can be composted (Table 1). About 60 percent of incoming waste passes to the drum screen underflow and this fraction is collected on conveyor belts and discharged directly into the asphalt lined windrow pad. This pad is sloped and has facilities to collect any leachate that seeps from the windrows. Windrow piles will be formed by front end loaders and then by means of large mobile windrow turners will be turned on 7th, 14th, and 21st days and collected on 28th day. Moisture, oxygen levels and temperature in the windrow piles will be regularly checked by on-site quality control staff to ensure optimum conditions for the composting process. The windrow turners have provisions for spraying water and biologically active inoculums to speed up the composting process and produce a better quality product. The inoculums also considerably reduce odors.

Table 1 Test of waste compositions

Waste Type	Mass %
wet waste	65.22
bread	0.86
soft & hard plastic	1.52
PET	0.27
Plastic bags	7.73
Paper	3.41
Cardboard	9.20
Ferrous metals	0.67
Non-ferrous metals	0.04
Fabric	4.38
Glass	1.27
Wood	0.16
Tiers	0.00
Leather	0.50
Dust & Rubble	0.85
Special Waste	2.58
Other	1.34

The layout of the plant has been designed for two possible options after the first stage composting process, as follows:

3.1 Option A

The raw composted waste is loaded into trucks and taken to the Kahrizak landfill to be used as cover material for final reclamation of the landfill. The raw compost matures naturally as it is placed on the landfill. This composted material has several very important functions as final landfill cover: (i) it retains moisture; (ii) it oxidizes the methane and other gases that escape from the landfill even in areas that have gas extraction wells, but most importantly in areas where it is not economic to drill wells and capture the gas. This results in additional GHG emission reductions that could be counted as positive leakage in this Small Scale methodology if a sound technical method can be developed by OWRC to measure the methane emission reductions that have been achieved; (iii) it reduces leachate ; (iv) it reduces odors; (v) it provides an ideal substrate to support the growth of trees even fruit and nut producing species, thereby rehabilitating the landfill site for a productive use; (vi) it greatly improves the visual impact of the landfill; (vii) prevents destruction of vegetation by oxidizing the undesirable gases; (viii) purifies the air around the landfill site; (ix) reduces the cost of soil cover as less cover material is required; (x) reduces the investment and O&M cost for composting as well as the footprint of the composting site; and (xi) reduces the process emissions in the composting process.

3.2 Option B

After 28 days processing coarse immature compost will be taken to the fine compost area and screened with mobile screening equipment to produce three fractions: (i) an immature compost product with a size range <10 mm (Grade 1); (ii) a product between 10 and 20mm, which will be sold as Grade II after further maturation; and (iii) a reject oversize fraction of >20mm, which will be landfilled, or reused in the leachate treatment plant at the landfill. The two product grades will be taken to the covered product maturation building where it will be held for at last 20 days, monitored and turned with front end loaders as needed and then sold as bulk compost or bagged for sale through distributors to individual buyers. Additives will be incorporated before sale to enhance the effectiveness and value of the compost. Physical and chemical analyses of fine compost <10mm will be carried out on a regular basis to ensure that it meets government quality standards and market demands. This will include analyses for heavy metals, particularly lead and cadmium. The other heavy metals such as copper and zinc, which are found in the compost, have beneficial impacts on agriculture as they tend to be deficient in most Iranian soils. All materials entering and exiting the site will be weighed.

3.3 Design, Built and operation of Waste screening plants

The present four waste screening plants which processed approximately 4,000 tones MSW from the time they were installed in March 2008 until September 2008 operated some 300 days in the year. In order to reach the 4,000 tone/day design capacity of the proposed Kahrizak Composting Plants the following up-grades and expansions have been done:

