MUNICIPAL SOLID WASTE GENERATION, CHARACTERIZATION, MICROBIAL ACTIVITY, VERMICOMPOSTING AND MANAGEMENT IN DINDIGUL TOWN

(Abstract)

Municipal solid waste (MSW) is a highly heterogeneous mass of unwanted materials and consists of kitchen wastes, market wastes, plant residues, hotel wastes, construction wastes, bio-medical wastes, commercial wastes, animal wastes and night soil. These wastes cause fly breeding, rodent menace, pig menace, transmission of pathogens, pollution, bad odour and unsightly appearance. Generally the MSW is disposed of merely by dumping in the dumping yard located inside or outside the municipal limits. In the present study a model of MSW management for Dindigul, a Class-1 Town in Tamil Nadu, India, has been worked out.

The three year study (2001-2004) was designed under five headings, i.e., waste generation pattern, characterization, evaluation of microbial activity, vermicomposting and management strategy. A preliminary survey carried out by direct count method showed that 69.3 t/d of MSW is generated by Dindigul Town, which is divided into 15 sanitary divisions for administrative purposes. This waste is generated by domestic (78.36 percent), commercial (3.61 percent) and mixed areas (18.03 percent). 74.91 percent of the waste is produced by the residential sector and 25.09 percent by the non-residential sector consisting of 37 wedding halls, 25 meeting halls, 52 big hotels, 163 small hotels, 10 vegetable markets, 3 mutton markets, 74 public toilets, 2 big hospitals, 46 small hospitals and 75 dispensaries/clinics.

The physical characterization of the MSW was carried out by segregation and hand sorting and the individual components identified were food wastes, paper, cardboard, plastics, glass, metals, rags, rubber, leather, plant residues, wood wastes, miscellaneous organics, construction wastes, ash and dirt. The procedure for standardization of the sub-sampling of the MSW was carried out by the reducing square method. Only the 6^{th} level of gradation, i.e., approximately 40.625 kg of MSW, contained all the representative components. The physico-chemical composition of the various components, randomly selected from the final square of sub-sampling, was analysed (n=15) and the results showed the presence of N, P and K of 0.72, 0.36 and

0.65 percent respectively and the C/N ratio was 53.97. The cellulose and lignin contents were also analysed. One year's collection and characterization of the bio-medical waste indicated the presence of 20.16 percent infectious materials.

The microbial activity in the MSW was evaluated by enumeration of the total colony forming units of microorganisms such as bacteria ($52X10^7$), fungi ($38X10^4$) and actinomycetes ($41X10^4$). The ligno-cellulolytic and the phosphate solubilizing ability of some of the fungal species present in the MSW sample were studied and the results showed the presence of 13 fungal species and, of them, eight showed cellulolytic property, five possessed lignolytic property and six carried phosphate solubilizing ability. An aeromicrobial survey carried out in the dumping yard showed that, with increase in the period of exposure, the number of colonies also increased for bacteria, fungi and actinomycetes and that, with increase in the distance, the number of colonies decreased. A microbial analysis of the leachate of the MSW, the ground water collected from the dumping yard and the ground water collected from a distance of 100 feet away from the dumping yard was also carried out.

Efforts were made to prepare vermicompost from the compostable organic materials using a native earthworm species newly reported in the Department of Biology, Gandhigram Rural Institute, Gandhigram, namely, *Perionyx ceylanensis,* and an exotic earthworm species, *Eisenia fetida.* The physico-chemical composition of the worm worked and the worm unworked MSW, i.e., pH, EC, organic carbon, total nitrogen, total phosphorus, potassium, sodium, calcium, copper, iron, cellulose and lignin, was estimated. Both the species were found suitable for vermicomposting the MSW.

The management strategy such as the energy expenditure from collection to dumping (7126.82 mJ/d), estimation of energy content (20287.85 kJ/kg), air required for composting (2565.20 m^3/t), combustion (2499.79 m^3/t) and methane production (759.46 m^3/t), recommended plan for collection of MSW, recommended sanitary manpower and recommended disposal methods were prepared.

Suitable suggestions are given in the thesis for collection, transportation, dumping, sorting, recycling and resource recovery from the MSW of a Class-I Town.