

Piranha Model Solid Waste Management - A Scalable Decentralised Waste Management Solution from Kerala

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ABSTRACT

Solid Waste Management is a wide range of Problematic Concern all over the world. Unwarranted or open dumping of waste causes serious effects in Urban Atmosphere, health hazards to public and thus leads to Environmental Pollution. Citizens in Trivandrum city is facing such problems nowadays, due to the open dumping of solid waste. Based on this Aspects Piranha model of Waste Management took initial steps to avoid the crucial crisis faced by solid waste in Trivandrum City which includes the collection, transportation, segregation and processing of bio and non bio waste. This study discloses a correct mechanism within the city to treat solid waste generated and ends up in the proper development.

Key words: Solid waste management, Urban atmosphere, Environmental pollution

Introduction

Garbage Collection and Management constitutes the assortment, transport, refining and land filling of waste materials (Cal Recovery, Inc., (2005). Management involves using three states of matter with totally different strategies and fields of experience (Cointreau, 2001). The main source of municipal solid waste includes waste generated by Residential, Economic, Institutional areas etc. The household waste which includes the bio and non bio waste will be increased in quantity and it can be varied in different seasons waste like metals, plastics, E- waste are increasing day by day rather than the bio waste The Modern society is interested in prepackaged

foods, dumping of plastic packages increases and thereby, developing countries like India suffer a lot to manage the waste. In urban areas the extra legal marketing could be a major disadvantage which causes great issues in human life and values. Additionally, it imposes a major economic burden on authorities responsible for developing these open waste disposal sites. Less awareness of assortment and disposal May lead to attract the pets, animals and other pathogens and can cause transmitting diseases to the society is also a drawback. Rural areas have comparatively less solid waste, due to less per capita generation than urban areas (Giusti L, (2009; Guerrero *et al.*, 2013).

Materials and Methods

Study Area

The study was conducted in ten wards of Trivandrum Corporation. Which includes Pangode, Kadakampally, Anamugham, Aranoor, Palayam, Pojappura, Thirumara, Mudavanmugal, Thrikkannapuram, Punnakkamughal. Due to Urbanization, the amount of waste generated in Trivandrum City is increased all over and thus leads to the unwarranted or indiscriminate dumping.

Implementation of Piranha Model of Solid Waste Management

After the effective observation of health impacts and survey of open dumping of waste in these selected places in the Trivandrum city. The foremost economical technological thoughts are identified and corrected with the assistance of Solid Waste Management rules of 2016 with V care Environmental solutions, a Bangalore based firm that manages the garbage disposal.

Collection of Waste

The kudumbasree workers are deployed to ensure the operation of the units. Waste is collected from the residence associations by the entrepreneurs who act as a piranha in this logistic operation. Waste collection was first done in Jawahar nagar. Initially, they collected waste from 150 residences and within 90 days it spread out to 7000 residents within the city.

Logistic Transportation

Collected waste is gathered into a common garbage point. Waste is collected in the logistic manner and transported to the different business units by logistic wings. 50 liter bins are used for the transportation of bio waste within 60 km and these get transported to the site by a collection vehicle. The vehicle contains air tight containers, collecting tanks, etc. for eminent transportation.

Non bio waste collection is done in 100 kg sacks and these wastes are collected by the waste collection vehicle and transported to segregation sites. The collection vehicle is connected to the GPS system. Both arrival and departure time of the vehicle can be analyzed by the customer through this centralized system. Hence quality control is assured.

Processing of Bio waste

The bio waste that is transported to the business units beneath goes varied process strategies that embody the windrow composting. The method of windrow composting is conducted in an open slender in which the bio waste is re-rotated and agitated everyday in order to get a good output. Then the feed stock and bio waste are added into of 1.5 m height array with a couple of dimensions in 1:50 magnitude relation and mixed with wood. Compost should be turned three times a week in order to get proper aeration, growth of microorganism. Turning Frequency plays a major role in Windrow Composting. The last procedure is screening of Compost which is done in order to remove the metal contaminants and plastics. And oversized substances are identified and cleared accordingly. The other technique is horticomposting. Which includes 2 ft breath 4ft height 3ft depth pit is made and about 350 kg of biowaste is deposited within 400 sq.ft yard. Which is then monitored by geomark software and bacteria is introduced into it for the proper composting and the bio compost is ready within 6 months

