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A Study for Solid Waste Management Plan for ITI Campus, SVP, A&N Islands

Sample Model - suitable for small institutes at geographically isolated locations.

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Abstract : This study has been undertaken to propose the Solid Waste Management (SWM) plan for the Industrial Training Institute (ITI), Dollygunj,Sri Vijay Puram, Andaman and Nicobar (A&N) Islands. The campus consists of an academic building, quarters, hostels, and workshops where there are 24 quarters and 39 academic buildings consisting of workshops, classrooms, and laboratories. In this regard, a number of environmental issues are faced by the ITI campus, with solid waste disposal being one of them. The study envisaged environmental issues in ,ITI campus, related to solid waste to propose Solid Waste Management Plan and Disposal Methods.

Key words – Solid Waste Management, Waste Disposal, Biodegradable, Sustainability.

I. INTRODUCTION

The basic aim of Solid Waste Management (SWM) is to provide a comprehensive approach for the efficient, effective, and environmentally friendly handling of waste from the point of generation to disposal. The goal is to safeguard health, maintain cleanliness, and reduce adverse environmental impacts caused by the waste. SWM stresses reduction in waste production, waste segregation, reuse, and correct disposal practices. SWM also focuses on creating strategies that integrate community participation, sustainable usage of resources, and environmental protection awareness. By systematically collecting, segregation, transporting, treating, and disposing of waste, SWM helps create a cleaner and healthier environment for all.

2. BRIEF ABOUT STUDY AREA

The ITI campus at Port Blair is a major institution offering vocational training o students through various trades such as carpentry, mechanical engineering, electrical engineering, welding, etc. The institution has classrooms, workshops, hostels, and administration building. In the various types of solid waste that are generated in the campus include paper waste, plastic waste, metal waste, food waste, and garden waste. Hence, it becomes crucial to design an effective solid waste management strategy.

The major focus in the study carried out for proposing solid waste management in the ITI campus included assessment of waste generation, segregation, and waste collection methods. The waste generation process involves the creation of waste in classes, workshops, while the segregation process involves sorting the waste into two categories: biodegradable and non-biodegradable waste. The waste collection process involves collecting waste using color-coded containers across the entire campus and delivering it to a central storage facility before transferring it to the municipal authorities for final disposal

3.NEED OF THE STUDY.

In the ITI campus, proper solid waste management is essential for ensuring the maintenance of a clean environment, maintaining hygienic standards, and creating awareness among the trainees regarding the need to protect the environment. This helps in creating a conducive learning environment, promotes sustainable development goals in the institution and provides an opportunity for the learners to understand environmentally-friendly practices. Proper waste management in the college helps reduce pollution, health risks, and improve the image of the institution, poor waste management leads to unsanitary environments, bad smell, and spread of diseases. The institute produces skilled trainees who in turn works in various workshops and fabrication units where the environmental friendly practices and green habits will help them in creating more hygienic and effective work areas.

3.1 Waste Generation Assessment

The study was divided into two parts. The first part of this study was aimed at evaluating the present situation regarding the solid waste generation in the ITI campus. Therefore, it was necessary to identify, gather and analyze the data concerning waste sources, volumes and types. The waste generation assessment included the following

3.1.1.To identify the total number of buildings in the campus:: to conduct a careful assessment of the ITI campus and identify the exact number of buildings and details of occupants . The purpose of this activity is to map the whole territory and identify all facilities which generate waste.

3.1.2. To gather the demographic characteristics of the campus: The number of people/occupants in the campus was estimated, including students, teachers and other stuff and hostlers. These characteristics were to be used for estimating per capita waste generation rates in different parts of the campus.

3.1.3. To identify the number of sampling points: It was important to identify the sampling points for waste collection on the ITI campus. The samples were taken from places as hostels, canteens, laboratories and classrooms.

3.1.4. To collect the data about the amount of waste generated by different sampling points for 15 days: The waste generated daily by different sampling points were marked for collecting data every fortnightly to ensure the accurate quantity of waste.

3.1.5 To conduct statistical analysis of the gathered data and obtain waste generation rate and waste volume: Finally, the gathered data were analyzed and graphical comparison was made to find the average waste generation rate and amounts of various kinds of waste in the campus under study.

