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WASTE DRYING MACHINE

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Abstract - The second largest populated country in the world, INDIA faces various hindrances to its development. Waste management is of critical concern and needs attention. The current waste management practice in INDIA involves collecting wastes from sources and gets transported to a low line landfill system. Open dumping practice is leading to various problems like pollutions and health hazards.

As a solution for all this problems we would like to introduce our project "WASTE DRYER". By this solar powered waste dryer, all type of waste including biological and household can be managed effectively.

The dryer consist of parabolic collector heat exchanger the electric blower, fan for circulating hot air, exhaust fan for controlling heat and sucking fan due to heat of sunlight , hot air get sucked up by heat exchanger. Hot air enter into the dryer there by waste material become dry. In addition to waste management the dryer convert waste material into organic fertilizers.

The dryer less expensive because it is operated by solar energy. It would b an excellent way for waste management.

***Key Words*: Waste Dryer, Waste ,Waste Management, Solar Energy, Organic Fertilizer**

1.INTRODUCTION

Waste management (or waste disposal) is the activities and actions required to manage waste from its inception to its final disposal. This includes the collection, transport, treatment and disposal of waste, together with monitoring and regulation of the waste management process. Waste can be solid, liquid, or gas and each type has different methods of disposal and management. Waste management deals with all types of waste, including industrial, biological and household. In some cases, waste can pose a threat to human health. Waste is produced by human activity, for example, the extraction and processing of raw materials. Waste management is intended to reduce adverse effects of waste on human health, the environment or aesthetics. The waste hierarchy refers to the "3 Rs" reduce, reuse and recycle, which classifies waste management strategies according to their desirability in terms of waste minimization. The waste hierarchy is the cornerstone of most waste minimization strategies. The aim of the waste hierarchy is to extract the maximum practical benefits from products and to generate the minimum amount of end waste; see: resource recovery. The waste hierarchy is represented as a pyramid because the basic premise is that policies should promote measures to prevent the generation of waste.

1.1 CLASSIFICATION OF WASTE DISPOSAL METHODS

1.1.1 Landfills

Throwing daily waste/garbage in the landfills is the most popularly used method of waste disposal used today. This process of waste disposal focuses attention on burying the waste in the land. Landfills are commonly found in developing countries. There is a process used that eliminates the odors and dangers of waste before it is placed into the ground. While it is true this is the most popular form of waste disposal, it is certainly far from the only procedure and one that may also bring with it an assortment of space. This method is becoming less these days although, thanks to the lack of space available and the strong presence of methane and other landfill gases, both of which can cause numerous contamination problems. Landfills give rise to air and water pollution which severely affects the environment and can prove fatal to the lives of humans and animals. Many areas are reconsidering the use of landfills

1.1.2 INCINERATION

Incineration or combustion is a type disposal method in which municipal solid wastes are burned at high temperatures so as to convert them into residue and gaseous products. The biggest advantage of this type of method is that it can reduce the volume of solid waste to 20 to 30 percent of the original volume, decreases the space they take up and reduce the stress on landfills. This process is also known as thermal treatment where solid waste materials are converted by Incinerators into heat, gas, steam and ash. Incineration is something that is very in countries where landfill space is no longer available, which includes Japan

1.1.3 RECOVERY AND RECYCLING

Resource recovery is the process of taking useful discarded items for a specific next use. These discarded items are then processed to extract or recover materials and resources or convert them to energy in the form of useable heat, electricity or fuel. Recycling is the process of converting

waste products into new products to prevent energy usage and consumption of fresh raw materials. Recycling is the third component of Reduce, Reuse and Recycle waste hierarchy. The idea behind recycling is to reduce energy usage, reduce volume of landfills, reduce air and water pollution, reduce greenhouse gas emissions and preserve natural resources for future use

1.1.4 PLASMA GASIFICATION

Plasma gasification is another form of waste management. Plasma is a primarily an electrically charged or a highly ionized gas. Lighting is one type of plasma which produces temperatures that exceed 12,600 °F . With this method of waste disposal, a vessel uses characteristic plasma torches operating at +10,000 °F which is creating a gasification zone till 3,000 °F for the conversion of solid or liquid wastes into a syngas. During the treatment solid waste by plasma gasification, the waste‟s molecular bonds are broken down as result of the intense heat in the vessels and the elemental components. Thanks to this process, destruction of waste and dangerous materials is found. This form of waste disposal provides renewable energy and an assortment of other fantastic benefits.

1.1.5 COMPOSTING

Composting is a easy and natural bio-degradation process that takes organic wastes i.e. remains of plants and garden and kitchen waste and turns into nutrient rich food for your plants. Composting, normally used for organic farming, occurs by allowing organic materials to sit in one place for months until microbes decompose it. Composting is one of the best method of waste disposal as it can turn unsafe organic products into safe compost. On the other side, it is slow process and takes lot of space

1.1.6 WASTE TO ENERGY

Waste to energy (WtE) process involves converting of non-recyclable waste items into useable heat, electricity, or fuel through a variety of processes. This type of source of energy is a renewable energy source as non-recyclable waste can be used over and over again to create energy. It can also help to reduce carbon emissions by offsetting the need for energy from fossil sources. Waste-to-Energy, also widely recognized by its acronym WtE is the generation of energy in the form of heat or electricity from waste

