

SOLID WASTE MANAGEMENT AND DISPOSAL PLANT DESIGN FOR A PLASTIC INDUSTRY

Chinchu k george¹, prof.Chinnamma²

*Malabar College of Engineering and Technology, Kerala Technology University,
Thrissur(Dist),Kerala,India*

Abstract

India has witnessed a substantial growth in the production of plastics and an increased consumption of plastic. In the absence of adequate waste collection and segregation process, the management of the waste created by discarded used plastics items, especially ones used for packaging applications has become a challenging task. My project provides an overview of the resource recovery from plastic waste with consideration of integrated waste management (IWM), to evaluate the best possible option for tackling waste in Indian circumstances. Solid and liquid wastes generated from plastic industries can significantly impair drinking, irrigation, recreational water and other water sources in rural and urban areas. Waste as a management issue has been evident for over four millennia. Disposal of waste to the biosphere has given way to thinking about, and trying to implement, an integrated waste management approach. This paper reviews the best recycling of plastic and design of disposal plant. Various problems of wastes in past and present, environmental ecology, general aspect of recycling and materials recovery are defined. . Different types of automated sorting systems on the market that employ some kind of detection signal and sensor to detect and analyze chemical or physical characteristics of different plastics. The preliminary survey done in Hycount plastic & chemicals Killikolloor, Kollam shows poor disposal methods of plastics which can result into environmental pollution. In order to reduce the pollution, there is a need of disposal plant which can reduce a quantity of solid produced by the industry. The best method which can be used for disposing the solid waste in plastic Industries is to recycle it and convert it into usable form. Plastics can be grinded into powdered form and can be used for road construction by adding bitumen and other components which make it long lasting. A

possible method to dispose plastics is to convert it into powdered form and used in the construction work. Its ca be used for interlock work due to its long-lasting property, durability and flexibility. A suitable flowchart of solid waste sorting process is created for the design of solid waste disposal plant. Separation process in disposal plant design is represented.

Index Term-waste management,waste recover,iwm,recovery anaerobic digestion.

1.INTRODUCTION

Environmental degradation with accompanying threats to health and disruption of ecosystem is not a new phenomenon. Nevertheless, with the advent of industrial revolution and large-scale adoption of technology, man now diverts vast amount of energy and materials flowing through the natural ecosystems to his own use. At present, there are about 30,000 units throughout the country engaged in the manufacture of various plastic products. These units manufacture a variety of items both for consumption and industrial use. About 120 units of plastic industries are functioning in Kerala. Among that I have chosen Hycount plastics and Chemicals industry, Killikolloor, Kollam as my reference which is a manufacturer of PVC pipes for potable water. At present Hycount has an installed capacity over 9000 tons per annum. Industries constitute a formidable source of pollution with large quantities of waste products in the form of solids liquids, gases, heat, noise etc. Which are discharged into the environment. Many of these pollution problems are inherent in the technology and a considerable amount of research and developmental efforts are needed to overcome these drawback Industrial research should not be limited only to the development of materials, methodologies and their management but it should also include

investigation on the effective methods of waste disposal, more so, recycling of waste for productive purposes., The reasoning is quite simple – recycling will not only be cost effective, butal so will reduce to a considerable extent contamination to our environment-pollution of air, water and land, three modern aspects with which every one is most concern. Plastic products have become an integral part in our daily life as a basic need. It produced on a massive scale worldwide and its production crosses the 150 million tons per year globally Plastics are non-biodegradable and remains on earth for thousands of years. The burning of plastics waste under uncontrolled conditions lead to generation of different hazardous air pollutants (HAPs), depending upon the type of polymers and additives used Nature has witnessed a considerable intensification in the production of plastics in last few decades and simultaneous increased consumption of plastic materials. With time, stability and durability of plastics have been improved continuously, and hence these groups of materials are now considered as a synonym for materials being resistant to many environmental constraints. Plastics can be formed into any products and this leads to problem in collection, separation and recycling.

II.MATERIALS AND METHODS

1.Recycling methods

Recycling is the combination of several technologies that are carried out on waste plastics to produce secondary raw materials Although recycling has a long-lasting history, it has only recently that environmental concerns and waste management issues are considered due to gradual increase in public awareness. Nearly, all the waste materials found in a common MSW are well capable to undergo recycling process with a variable extent of efficiencies. Recovery of secondary raw materials through recycling and composting is given the highest priority in the solid management hierarchy after source reduction and reuse.

1. collection

Tons and tons of scrap plastic are collected and sent to a collecting yard where they are then packed and transported to plastic processing

plants. Unfortunately, not all countries have the capacity to recycle plastics.