3.2 Implementing basic process for effective Solid Waste Management Plan

The second part of the study involved in developing and implementing an effective solid waste management system based on the data and insights obtained from par one. In this phase following activities were implemented;

3.2.1. Planning proper segregation of waste: Solid waste was separated at source into biodegradable, reusable, and hazardous components. These components were separately collected, treated through composting, reusing, or energy generation, and the residual waste alone was disposed of in sanitary landfill sites.

3.2.2. Integrated waste management plan for ITI campus: ITI campus plan involved creating a system for using waste paper by forming a paper recycle unit, creating a vermicomposting unit for converting biodegradable waste to compost and creating a biomass pellet unit for generating fuel from dry leave and bio waste collected from greenery and gardens.

3.2.3. Cost estimation and budget planning for waste management: Estimation covered the cost including setting up machinery, manpower, and maintenance for paper recycling plant, vermi-compost plant and biomass pellet plant. This guarantees effective budgeting for waste management and resource optimization within the ITI campus.

4. METHODOLOGY

The methodology used for managing solid waste involved identification of waste sources, collection of data through observations and documentation, and categorization of waste into biodegradable, non –biodegradable and recyclable waste types. This was initiated with the study of the current practices of collection, segregation and disposal of waste. The effluent samples were collected from various sources and their weights measured based on the nature of the solid waste generated. Sampling points included academic buildings, hostels, residential quarters, and workshops. The samples of the waste were observed to be segregated at the collection point. The types of solid waste included organic waste, paper waste, plastic waste, etc.

4.1. Quantitative Sampling and Statistics

The present solid waste management practices at the study area was nominal as segregation and disposal required effective monitoring. The sample quantities collected fortnightly (as given in table 3.1) indicated the points where maximum attention and monitoring was required. It revealed that solid waste is mainly generated from classroom areas, workshops, hostels, and canteens. Segregation at source was not effectively practiced; hence, biodegradable and non-biodegradable waste is sometimes mixed. Collection and transportation of solid waste within the campus is undertaken by staff members at the institution.

Table 3.1- Total Waste generated in ITI campus in 15 days(in Kg)

Point of sampling	Quantity collected in Kg
Boys hostel	100
Girls hostel	21.5
Academic	23.8
Quarter	71.8
Workshop	148
Garden waste	180.5
TOTAL (in kg)	**545.6**

The percentage of waste contribution of various areas for the fortnight sampling (shown in Figure 3.1) indicated that garden waste is in huge quantity which could be re-cycled and processed for further manure preparation or for pellet production. Thus , the continuous sampling for every fortnight for three months revealed the pattern of waste produced in the study area. The above collection process is not including the e-waste as for the entire A&N Islands the e-waste disposal is carried out through appropriate vendors.

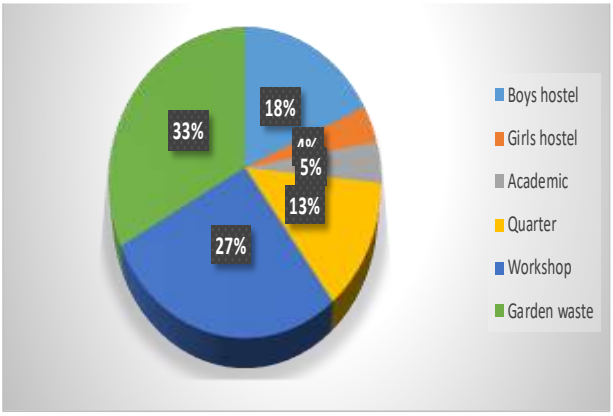

Figure 3.1- Total waste generated in ITI campus in a fortnight

Therefore, the total waste generated per day was also analyzed to assess the quantity (as given in Table 3.2) and volume for the proposed SWM plan.