1.1.7 WASTE MINIMIZATION

The easier method of waste management is to reduce creation of waste materials thereby reducing the amount of waste going to landfills. Waste reduction can be done through recycling old materials like jar, bags, repairing broken items instead of buying new one, avoiding use of disposable products like plastic bags, reusing second hand items, and buying items that uses less designing. Recycling and composting are a couple of the best methods of waste management. Composting is so far only possible on a small scale, either by private individuals or in areas where waste can be mixed with farming soil or used for landscaping purposes. Recycling is widely used around the world, with plastic, paper and metal leading the list of the most recyclable items. Most material recycled is reused for its original purpose

1.2 CLASSIFICATION OF SOLID WASTE

1.2.1 CLASSIFICATION ON THE BASIS OF SOURCE

- Residential and Municipal: Waste originate from residential area like houses, apartments etc. It consists of waste includes food scrapes, vegetables, peeled material, plastics, wood pieces, clothes, ashes, dust, leaf litter, building debris and treatment plant sediments etc. It also includes waste originated from demolition, construction, street cleaning, land scraping etc.
- Commercial and Institutional: It includes waste originate from stores, hotels, markets, shops and medical facilities etc. like grocery materials, leftover food, glasses, metals and ashes etc.Waste material like paper, plastic, glasses etc. originate from school, colleges and offices is known as institutional waste.
- Agricultural: Waste material like spoiled food grains, vegetables, grass, litter etc. originated from agricultural activities is known as agricultural waste.

1.2.2 CLASSIFICATION ON THE BASIS OF TYPE

- Refuse: it includes all types of rubbish and garbage.
- Garbage: waste materials from kitchen waste, food, slaughter houses, canning and freezing industries can decompose easily are known as garbage.
- Rubbish: it includes wastes material like paper, rubber, leather, wood, garden wastes metal, glass, ceramics, stones and soil.
- Ashes: solid products left after heating and cooking or incineration of waste material is known as ash.
- Street wastes: wastes collected during cleaning of streets, walkways, parks, playgrounds etc. It includes soil, paper, cardboard, plastics, leaves and vegetable matter in large quantities.
- Large wastes: waste like parts or whole of automobile, furniture, refrigerator and other home appliances, trees, fires, demolition and construction wastes is considered as large waste.
- Industrial wastes: waste originated from industries like chemicals, paints, fertilizer, pesticides, sand and explosives etc. It can be of hazards nature.

- Sewage sludge: it includes sludge from primary and secondary settling tank and solids from screens etc.
- Mining wastes: waste originated from mines which include mine dump, slug ropes and waste from coal mines like coal dust, fine coal and dirt.
- Agricultural wastes: waste originated from animal farm like crop residue, cattle dung, manure etc.

1.3 MUNICIPAL SOLID WASTE (MSW)

Waste originate from communities which include residential colonies/home is known as municipal solid waste (MSW). It mainly includes waste originate from domestic and commercial activities. It also includes waste originated from institutional and industrial activities. Components of MSW is highly diverse in nature which includes packaging and containers, food waste, news paper, paper, leather, textile, metals, glass, yard waste and home appliances etc . The MSW consist biodegradable organic waste like food waste, vegetable and fruit peels, recyclables waste like paper, plastic, metals, glass etc., toxic waste like paints, pesticides, used batteries etc. and medical waste like blood stained cotton, sanitary napkins, disposable needles and syringes etc. MSW can be categorized into biodegradable and non-biodegradable.

1.4 BIODEGRADABLE WASTE

This type of waste can be decomposed easily by the microorganisms into simpler substances i.e. CO2 and H2 O under aerobic conditions and CH4, CO2 and H2 S under anaerobic conditions. Mainly organic wastes such as kitchen waste and waste from agricultural activities constitute the bulk of these wastes generated

1.5 NON-BIODEGRADABLE WASTE

The waste like polythene bags, plastic stuff, discarded vehicles, pesticide and fertilizer residues, worn tires, industrial wastes including metal scrap and medical waste such as disposable needles and syringes, plastic and glass bottles etc. are non-biodegradable. They do not decompose with time and persistent in nature.

1.6 INGENUITY CONCEPT

Here we introduce a new product that can do waste management very effectively on household wastes and any biodegradable wastes. This product very user friendly and its compactness compared to other methods are the major highlights. In this type of waste management system we can dry the waste and which can be grinded using a grinder and used as fertilizer for plants. This type of waste management system in urban areas make waste disposal much easier. Instead of waste drying and it can be used to dry other fruits and vegetables.

2. LITERATURE REVIEW

In the topic "Municipal Solid Waste Management Challenges and Problems for Cities in Low-Income and Developing Countries" discussed in the journal "International Journal of Science and Engineering Applications" Volume: 6 Issue :2 authors Mahmood Zohoori ,Master of Environmental Management Putra University of Malaysia Birjand, Iran and Ali Ghani Master of Business Administration (MBA) Industrial Management Institute Birjand, Iran. It enlists the Solid waste management is a challenge, problem as well as opportunities for the cities' authorities in developing countries especially low-income ones mostly because of the enhancing generation of waste, the burden posed on the budget of municipalities as a consequence of the high expenses belonged to its management, absence of the perception over a variety of factors which affect the various stages of management of waste and linkage essential to provide the whole handling system functioning. The data and information provided is very beneficial for changing, implementing or planning waste management system in towns. This article brings a general overview of state of municipal solid waste management (MSWM) by domestic authorities and available condition and current challenges of solid waste management (SWM) in developing countries particularly low-income ones. In addition, approaches of feasible solution which can be undertaken to prosper municipal solid waste (MSW) services are discussed. Approximately poor economic growth of the low-income developing countries annually has resulted in a rise in the poverty levels. Besides, migration from rural zones to urban zones has resulted in an unplanned settlements in suburban areas accommodation. Furthermore political interference prevents the smooth running of the domestic authorities. Vulnerability of surface and groundwater pollution is increasing due to lack of surveillance of local authorities in considering the environmental impact in siting MSW disposal sites. Illicit dumping of MSW on the roadside or river banks demonstrates economic and environmental threats on suburb properties. There are also lack of servicing of MSW collection vehicles, poor state of infrastructure and inadequate funding and budget which fight against the optimization of MSW disposal service. The rural economy requires to be developed if the migration of rural-urban areas is to be handled. In addition, involvement of stakeholders is necessary to obtain any meaningful and sustainable municipal solid waste management. Successful usage of low-tech approaches, and the association of informal refuse scavengers and collectors exist in different Asian, African and Latin American towns. Besides, a decentralized system can help solve the apparently intractable challenges and problems of waste management in low-income developing country cities in a socially favorable, economically viable, and environmentally sound manner.