Other Techniques

Mini Incinerator

There are small-scale Mini incinerators that is helpful technology, and can be used in the rainy season to combust home waste (especially baby diapers and napkins), Hospital waste, and Animal waste, etc. rather than disposing into an exceedingly lowland. Mini incineration can be applied as an energy recovery machine and thereby, reducing the health impacts caused by the open dumping of solid waste. Waste obtained can be separated to attain the organics and the ashes obtained in the process may contain harmful metals and it should be disposed in an economical way

Biowaste as a feed for Cattle, Poultry, and Larvae

The waste generated from the residential areas and hotel industries is a huge Task. Due to Atmospheric Pollution also the expensive costs for the disposal of waste, there should be an adequate place for the storage of waste material for safe disposal. Thus we collect 60% of biowaste food scraps directly from hotels and take them to the farm, which is a basic free of cost method. Biowaste is arranged, ground

and processed to feed the pigs, and about 10% of biowaste is used to feed open-air chicken farms. Personals handling the waste area units strictly follow the hygiene rules and are often supervised. This Method of reduction of bio waste is common technique and eco friendly too. Both farm and hotel industries get huge benefit from it. The other form of method is conversion of bio waste by the help of insect larvae called Black Soldier Fly (BSF), *Hermetia illucens*, it is widely used method, in which larvae are allowed to feed on bio waste in order to reduce it. At the end, the larvae are harvested and refined and the waste residue is processed as suitable animal feed thus, converting the bio waste in to an economical feed (Fig. 1).

Segregation of Non Bio Waste

It solves the city's drawback of waste management. The correct segregation of waste results in a "circular economy" by reducing consumption of virgin resources and promoting investments and innovations. Mostly, the segregation of non-bio waste is done at the source itself. Even the leftover food items are removed by the kudumbasree workers who act as volunteers segregate the non-bio waste into 18 categories. And these differentiated packages will be moved to the forwarding links.

Processing of Non Bio Waste

Major non biodegradable waste includes Plastics, which are light-weight. The plastic processing involves aggregation, sorting, shredding. Sorting of plastic waste is done manually to remove all the contaminants square measure off from the plastic

waste stream. Before cutting the plastics it should be properly shredded and cut it three to four pieces and put it into the device for further cutting. Different types of machines are used for cutting rigid and skinny film plastics. Horizontal cutting device is used for cutting the rigid ones only. The sizes of cut plastics square measure form five to ten metric linear units. Cut plastics square measure will be aggregated into a luggage and it is recovered and cramped. The cut plastics might endure additional laundry to confirm cleanliness, particularly because the cut items square measure additional simply clean once they square measure in little sizes than in massive ones. In the case of glass waste material, quite an expensive method with high transportation charge, it is collected once in a week from the city residents and forwarded to the retailers.

E-waste is a growing stream which is widely increasing all over, several customers are still unsure of the way to safely eliminate old computers, smart phones or different electronic devices. E-waste is collected from the city residents through a special drive and handed over to the Clean Kerala Company for further processing.

Quality Control System

The quality assurance (QA) is a method that intended to produce the mandatory confidence that adequate measures area unit is being taken to ensure that a facility or method is constructed and operated in an exceeding method of efficient quality management system that fulfills the customer satisfaction though, the quality assurance is the most relevant part, there is a digital platform, an mobile app