Table 3.2- Total Waste generated per day in ITI campus

Total Waste Generated in ITI Campus	Hostels	Classes	Quarters	Workshops	Total Waste (in Kg)
Total plastic waste generated in ITI campus per day	0.835	0.31	0.5	-	**1.64**
Total paper waste generated in ITI campus per day	0.645	0.54	0.445	-	**1.63**
Total organic waste generated in ITI campus per day	6.78	-	4.331	-	**11.11**
Total metal waste generated in ITI campus per day	-	-	-	10.175	**10.17**
Total wood waste generated in ITI campus per day	-	0.08	-	0.88	**0.96**
Total cloth waste generated in ITI campus per day	-	0.7	-	-	**0.7**
Total copper wire waste generated in ITI campus per day	-	-	-	1.065	**1.06**
Total sanitary of girls hostel waste generated in ITI campus per day	0.6	-	-	-	**0.6**
Total garden waste generated in ITI campus per day					**15**
Grand Total					**42.88**

The graphical representation of categorized waste generated per day in the study area is given in Figure 3.2

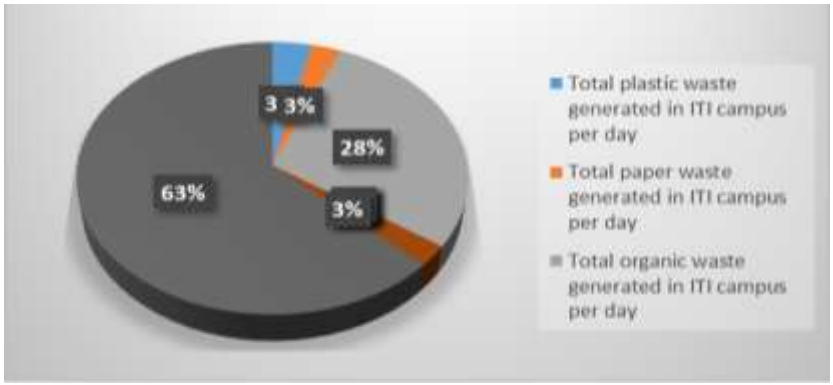

Figure 3.2- Total waste generated per day in ITI campus

4.2 Proposed Effective Solutions

The primary and secondary data collected from the study area lead to the following solutions

4.2.1. Installation of Paper Recycling Unit

The paper re-cycling unit will reduces costs through recycling of waste paper. Further, it will reduce the need to purchase new paper and will produce useful items (folders, papers, notebooks) to be used in the institution for academic and official purpose. The unit will inculcate environmental friendly skills in the trainees and the estate office of the institute can also earn capital money from the recycled products and getting raw –used paper from nearby offices and establishments.

The benefits of paper re-cycling includes decrease in deforestation (thus protecting trees) and related environmental pollution. It conserves energy and water required for manufacturing paper and thereafter lessens waste dumped in landfills. The process encourages sustainability and eco-friendliness. The products from recycled paper can be re-used for making newspaper, notebook, package paper, cardboard and carton etc. It can also be used for manufacturing of tissue paper and paper board for local tourism industry in the Islands.

4.2.2. Effective usage of bio waste through vermicomposting plant

The vermicomposting plant recycles organic material to create useful compost which is very cost-effective waste disposal method. Organic fertilizer produced through this composting plant can be re-used for gardens and can also be sold in local market to ear revenue. The compost also increases soil fertility so it can be an easy attractions for kitchen garden and farming people. This will address the problem of solid waste in landfills and will give cleaner product by creating ecological organic manure which enhances soil quality and crop production. This also leads to reduction in usage of chemical fertilizers on the college premises. Such green practices will give learning opportunities & skill development for students and inhabitants.

4.2.3 Installation of Biomass Pellet Producing unit

The garden waste being the highest in volume amongst all the solid waste lead to this solution of proposing the easily operational and installable Pellet producing unit for the campus. It will transforms waste (leaves, wood shaving, agro-residue) into productive fuel and will solve waste management issues. Thus, contributes to savings (serves as fuel for heating/food preparation) in boilers and kitchen units of hotels for tandoor and such application where fuel is required. The institute can generate revenue through pellet sales and this new solution in the Islands will offers hands-on experience and skill acquisition for the users. The other benefits of the Pellet production unit includes harnessing renewable energy, minimizing reliance on non-renewable resources, producing less pollution than coal/fuel wood, it aids in the management of agricultural and organic waste and promotes sustainable development.