In "Municipal solid waste management in Indian cities" from the Department of Civil Engineering, Jamia Millia Islamia

(Central University) in the year 2007 authors are Mufeed Sharholy and Kafeel Ahmmad discussed the prospects of Waste management in Indian cities.It outlined that Municipal solid waste management (MSWM) is one of the major environmental problems of Indian cities. Improper management of municipal solid waste (MSW) causes hazards to inhabitants. Various studies reveal that about 90% of MSW is disposed of unscientifically in open dumps and landfills, creating problems to public health and the environment. In the present study, an attempt has been made to provide a comprehensive review of the characteristics, generation, collection and transportation, disposal and treatment technologies of MSW practiced in India. The study pertaining to MSWM for Indian cities has been carried out to evaluate the current status and identify the major problems. Various adopted treatment technologies for MSW are critically reviewed, along with their advantages and limitations. The study is concluded with a few fruitful suggestions, which may be beneficial to encourage the competent authorities/ researchers to work towards further improvement of the present system.

In review of "Solid waste management challenges for cities in developing countries" from article "Waste Management" Volume 33, Issue 1 in the year of January 2013 authors are Lilliana abarca Guerrero and Ger maas. It highlights the factors affecting the waste management system.

Solid waste management is a challenge for the cities‟ authorities in developing countries mainly due to the increasing generation of waste, the burden posed on the municipal budget as a result of the high costs associated to its management, the lack of understanding over a diversity of factors that affect the different stages of waste management and linkages necessary to enable the entire handling system functioning. An analysis of literature on the work done and reported mainly in publications from 2005 to 2011, related to waste management in developing countries, showed that few articles give quantitative information. The analysis was conducted in two of the major scientific journals, Waste Management Journal and Waste Management and Research. The objective of this research was to determine the stakeholders‟ action/behavior that have a role in the waste management process and to analyze influential factors on the system, in more than thirty urban areas in 22 developing countries in 4 continents. A combination of methods was used in this study in order to assess the stakeholders and the factors influencing the performance of waste management in the cities. Data was collected from scientific literature, existing data bases, observations made during visits to urban areas, structured interviews with relevant professionals, exercises provided to participants in workshops and a questionnaire applied to stakeholders. Descriptive and inferential statistic methods were used to draw conclusions. The outcomes of the research are a comprehensive list of stakeholders that are relevant in the waste management systems and a set of factors that reveal the most important causes for the systems‟ failure. The information provided is very useful when planning, changing or implementing waste management systems in cities.

Thiago Edgwinges published "Influence of chemical composition on biochemical methane potential of fruit and vegetable waste" in the article "Waste Management" volume 71 in the year of January 2018. This study investigates the influence of chemical composition on the biochemical methane potential (BMP) of twelve different batches of fruit and vegetable waste (FVW) with different compositions collected over one year. BMP ranged from 288 to 516 LN CH4 kg VS−1, with significant statistical differences between means, which was explained by variations in the chemical composition over time. BMP was most strongly correlated to lipid content and high calorific values. Multiple linear regressions were performed to develop statistical models to more rapidly predict methane potential. Models were analyzed that considered chemical compounds and that considered only high calorific value as a single parameter.

2.1 WASTE MANAGEMENT INDIAN SCENARIO

The energy crisis and environmental degradation are currently two vital issues for global sustainable development. Rapid industrialization and population explosion in India has led to the migration of people from villages to cities, which generate thousands tons of municipal solid waste daily, which is one of the important contributors for environmental degradation at national level. Improper management of municipal solid waste (MSW) causes hazards to inhabitants. The management of MSW requires proper infrastructure, maintenance and upgrade for all activities. The MSWM (municipal solid waste management) system comprises with generation, storage, collection, transfer and transport, processing and disposal of solid wastes. Rapid urbanization, industrialization and population growth have led to severe waste management problems in several cities of developing or under developed world like India, Malaysia, Nepal. Although municipal solid wastes (MSWs), a vital part of any society, does not have the catastrophic potential of either global warming or stratospheric ozone depletion, has long posed threats to environmental quality and human health.

The uncontrolled urbanization has left many Indian cities devoid of many infrastructural services such as water supply, sewerage and municipal solid waste management. Most of urban centers worldwide are overwhelmed by severe problems related to solid waste due to lack of seriousness efforts by town/city authorities, garbage and its management. Tremendous increase in the amount of municipal solid waste has been reported in the cities due to an improved lifestyle andsocial status . Accelerating urbanization accompanied with increasing per capita incomes have also led to rapid increases in MSW generation that have dramatically expanded the burden on local governments in many developing countries for collection, processing, and disposal of MSW in efficient ways . Municipal corporations in developing countries are unable to handle

increasing quantities of waste, which results in uncollected waste on roads and in other public places. The most traditional and popular MSW disposal practice worldwide is landfilling or open dumping. Due to limited land availability in some countries and various environmental problems associated, such as gas emissions and leachate production, the technology of landfilling needs to be improved. There is an urgent need to work towards a sustainable solid waste management system, which is environmentally, economically and socially sustainable. Waste to energy generation option can be an alternative for sustainable management of this waste and will be helpful in tackling this huge quantity of waste.