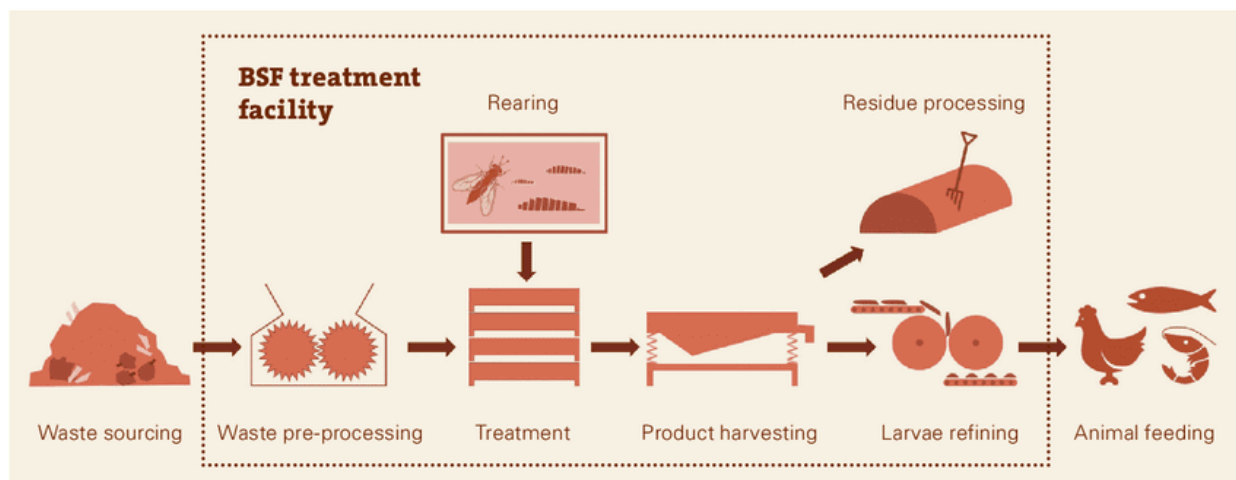


Fig. 1. BSF Treatment System (Source: Zurbrugg C etal. (2017))

for customers as well as the employers for the effective functioning of the piranha model of waste management system. In which the customer has to login the app and give instructions. These instructions are analyzed by the employees and they assign the operations and update it. If any dissatisfaction occurs from the customers it can be cleared by the Risk management team. Since 9 years the customer satisfaction level is always above 80%, and it is managed in such a manner and also the customers have a feedback system for improving the system [Table chart: 1]

Results and Discussion

Piranha model waste management unit additionally create healthy environment, in which the unwarranted wastes area unit are clearly supervised. From the source to end they attain hundred percentage of quality assurance and some extent merit and correct safety measures are taken into account of suitable waste management techniques. Piranha model of waste management is often the most effective way in which, cutting down of trees principally finished the assembly of paper. In this technique we are able