2.Sorting

There are specially designed machines that help in sorting of the plastics according to their resin content. Then the recycling mill sorts the scrap plastic by symbols at the bottom of the plastics.

3. shredding

After sorting the plastics, the next step is to cut the plastics into tiny chunks or pieces. Plastic pulverizers are employed to grind the plastic bottles and containers into tiny pieces or flakes. The heavier and lighter plastic flakes are separated using a specially designed machine.

4.Cleaning

After a complete separation, the flakes or chunks are then washed with detergents to remove the remaining contamination. Once the cleaning process is complete, the clean flakes are passed through specialized equipment that further separates the plastic resin types

5.melting

The dry flakes are melted down. They can be melted down and molded into a new shape or they are melted down and processed into granules. The melting process is done under regulated temperatures

2.RECENT TECHNOLOGIES FOR DISPOSING PLASTICS

1.Polymer Blended Bitumen Road: The process of road laying using waste plastics is designed and the technique is being implemented successfully for the construction of flexible roads at various places in India

2. Co-processing of Plastic waste in Cement

Kiln: Plastic waste generated from different cities and towns is a part of municipal solid waste (MSW). It is a matter of concern that disposal of plastic waste is causing many problems such as leaching impact on land and ground water, choking of drains, making land infertile, indiscriminate burning causing environmental hazarded. Plastic waste, being non-biodegradable, is littered in most of the

cities/towns and their-by giving an ugly appearance.

3.Co-processing of plastic waste as an Alternative Fuel and Raw Material (AFR):

Coprocessing refers to the utilization of waste materials in industry process such as cement,Production of lime or steel and power stations or any other large combustion plants. Co-processing shows replacement of primary fuel and raw material by waste recovering industry and material from waste. Waste materials, for instance, plastic waste used for co-processing are referred to as alternative fuels and raw material (AFR). Co-processing of plastic waste suggests advantages for cement industry as well as for the Municipal Authorities responsible for waste management. In other hand, cement producers can save fossil fuel and raw material consumption, contributing the more eco-efficient production. In addition, one of the advantages of recovery method used in existing facility would be, eradicating the need to invest on other plastic waste practices and to secure land filling.

4.Co-processing of Plastic waste in Cement

Kiln: One of the most effective methods of recycling of plastics waste for recovery of energy is its use as an alternative fuel in cement kilns. Apart from recycling of plastic for making new products and saving energy, there are also projects which aim to turn plastic into new energy sources. Plastic is prepared from crude oil, which is the same raw material from which fuel is made. Thus, some scientists have made it their goal to turn waste plastic back to crude oil so that it can be reused for powering engines. With the help of this method, waste plastic is not only put to actual use, but it also helps to save the scarce crude oil resources left on earth. The high temperature used in the cement kilns gives a scope for use of even some type of plastic waste contaminated with toxic chemicals like pesticides and some other hazardous materials without creating any increased emissions in the air or water. No segregation or cleaning is required for such type of disposal.

3.METHODOLOGY

1.SOLID WASTE SEPERATION, SORTING PROCESS IN A DISPOSAL PLANT

Waste sorting is the process by which waste is separated into different elements. Waste sorting can occur manually at the household

and collected through curbside collection schemes, or automatically separated in materials recovery facilities or treatment systems. Hand sorting was the first method used in the history of waste sorting. Waste can also be sorted in a site. "Waste segregation" means dividing waste into dry and wet. Dry waste includes wood and related products, metals and glass. Wet waste typically refers to organic waste usually generated by eating establishments and are heavy in weight due to dampness. Waste can also be segregated on the basis of being biodegradable or non-biodegradable. Landfills are an increasingly pressing problem Less and less land is available to deposit refuse, but the volume of waste is growing. As a result, segregating waste is not just of environmental importance, but also of economic concern. Waste is collected at its source in each area and separated. The way that waste is sorted must reflect local disposal systems. The following categories are common Paper, Cardboard (including packaging for return to suppliers ,Glass (clear, tinted – no light bulbs or window panes, which belong with residual waste),Plastics, Textiles, Wood, leather, rubber metal, Compost ,Special/waste, Residual Organic waste can also be segregated for disposal: Leftover food which has had any contact with meat can be collected separately to prevent the spread of bacteria. Meat and bone can be retrieved by bodies responsible for animal waste. If other leftovers are sent, for example, to local farmers, they can be sterilized before being fed to the animals. Peels and scrapings from fruit and vegetables can be composted along with other degradable matter. Other waste can be included for composting, such as cut flowers, corks, coffee grounds, rotting fruit, tea bags, eggshells and nutshells, and paper towels