2.1.1 WASTE GENERATION IN INDIA AS WELL AS WORLD

Generally, the greater the economic prosperity and higher the proportion of urban population, the greater is the amount of solid waste produced. In India, urban solid waste management has remained one of the most neglected areas. The urban population in India generated about 114,576 t d−1 of municipal solid waste (MSW) in 1996, which is predicted to increase 4 fold and reach about 440,460 t d−1 by the year 2026. This tremendous increase in the amount of MSW generated is due to changing lifestyles, food habits and living standards of the urban population. The MSW collection efficiency ranges between 70 and 90% in the major metro cities in India, whereas in several smaller cities it is below 50%. It has been reported that Indian cities dispose of their waste in open dumps located in the outskirts of the city without any concern for environmental degradation or impact on human health. The economical and infrastructural constraints, including unavailability of land for safe waste disposal, and lack of awareness and fear at all levels restrain progress resulting in inefficient, unsafe urban solid waste management. About 13.9 million residents living in 2.96 million households generates approximately 7000 t d−1 of MSW at the rate of 0.500 kg−1capita−1 d−1 in Delhi.

2.1.2 GENERATION OF MSW IN INDIAN CITIES

As per census 2001there are about 593 districts and about 5000 towns in India. Nearly 27.8% of total Indian population i.e. of more than 1 billion lives in urban areas. The projected urban population percentage will be 33.4% of the total by the year 2026. In India management of MSW continues to remain one of the most neglected areas of urban development. In many cities more than half of the solid waste generated remains unattended. This gives rise to unhygienic conditions especially in densely populated areas, which in turn may have serious health and environmental consequences. The quantity of municipal solid waste generated in Indian towns and cities is increasing gradually on account of its increasing population and increased GDP. In the Indian cities amount of solid waste generated annually has been increased from 6 to 48 million tons from year 1947 to 1997 with an annual growth rate of 4.25%, and is anticipated to increase and reach up to 300 million tons by 2047.

Asia-Pacific region generates about 700 million tons of total solid waste yearly; however industrial activities generate about 1900 million tons of waste per year. The industrial wastes are markedly different and specific to each serving industry. In this region 2.6 billion tons of total amounts of waste is generated every year. It is also estimated that about 30–50% of the generated waste remains unattended. According to TERI about 80% of the municipal solid waste generated in National Capital Territory (NCT) of Delhi is being collected, and the rest remains unattended on streets or in small dumps. About 90% of the MSW collected is disposed in landfills, and the remaining is composted. European Union generates about 1.3 billion tons of wastes annually with agriculture contributing another 700 million tons. Due to the tremendous increase in population rise and MSW generation the situation over the last two decades has been aggravated. The higher levels of resource consumption have resulted in severe impacts, leading to constraints and environmental degradation. According to Jin et al. MSW characteristics significantly depends on lifestyles, cultural traditions, economic status, literacy rates, food habits, climatic and geographical conditions of the area. Municipal solid waste from Europe includes the waste originating from households, public buildings areas, as well as in small commerce. It does not include human faeces (night soil) and the sewage sludge generated in wastewater treatment plants. Demolition debris, agricultural throw away, industrial wastes as well as hospital fritter away are also not incorporated. In contrast, MSW from Asia includes the waste generated by human settlements as well as from the industries producing consumer goods including the waste from demolition debris and agricultural. Therefore waste from the Asian cities can have a significant hazardous potential than that of the European.

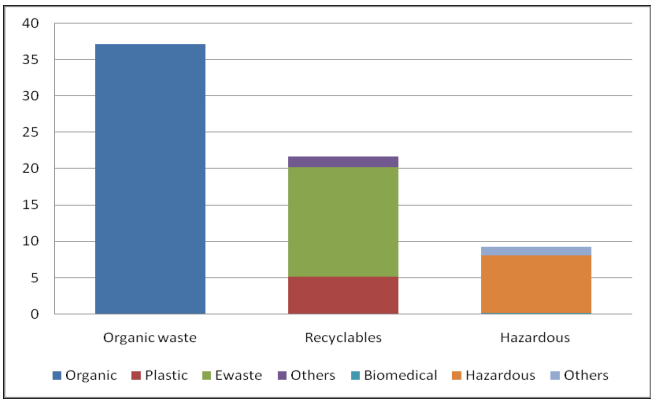

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Chart -2.1: Graph depicting composition of MSW in India

2.2 WASTE MANAGEMENT IN KERALA

On an average 6000 tons of Solid Waste is being generated in all across Kerala. Waste Management is an essential service

to be provided by the municipal and local government authorities. Failure to provide it efficiently could be disastrous. Private sector participation is one of the best choices open to boost the performance of public services like solid waste management. There has been a significant increase in waste generation in India in the last few decades, largely due to rapid population growth and economic development. This is an attempt to explore business potential for private investors, especially Small & Medium Enterprises (SMEs), in Waste Management business. Waste management has come to be serious issue in Kerala as well. As per some estimates, on an average 6000 tons of Solid Waste is being generated in all across Kerala, in its 999 Panchayats, 53 Municipalities and 5 Corporations