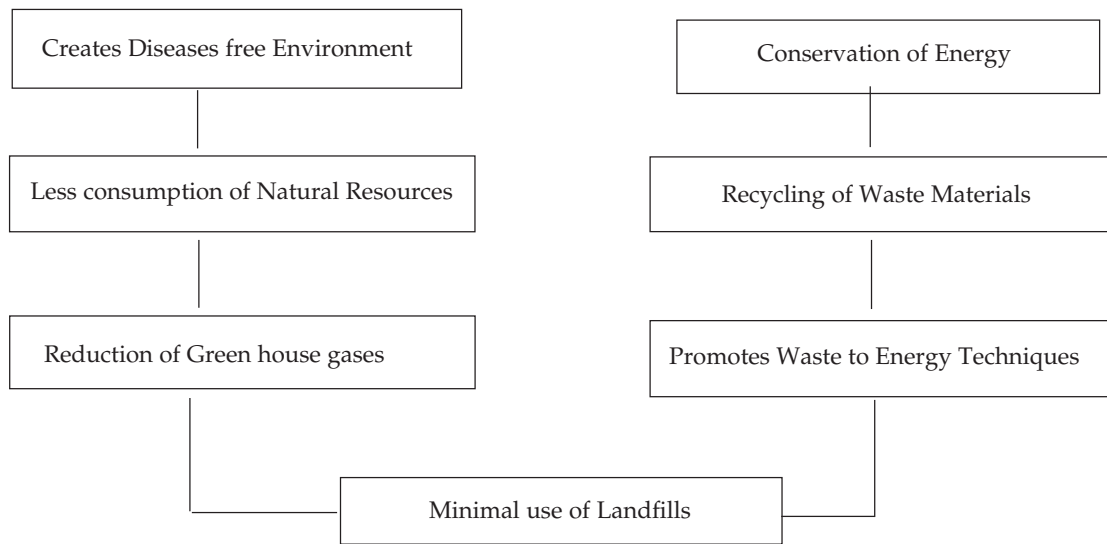


Table chart 1. Benefits of Piranha Model of Waste Management

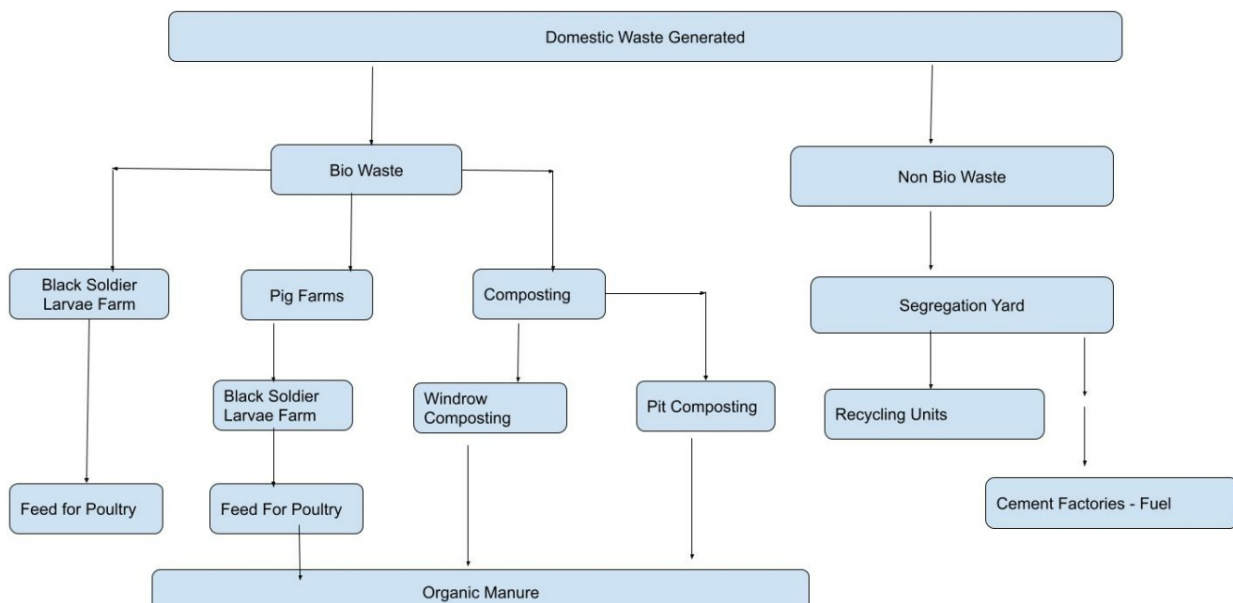


Fig. 2. Flowchart describes the domestic waste processing in piranha model of waste management

to conserve energy with the help of employees and achieve sustainability. By this technology the old papers are recycled, and quality ones are obtained economically and thus reducing the emission of green house gases like carbon dioxide and methane. From the source to the end process of solid waste management the need or quality of labor is very important it should be in an available form, especially in the segregation sector. The kudumbasree workers act as a green technicians (entrepreneurs), logistic departments, drivers who transport the waste materials, software technicians, software tracking staffs, composting units, farm business units, recycling units employers, billing unit of cement factories, supporting staffs, management staffs, financial teams, all these teams constitute the piranha model of waste management. Techniques like mini incinerator, V composter, windrow composting, BSF Composting used in the piranha model of solid waste management will be highly applicable to the people in Trivandrum city. It is a troublesome task to manage the solid waste in developing countries due to the lack of infrastructure and financial instability. To make the sector viable private sector should take initiative and solve the problem and also by implementing environmental protection rights and also policy making reduce the solid waste management problem to a great extent. The byproducts or residue formed after each process should be converted to energy which leads to circular economy thus, promote green energy which reduces the landfill disposal and health impacts to the future society (Fig. 2).

Conclusion

The study encloses the implementation of Piranha Model of solid waste management in Trivandrum Corporation. And analyze the effectiveness of the system and categorize the challenges addressed and the way in which it will be re-corrected. Closing note of the study it has been analyzed that by implement-

ing Piranha Model of solid waste management by V Care Environmental Solutions includes several employees, with special tasks looks to be concluding their duties effectively on time, with reduction of corruption, updated technology, better-trained workers, a lot of hands, gives augmented education and awareness to the customers. Due to the increased population urban Economy waste generation will be a immensely high and thereby, plastic handling can cause destruction in land areas, interference avoidance rule and Animal health hazards. So by implementing the piranha model to a great spread gives a sustainable economy in the future.

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