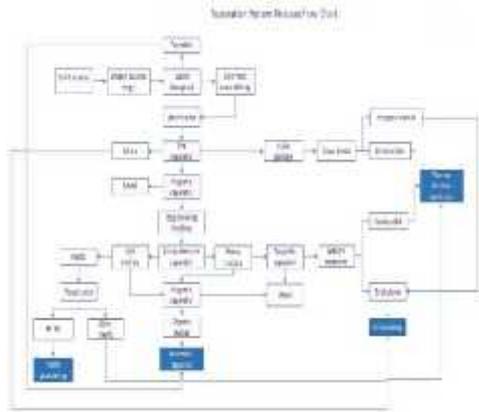


Fig1: Flow chart of solid waste separation process

2.MUNICIPAL SOLID WASTE

Municipal solid waste (MSW) commonly known as trash or garbage in the united states and rubbish in Britain,is a type consisting of everyday items that are discarded by the public."Garbage" can also refer specifically to food waste,as in a garbage disposal;the two are sometimes collected separately.



Fig 2 Municipal Solid Waste

3.SOLID WASTE MANAGEMENT IN THIRUVANTHAPURAM CITY

The study conducted at Thiruvananthapuram City Corporation shows that a total of 290-300 tonnes of solid waste are generated per day from various sources. The sample survey conducted at 50 wards showed that among these 300 tonnes, 181 tonnes of solid waste are from households. The waste generated by shops and commercial establishments comes to about 13-15 tonnes per day. The study also revealed that about 55% of shops and other establishments recover most of the recyclable materials from the waste before final disposal. The hotels and restaurants generate about 30 tonnes of degradable waste per day while

markets produce about 40 tonnes of waste per day

CLASSIFICATIONS	QUANTITY(tpd)
City co-operation	280-350
Large municipalities, towns	60-100
Small municipalities	5-15
panchayat	2-5
Trickling filter	Diameter 70m, 2m
Disinfection tank	1.3mx1mx1m

4. WASTE MANAGEMENT SYSTEM IN THIRUVANANTHAPURAM CITY

Thiruvananthapuram is the first Corporation of Kerala State, though now several have been added. It has a naturally undulated geographical feature and has highly urbanised spots on a serenely rural base. Once upon a time called the Cleanest City in India, Thiruvananthapuram is striving hard to emulate other cities in dirtiness. The blame squarely lies with the people, the authorities both political and official, the workers and the citizens themselves. Thiruvananthapuram City Corporation, which had only 50 wards with an area of 74 Sq.km, has been expanded by including all the contiguous Panchayats and now has 81 wards with 141.74 Sq.km area. Consequent to the increase in the area, the population under it, has increased, and along with that the responsibilities of the Corporation authorities and the expectation of the citizens. In earlier days, small quantities of solid waste used to be collected in bullock carts and now huge lorries carrying a minimum of 4 tonnes are needed for transporting solid wastes. With nook and corners of the City occupied for residential and business purposes such places are essential by the public. The installation of a solid waste processing plant at Vilappilsala is a commendable move and a great achievement. Collection of solid waste from Dumper Placer Container (DPC), transporting them to transit points and hence transporting to the processing plant is a major task. The waste collected from different streets are brought together and dumped along with the immense quantity of solid waste generated in four main markets in Thiruvananthapuram City, like Manacaud, Chalai, Palayam and Peroorkada.

5.various separation process outcomes

Organic waste is material that is biodegradable and comes from either a plant or an animal. Organic waste is usually broken down by other organisms over time and may also be referred to as wet waste. Most of the time, it is made up of vegetable and fruit debris, paper, bones, and

human waste which quickly disintegrate. Organic materials found in municipal solid waste include food, paper, wood, sewage sludge, and yard waste. Because of recent shortages in landfill capacity, the number of municipal composting sites for yard wastes is increasing across the country, as is the number of citizens who compost yard wastes in their backyards.