2.2.1 REASONS FOR GROWING WASTE

There are various reasons for growing municipal waste generation. Following are some of the reasons:

- changing lifestyles
- food habits
- Change in living standards
- Fast economic development
- Urbanization
- Growing tourism industry

2.2.2.Impact

Uncollected garbage- pileup and stinking waste across both sides of national highways of Kerala is a normal scene today. Piling up of garbage and litter and failure to adopt state of the art methods of waste management processes has serious consequences as follows:

- Environmental: pollution from poorly maintained landfill sites are prone to groundwater contamination and facilitate breeding of flies, mosquitoes, cockroaches, rats, and other pests.
- Public health: Possibility of frequent outbreaks of communicable diseases, such as Malaria, Dengue fever, Chickungunia etc., are enhanced
- Economic effects: can have negative impact on tourism industry
- Labor productivity gets affected with frequent outbreaks of communicable diseases

2.2.3 WASTE AND WASTE MANAGEMENT

Waste is an unavoidable by-product of most human activity. economic development and rising living standards have led to increases in the quantity and complexity of generated waste. solid waste is a mixture of organic and inorganic waste generated by domestic or commercial activities. waste management is the collection, transport, processing, recycling or disposal, and monitoring of waste materials. however poor solid waste management is a threat to public health. management of residential and institutional waste is considered to be the responsibility of local government authorities. municipal solid waste is generated from households, offices, hotels, shops, schools and other institutions. the major components are food waste, paper, plastic, rags, metal and glass, although demolition and construction debris is often included in collected waste, as are small quantities of hazardous waste, such as electric light bulbs, batteries, automotive parts and discarded medicines and chemicals

2.2.4 TYPES OF WASTES

There are degradable and non-degradable wastes. Degradable wastes are mainly organic substances. There are hazardous and non-hazardous wastes. As far Municipal waste is concerned, a major chunk of it emanates from households, hotels, schools, institutions, marriage parties, slaughter houses etc. Further, there are E- wastes as well. Following tables present a picture of sources and types of solid wastes generated in Municipal localities in a developing country as well as in Kerala:

Source	Typical waste generators	Types of solid wastes
Residential	Single and multifamily dwellings	Food wastes, paper, cardboard, plastics, textiles, leather, yard wastes, wood, glass, metals, ashes, special wastes (e.g. bulky items, consumer electronics, white goods, batteries, oil, tires), and household hazardous wastes
Industrial	Light and heavy manufacturing, fabrication, construction sites, power and chemical plants	Housekeeping wastes, packaging, food wastes, construction and demolition materials, hazardous wastes, ashes, special wastes
Commercial	Stores, hotels, restaurants, markets, office buildings, etc.	Paper, cardboard, plastics, wood, food wastes, glass, metals, special wastes, hazardous wastes

Institutional	Schools, hospitals, prisons, government centers	Paper, cardboard, plastics, wood, food wastes, glass, metals, special wastes, hazardous wastes
Construction and demolition	New construction sites, road repair, renovation sites, demolition of buildings	Wood, steel, concrete, dirt, etc
Municipal services	Street cleaning, landscaping, parks, beaches, other recreational areas, water and wastewater treatment plants	Street sweepings, landscape and tree trimmings, general wastes from parks, beaches, and other recreational area, sludge
Process	Heavy and light manufacturing, refineries, chemical plants, power plants, mineral extraction and processing	Industrial process wastes, scrap materials, offspecification products, slag, tailings
Agriculture	Crops, orchards, vineyards, dairies, feedlots, farms	Spoiled food wastes, agricultural wastes, hazardous wastes (e.g. pesticides)

Table 2.1 Types of Wastes in Kerala

Source of Solid Waste in Kerala	
Household Waste	49%
Hostels, Marriage halls, Institutions	17%
Shops & Markets	16%
Street sweepings	9%
Construction	6%
Slaughter house, Hospitals	3%

Chart 2.2 Sources of Wastes in Kerala

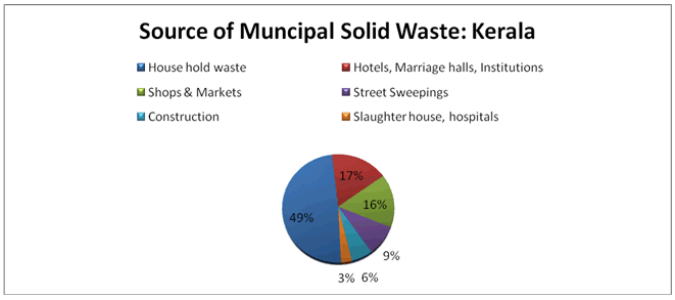

Fig 2.1 Sources of Wastes in Kerala

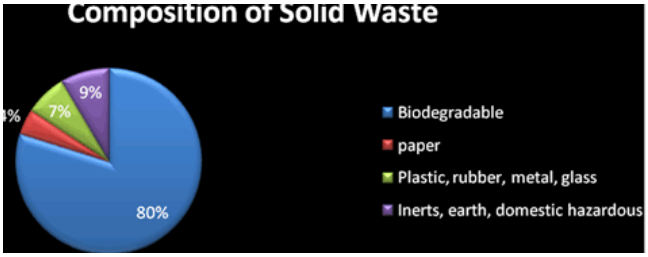

Fig 2.2 Composition of Solid Waste: Kerala.