- The 500 tone/day screening plant, which is located in the north section of Arad kooh mechanical compost plant site, will be relocated next to the second 500 tone/day screening plant in the southern section of the site to reduce management and maintenance costs. Both of these plants will be overhauled to ensure reliable operation under the expected future throughput
- The 2*500 tone/day screening plant also have been designed and constructed by local experts and the two sorting lines and the press system have been relocated under the sorting building. These 2 lines are expanded for working in 2 work shift. Consequently, the capacity will rise to 2000 tpd.
- A new 3*500 tpd sorting hall has been installed on the mechanical compost plant site
- The composting pad has been reconstructed to support heavy machinery and will be sealed with asphalt with drains to collect any leachate that seeps from the windrows. The leachate will drain to a sump and the collected leachate either re-used by spraying on the windrows or taken to the proposed leachate treatment plant at the landfill.
- A dedicated fuel storage and distribution center will be established to dispense fuel only for use by process equipment on the site as required under this Small Scale Methodology
- A well stocked spares parts warehouse will be installed to reduce the idle time.
- OWRC's laboratory on the site has been upgraded with analytical equipment, re-agents and portable equipment to measure oxygen, temperature and moisture in the windrows, regularly analyze for C, N, moisture and ash as required by the monitoring methodology and carry out maturation and other tests described above on any compost that is sold for agricultural purposes.

After the overhaul and expansion the Kahrizak Composting Plants it is expected to treat 1,200,000 tone of waste annually, of which 720,000 tones of screened underflow will be composted, 36,000 tones of recyclable materials will be recovered and sold, and 444,000 tone of rejects containing very little biodegradable organic matter will be pressed and ready to change in to RDF. Each year the composting operation will produce some 230,000 tone of raw compost, which will either be used for rehabilitation of the landfill as under Option A, or processed as under Option B to produce 134,000 tone of Grade 1 and 48,000 tones of Grade 2 compost and 48,000 tones of screened rejects that will be landfilled. Under Option B the refined compost will have value as an organic fertilizer for certain crops under controlled application rates, as well as use in horticulture and for green areas in the city. Green area maintenance contractors should be required in their contracts to use this compost instead of mineral fertilizers to boost the local demand for the product and improve the profitability of the plant. The green areas can tolerate higher applications of trace metals than crops which are destined for human consumption.

3.4 Estimated Capital and Operating Costs for 4,000 tpd Composting Plant Options A and B (Table 2)

Table 2 Cost Estimation

Option	Capital Cost (US$)	Yearly O&M Cost (US$)	O&M Cost/tone Waste (US$/tone)
A	9,100,000	3,870,000	3.22
B	10,580,000	3,600,000	3.00

3.5 Compost plant management (present and past)

Before new construction and compost plant expansion, the Contractors are being paid 22,000 Rials, or US$ 2.4 as gate fee and are being charged 15,000 Rials (US$ 1.63) as a tipping fee by OWRC for disposing of their rejects in Kahrizak Landfill. The rejects are estimated at 40 percent of the input waste and the tipping fee is charged against their accounts on a monthly basis. The net revenue received by the Screening Plant contractor = 2.4 – 0.4*1.63 = US$ 0.98/tone waste. The revenue received by the Contractor from the Recyclers is US$ 0.35/tone, giving total revenue of US$ 1.33/tone waste. This is less than the tipping fee but the Contractors have been accumulating screened waste on the plant site and OWRC had the responsibility of clearing the site and the cost of transporting to the landfill. Hence OWRC is incurring real costs greater than the tipping fee and is not saving costs as a result of the operation of these screening plants as it may have thought in the beginning when it set their gate and tipping fees.

While OWRC would be responsible for the capital investments in the 4000 tpd composting plant it would contract with a Management Contractor to manage and operate the plant. At the present time, the Management Contractors cover its costs by selling valuable materials. Nevertheless, they also pay tipping fee on a monthly basis. Mean while OWRC manage fermentation zone and compost production by it self.

At the next step, The OWRC select contractor to produce fine compost at its own cost for installing the new screening equipment and marketing the compost. The contractor should be allowed to keep any revenues from compost sales which will provide an added incentive to process and compost the waste in a well managed way.

4 Conclusion

Hence, Assume Carbon Revenues of US$18,000,000 for 6 years from 2009 – 2014 and US$9,000,000 paid upfront for the capital cost of the plant. Therefore the Municipality will receive US$1.5 million per year from carbon revenues However, there will be many benefits from this investment by delaying costly construction of new landfill capacity and reducing leachate generation by about a half.

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