



DESIGN OF A COMPOST PLANT FOR MUNICIPAL SOLID WASTE MANAGEMENT OF ROORKEE

SONAM CHAUHAN, VARUN JOSHI

Faculty, Department of Civil Engineering, PHONICS Group of Institution, Roorkee, Uttarakhand

ABSTRACT

A tremendous increase in generation of MSW is observed due to increase in population and rapid socio-economic development. The safe and suitable disposal of MSW has become a tremendous area of concern in most of the Indian cities. This paper consists of one of the disposal methods of MSW for Roorkee Metropolitan area. The population of Roorkee Metropolitan area is estimated for the year 2035 by the United Nations – World's Population Prospectus and then the waste generation is calculated from it. From the data, a compost plant is designed. For 2022, the total quantity of MSW is calculated as 135.66 tons/day and the average waste generation as 0.357 Kg/Capita/Day taking waste generation annual growth rate of 1.41% given by World Bank. For Composting plant, 60 numbers of aerobic windrows are found to be required.

KEYWORDS: MSW (Municipal Solid Waste), Composting, Compost Plant, Windrow

INTRODUCTION

The rapid development and urbanisation are the major reason of rapid increase of MSW generation, it leads to the growing issue of disposal of solid waste without hampering the environment and surrounding localities. In India, there is scarcity of suitable or safe Waste Treatment systems and disposal methods. Roorkee is a municipal corporation city of Uttarakhand of India spread over a flat terrain under Shivalik Hills of Himalayas. It is located at 29.87°N 77.88°E, has an average elevation of 268 m (879ft). As per provisional reports of census India, population of Roorkee Metropolitan area in 2011 is 238,422 and the plain region is spread over 129.88 Km². Although Roorkee Municipal Corporation takes care of cleanliness within the region but still lack an efficient disposal system of MSW and advanced technology of treatment of solid waste. Landfilling is the final method of treating Municipal Solid Waste (MSW) Management (CPCB, 2008). If the MSW is first composted and the residual after composting is disposed in sanitary landfill than it will reduce the environmental risk such as odour nuisance, fly nuisance and leachate problem etc.

OBJECTIVES

For the treatment of MSW, a composting system is designed for sustainable and healthier environment.

- Calculation of total solid waste generated for the Roorkee Metropolitan area for a period of 10 years span from 2022-2032.
- Design of a compost plant.

RESULTS AND DISCUSSIONS

According to United Nations – World Population Prospects, population of Roorkee Metropolitan area in 2022 is 380,000 with growth rate of 3.54% and estimated population for 2032 will be 490,000 with growth rate of 2.08%.

Roorkee block has 49 villages and each village generates 5-10 metric tonnes of garbage every day (ECON Laboratory & Consultancy, Dehradun 2019 Report). The MSW contains approximately 28-30% compostable waste (Adapted from EPA, Municipal Solid Waste, 2016). The per capita per day solid waste generation in Roorkee is 0.33 Kg (Alam & Kulkarni, 2016). The rate of waste generation is estimated to grow at an exponential rate of 1.41 percent per annum by the World Bank's Urban Development Section (East Asia and Pacific Region) (Verma 2010).

Table 1: Calculation of Population and Waste Generation

Year	Population	Waste Generation Rate (Kg/Capita/Day)	Total Waste Generation (Tons/Day)
2022	380000	0.357	135.660
2023	392000	0.362	141.904
2024	404000	0.367	148.268
2025	416000	0.372	154.752
2026	427000	0.377	160.979
2027	438000	0.382	167.316
2028	448000	0.387	173.376
2029	459000	0.392	179.928
2030	469000	0.397	186.193
2031	480000	0.402	192.960
2032	490000	0.407	199.430

Revenue from Compost Plant

Total waste generation = 135.660 tons/day

Total compostable waste = 40.70 tons/day

Assuming total compost = 50% of total volume of waste

Total compost = 20.35 tons/day

Price of compost in Roorkee = ₹3 per Kg/

So, total revenue from compost = ₹61050

Dimensions for the Windrow Composting

Volume required for composting = (total solid waste in Kg/density) = 1305.62 m³

Considering air circulation arrangement and taking windrow height = 2.7m

width = 3m Upper and 6m Lower

Length required for composting = Volume/(height/2) x (Upper width + Lower width)) = 12.15m

As composting takes 2 months, at least 60 numbers of windrows are needed.

CONCLUSIONS

At present scenario of MSW management in Roorkee, the MSW is collected from households and transported to dumped site. After that segregation has been done and remaining waste is disposed to a dumping area without any treatment. By adopting segregation methods and composting processes, the amount of waste dumped to dumping grounds is reduced. Moreover, a healthy environment is created by adopting these methods.

Proper segregation of Municipal Solid Waste should be done at generation level means at household level especially the organic matter should be kept separate for composting. After decomposition the organic matter can be used as fertilisers and a good

amount of revenue will be generated. This work or study can be continued for advanced techniques of Composting plants and also for Sanitary Landfill ideas.

REFERENCES

1. Manual on municipal solid waste management (2000). Ministry of urban development, Government of India.
2. Chandramouli, C., & General, R. (2011). Census of India 2011. Provisional Population Totals. New Delhi: Government of India.
3. United Nations – World Population Prospectus.
4. Environmental Protection Act (EPA), Municipal Solid Waste, 2016.
5. Central Pollution Control Board (CPCB), 2004. Management of Municipal Solid Waste. Ministry of Environment & Forests, New Delhi, India.
6. Rawat, S., and Daverey, A. (2018). Characterization of household solid waste and current status of municipal solid waste management in Rishikesh, Uttarakhand. *Environmental Engineering Research*, 23 (3), 323-329.
7. Econ Laboratory and Consultancy, Dehradun, Uttarakhand. Solid Waste Characterisation Report for “*Environmental Baseline Study of Municipal Solid Waste Dumpsite Roorkee, Uttarakhand*”.
8. Purbashree Sarmah, Troyee Tanu Datta, Sagar Sen & Rupali Sarmah, “*Design of a Combination of Compost Plant and Landfill for Municipal Solid Waste Management of Guwahati City*”. IJCSEIERD ISSN(E): 2249-7978 Vol. 5, Issue 4, Aug 2015, 45-52.