2.2.5 STATUS OF WASTE MANAGEMENT SYSTEM IN KERALA

As per a Supreme Court of India had directive, all the local governments in India above a population strength of over ten lakh need to set up proper facilities for processing waste generated within their limits. And Supreme Court wanted waste management facilities to be in place in such municipalities by December 31, 2003. But a majority of the municipalities in India could not successfully implement this Supreme Court directive, even as on mid - 2010.Whereas Kerala is one of the few States in the Country that took some measures to address this issue by launching an initiative called Clean Kerala Mission. The mission was launched in 2002.

Objective of the mission was to create a garbage free Kerala. It was given a task of capacity building within local government institutions (LGIs) and enabling and preparing them taking up the challenge of implementing solid waste management projects. There were efforts to achieve this goal with the participation of NGOs, Community organizations such as Kudumbasrees across Kerala. The first phase of the project was implemented in five Corporations and 26 municipalities with the participation of Women Self-Help-Groups and `Kudumbasrees'. In the second phase of the `Clean Kerala Mission' another 27 cities and 25 villages were included

2.2.6 SCOPE OF OUR IDEA IN KERALA

As per the studies the most of the waste that produced in Kerala is biodegradable waste. Depending up on the above data‟s in Kerala about 80% of wastes are biodegradable waste and it is considered as 60% of biodegradable waste can be used as bio fertilizer for agriculture from ancient times. By the invention of our product waste dryer, we can control the accumulation of biodegradable waste in environment up to an extent. Through this we can directly dry the household wastes and which can be used as fertilizers through grinding it, it should also help to reduce the waste dubbing in Kerala and we believe that it gradually reduce intensive use of chemical fertilizers in Kerala. In future it becomes very helpful in urban areas to waste management. Through taking different action plan we can encourage the possibility of waste management using „waste dryer‟, here we can introduce an action plan like collecting the dried wastes from each houses in an area and which can be distributed to farmers by making it as a bio-ferti

3.OBJECTIVE

The main objectives of waste management are:

1. For the protection of environment through effective waste management techniques.

2. To protect health, well-being and environment.

3. To reduce and reuse of waste.

4. Safe disposal of waste.

Waste management purpose is collection and disposal of waste in the world to keep environment safe and clean Almost 30% of waste is organic waste composted and transformed into nutritious soil. For proper disposal of waste material the activities required to degrade waste easily. Increased recycling levels and reduction of organic waste in landfills. The most important reason for proper waste management is to protect the environment and for the health and safety of the population. Reduce the lizer.
volume of the solid waste stream through the implementation of waste reduction and recycling programs. Maintain a balanced SWM system which benefits the community while following regulatory requirements. Provide efficient and economical refuse collection, recycling, and disposal services. On focusing on these objectives we are introducing the all new concept of waste management system “Waste Dryer”. Here we can reuse most of the bio degradable wastes through converting it to fertilizer and which reduce difficulties in waste management system in our countries.

4. METHODOLOGY

- The ultimate aim of the product is to reuse waste materials in an useful way.
- The components are heat exchanger, blower and solar collector
- Waste material can placed in the three layers of trays made up of net
- The blower connected to the tray supplies heat from solar collector
- Sucking fan sucks the heat from bottom chamber and which is used to dry waste
- A exhaust fan is provided to maintain the temperature inside the trays

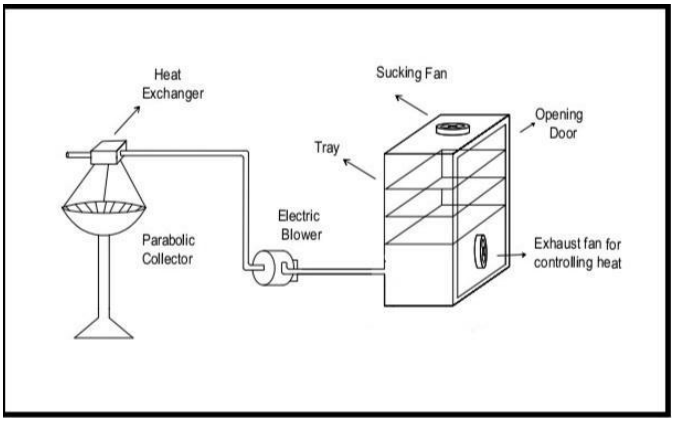

Fig 4.1 Schematic Diagram of Waste Dryer

5. COMPONENTS AND DESCRIPTION

The major components that are used in this project are as follows:

1.Dryer cabinet

2.Parabolic collector

3.Heat Exchanger

4.Electric blower

5.Sucking Fan

6.Exhaust fan

7.Thermostat

8.Battery

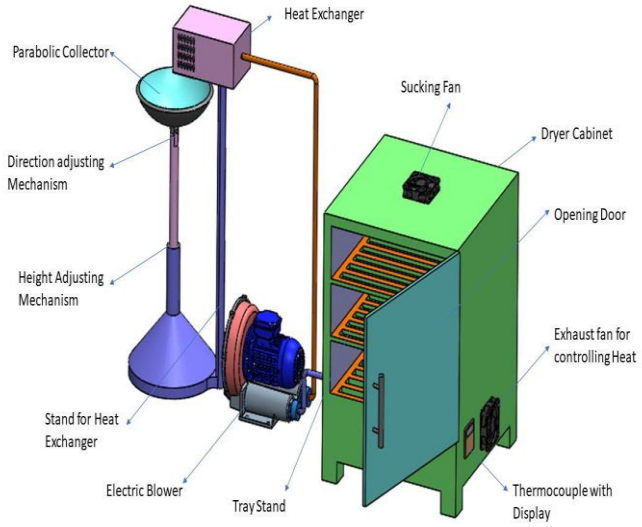

Fig 5.1 components of waste dryer

5.1 DRYER CABINET

Here the dry cabinet is used to dry the waste up to a temperature of 50 degree Celsius. It is made up of sheet metal and it consists of three layers of tray stands for carrying the waste for drying. Inside dry cabinet there is a temperature sensor and which sense the temperature inside the dry cabinet and based on which the temperature is maintained inside it.