5 RESULTS AND DISCUSSION

A Solid Management Plan has been designed for the ITI campus based on waste generation information for different areas in the campus like hostels, academic building, residential area, workshop, and gardens. Different methods have been devised for segregating wastes into biodegradable, recyclable, and hazardous categories. Three sustainable systems were suggested for the study area under this project include Paper Recycling systems for the recycling of paper waste, Vermi-composting System to make compost from organic wastes and Biomass Pelletization system to generate energy from garden waste. Standard Operating Procedures (SOP), as shown in Figure 5.1 (a) and (b), layout plans, and budgetary estimations were made for all three systems.

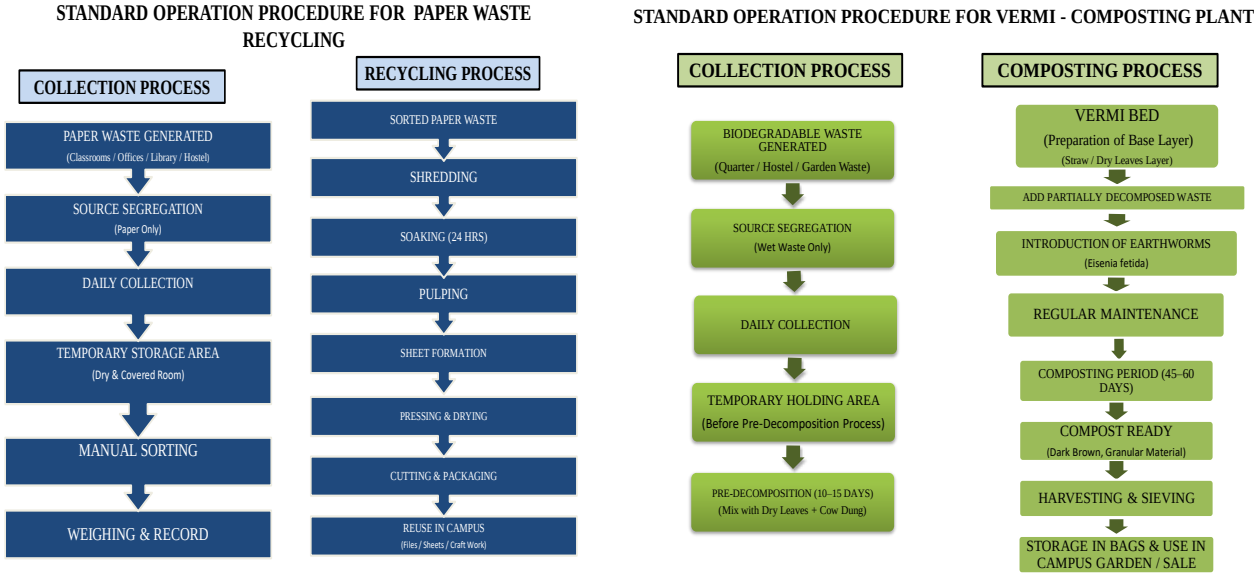

Figure 5.1(a) - SOP for paper recycling plant and vermin-composting plant

STANDARD OPERATION PROCEDURE FOR BIOMASS PELLETS

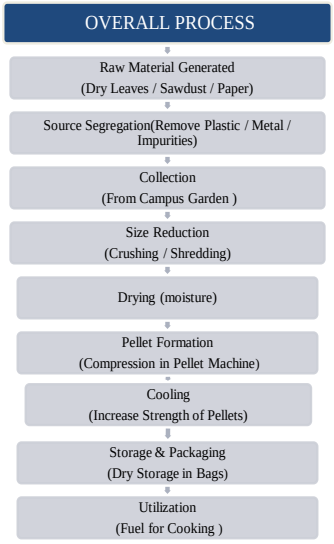

Figure 5.1(b) - SOP for Bio-mass pellet producing plant

5.1 Conclusion

Thus, the waste management plan will not only ensure environmental protection but will also ensure sustainability, as waste would be reused, recycled, or used for other productive purposes, such as compost and fuel. This would minimize the impact of waste on the environment. The plan assists in reducing pollution, conserving natural resources, and decreasing landfill problems, which will result in a healthier environment. However, not only do environmental benefits accrue from the plan, but economic benefits as well since the cost of waste disposal is decreased, income generated, and job creation. The social benefits include improved public health and increased public participation and awareness.

II. ACKNOWLEDGMENT

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