Fig 3: Ways of Processing Organic Waste

III. RESULTS AND DISCUSSION

1.PRELIMINARY SURVEY RESULTS OF HYCOUNT PLASTICS AND CHEMICALS

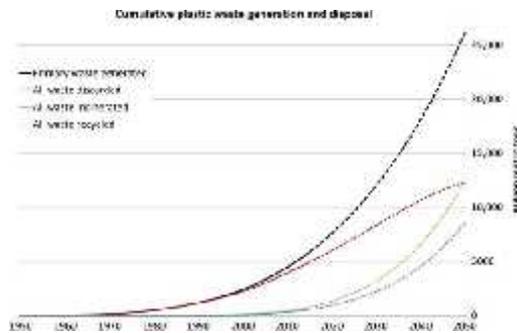


Fig: 4 plastic waste generation from the year 1950 to 2050

2. PRELIMINARY DETAILS OF VARIOUS SECTORS IN INDIA

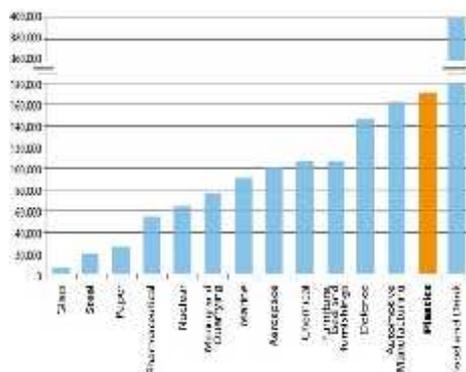


Fig 5: Approximate Direct Employment in Various Manufacturing Sectors In INDIA

3.Comparitive Study Manual Separation Versus Disposal Plant Seperation

Material	MANUAL SEPERATION (kg/hrs/sorter)	DISPOSAL PLANT SEPERATION
Newspaper	700-4500	4500-5000
Corrugated	700-4500	4500-5000
Glass containers	400-800	500-1000
Glass containers (colour)	200-400	400-600
Plastic container	140-280	250-320
Aluminium cans	45-55	75-95
Working hours	2-3(days)	20hrs

1V CONCLUSION

Plastics which have wide application in day to day human life generate large amount of waste, which is a serious environmental problem. In the case of solid wastes including plastics, significant progress has been made in reducing waste and increasing the quantities being recycled the sorting of plastics is very crucial in plastic recycling for energy recovery since separated resins have higher values and are preferred by most re claimers. Manual sorting is very laborious and human error is considerable. Nowadays there are many different types of automated sorting systems on the market that employ some kind of detection signal and sensor to detect and analyze chemical or physical characteristics of different plastics the preliminary survey done in Hycount plastic & chemicals Killikollloor, Kollam shows poor disposal methods of plastics which can result into environmental pollution. In order to reduce the pollution, there is a need of disposal plant which can reduce a quantity of solid produced by the industry. The best method which can be used for disposing the solid waste in plastic Industries is to recycle it and convert it into usable form. Plastics can be grinded into powdered form and can be used for road

construction by adding bitumen and other components which make it long lasting. A possible method to dispose plastics is to convert it into powdered form and used in the construction work. It can be used for interlock work due to its long-lasting property, durability and flexibility. A suitable flowchart of solid waste sorting process is created for the design of solid waste disposal plant. Separation process in disposal plant design is represented through schematic representation. Municipal waste was collected from the cooperation of Thiruvananthapuram city. After all the case study and work oriented process from which collected data samples helps to design the disposal plant and the machineries, calculating the efficiency of it. All though the average expenditure of the disposal plant is set up on it from these research survey and data collection makes our disposal plant to initiate the process work successfully in all methods.

Chinchu k George received B.tech degree in civil engineering from Younus college of engineering and technology, in 2016 and currently pursuing M.tech environmental engineering from Malabar College of Engineering and Technology

REFERENCES

- [1] **Shah, A.A., Hasan, F., Hameed, A, Andahmed, S.** (2007). Isolation and characterization Of Poly (3-Hydroxybutyrate-Co-3-Hydroxyvalerate) Degrading Bacteria and Purification of PHBV De polymerase From Newly Isolated BacillusSp.
- [2] **Achilias, D.S., Roupakias, C., Megalokonomos, P.** (2007). Chemical Recycling of Plastics Wastes Made from Polyethylene (LDPE and HDPE) And Polypropylene (PP). Journal of Hazardous Materials.
- [3] **Gupta, S., Mohan, K., Prasad, R., Gupta, S., And Kansal, A.** (1998). Solid Waste Management in India: Options and Opportunities. Resources, Conservation and Recycling
- [4] **Giugliano, M., Grosso, M., Andrigamonti, L.** (2008). Energy recovery from municipal Waste: A Case Study for A Middle-Sized Italian District. Waste Management.
- [5] **Berrueco, C., Mastral, J.F. & Ceamanos, J.** (2007) Modelling of the pyrolysis of high-density polyethylene: product distribution in a fluidized bed reactor. Journal of Analytical and Applied Pyrolysis,
- (6) **Finnveden G (2011):** Plastic waste as a fuel: CO₂ neutral or not.