5.2 PARABOLIC COLLECTOR

Parabolic collector which is used to collect the heat from the sun. Here the parabolic collector is made of by using a dish antennae and 2 inch mirror pieces. The 2 inch mirror pieces are attached to the dish of the antennae and which act as parabolic collector. This reflects the sun‟s rays to the heat exchanger. Depending upon the light we can adjust or displace the parabolic collector to different areas

5.3 HEAT EXCHANGER

Heat exchanger is used to extract the heat from sun‟s ray. Here it is a rectangular box which consists of steel wool. The heat exchanger collect heat from sun‟s ray and this heat is passed to the dry cabinet through an electric blower.

5.4 ELECTRIC BLOWER

Blower is equipment or a device which increases the velocity of air or gas when it is passed through equipped impellers. They are mainly used for flow of air/gas required for exhausting, aspirating, cooling, ventilating, conveying etc. Blower is also commonly known as Centrifugal Fans in industry. Here blowers which increase the velocity of hot air to the dry cabinet**.**

5.5 SUCKING FAN

The function of exhaust fan is to maintain the temperature inside the dryer cabinet. It is connected with a thermostat and whenever the temperature reading in the thermostat reaches 50 degree Celsius, the exhaust fan start working and it reduce the temperature. Exhaust fan cut off temperature is 45 degree Celsius.

5.7 THERMOSTAT

It is a device that automatically regulates temperature, or that activates a device when the temperature reaches a certain point. Here the thermostat which activates the exhaust fans at a certain temperature to maintain the temperature inside the dryer cabinet. It determines the temperature inside the cabinet through a temperature sensor.

5.8 BATTERY

A battery is a device consisting of one or more electrochemical cells with external connections for powering electrical devices such as flashlights, mobile phones, and electric cars. When a battery is supplying electric power, its positive terminal is the cathode and its negative terminal is the anode. Here we are using 3 units of lead-acid rechargeable battery of 4V 2.0Ah. It is used to operate the thermostat and fans of the dryer cabinet

Fig 5.2 lead acid battery

6. DESIGN

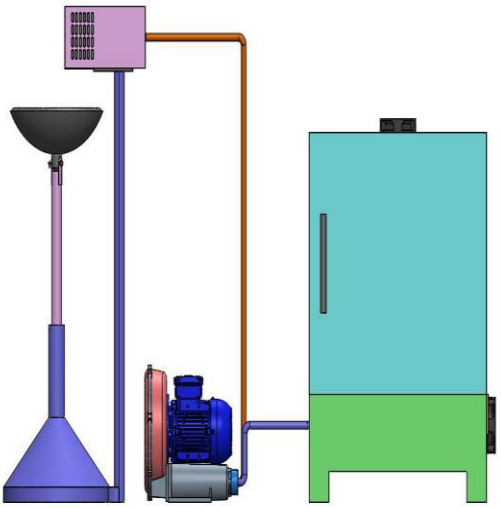

Fig-6.1. Structural view

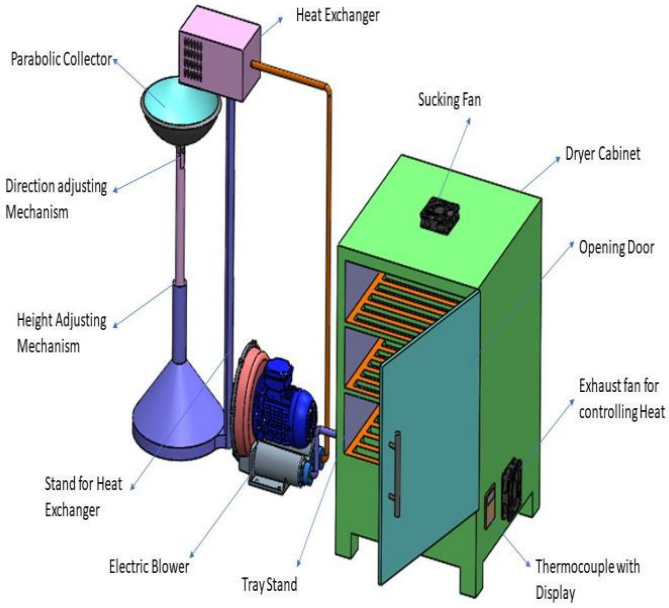

Fig-6.2. 3D Drawing

7. FABRICATION PROCESS

7.1 PROCESS INVOLVED IN FABRICATION

Fabrication involves turning raw material to finished products, to be used for various purposes. There are a large number of processes involved in the fabrication. These are solid state manufacturing processes involve minimum amount of material wastage. This solidifies temperature and large force is applied such the material flows and act in desired shape. The desire shape is controlled by means of a set of tool and dies, which may be closed during fabrication. These processes are normally used for large scale production rates. These are generally economical and in many cases improve the mechanical properties. These are fabrication processes where the starting raw materials are produced by any one of the previous fabrication processes

7.1.1 MEASURING AND MARKING

A measurement is a comparison to a standard. Measurement is the process or the result of determining the magnitude of a quantity, such as length or mass, relative to a unit of measurement, such as a meter or a kilogram. For example length, width , depth , height , temperature , density etc. Marking out is a means of transferring shapes and lines onto material to provide a guide for cutting, bending, turning, drilling, grinding such as different machining process. The importance of marking out can be overlooked (especially by school pupils) leading to problems at the end of the manufacturing process when a product/work doesn‟t fit together correctly.

7.1.2 CUTTING

Cutting is the separation or opening of a physical object, into two or more portions, through the application of an acutely directed force. For metals many methods are used and can be grouped by the physical phenomenon used. It is the process of producing a work piece by removing unwanted material from a block of metal, in the form of chips. Power hacksaws are used to cut large sizes (sections) of metals such as steel. Cutting diameters of more than 10/15mm is very hard work with a normal hand held hacksaw. Therefore power hacksaws have been developed to carry out the difficult and time consuming work. Apart from using hacksaw, power saw, chisels, etc. for metal cutting operation, gas or oxygen cutting is extensively used now-a-days in industry.

7.1.3 WELDING

Welding is a process of joining two metal pieces by the application of heat. Welding is the least expensive process and widely used now a days in fabrication. Welding joints different metals with the help of a number of processes in which heat is supplied either electrically or by mean of a gas torch. Different welding processes are used in the manufacturing of Auto mobiles bodies, structural work, tanks, and general machine repair work. In the industries, welding is used in refineries and pipe line fabrication. It may be called a secondary manufacturing process. Arc welding is welding process that is used to join metal to metal by using electricity to create enough heat to melt metal, and melted metals when cool resulting binding of metals there is a type of welding that uses welding power supply to create an

electric arc between metal stick and the base material to melt the metals at point of contact. It use either direct or alternating current, and consumable or non-consumable electrodes. The process may be manual, semi-automatic or fully automatic. The process is very versatile require little operate training and inexpensive equipment so for welding of frame and grippers arc welding is used.

7.1.4 BENDING

In bending operation the material in the form of flat sheet or strip is uniformly strained around a linear axis which lies in the neutral plane and perpendicular it‟s the length wise direction of the sheet or metal. It is a manufacturing process that produces a V-shape, U-shape, or channel shape along a straight axis in ductile materials, most commonly sheet metals. Commonly used equipment includes box and pan brakes, brake presses, and other specialized machine presses. Typical products that are made like this are boxes such as electrical enclosures and rectangular ductwork.

7.2. MATERIAL REMOVAL PROCESSES

These are also a secondary removal manufacturing process, where the additional unwanted material is removed in the form of chips from the blank material by a hard tool so as to obtain the final desired shape. Material removal is normally a most expensive manufacturing process. Because more energy is consumed and also lot of waste material is generated in this process. Still this process is widely used because it delivers very good dimensional accuracy and good surface finished. Material removal process are also called machining processes

7.2.1. DRILLING

Drilling is a cutting process that uses a drill bit to cut a hole of circular cross-section in solid materials. The drill bit is usually a rotary cutting tool, often multipoint. The bit is pressed against the work piece and rotated at rates from hundreds to thousands of revolutions per minute. This forces the cutting edge against the work piece, cutting off chips from the hole as it is drilled. The hole is usually not made through a circular cutting motion, though the bit is usually rotated.

7.2.2 GRINDING

Grinding is abrasive machining process that use grinding wheel as cutting tool. It can produce very fine finishers and very accurate dimension. In mass production it contexts it can also rough out large volumes of metal quite rapidly. It is usually better suited to the machining of very hard materials than regular machining. Grinding is subset of cutting, as grinding is true metal cutting process. Each grain of abrasive function as a microscopic single point cutting edge and shears a tiny chip that is analogues to what would conventionally be called cut chip. Grinding is a subset of cutting, as grinding is a true metal-cutting process

Fig-7.1. Proposed machine

8. WORKING PRINCIPLE

- The ultimate aim of the machine is to dry the bio-degradable waste and ensure the cleanliness of environment.
- The machine consist of a dryer cabin, solar collector, electric blower, heat exchanger, exhaust fan, sucking fan, thermostat, temperature sensor and batteries.
- The solar collector is placed in the open area were sufficient sunlight is available.
- The mirrors fixed in the solar collector reflect the sunlight into a concentrated beam of light and this concentrated light beam is focused to the heat exchanger.
- Heat exchanger absorbs the heat energy and which is sucked by the electric blower through a thermally insulated pipe.
- Electric blower which increase the velocity of the hot air from the heat exchanger and which is pulled to the bottom of the dryer cabinet.
- In dryer cabinet there is a three layer of tray stand, which is for keeping the waste for drying.

- At the top of the dryer chamber there is a sucking fan, which sucks the air from the dryer cabinet, which resulted in the upward flow of hot air to the upper side.
- During this upward flow of hot air make the waste particle dry easier. Normally we maintaining a temperature of 45 degree Celsius in the dryer cabinet.
- The temperature in the dryer cabinet is measured using a temperature sensor and a thermostat.
- A temperature sensor is placed at the top inner side of the dryer cabinet and which measures the temperature and thermostat which indicates it.
- Although the major function of thermostat is to maintain the temperature inside the dryer cabinet.
- There is exhaust fan is provided to maintain the temperature inside the dryer cabinet by expelling some amount of air to atmosphere.
- When the temperature reaches 50 degree Celsius, the thermostat will power on the exhaust fan.
- After that when temperature drops to about 45 degree Celsius, the thermostat automatically cut off power of exhaust fan.
- The temperature required to power on and power of the exhaust fan can be changed in the thermostat as per our needs

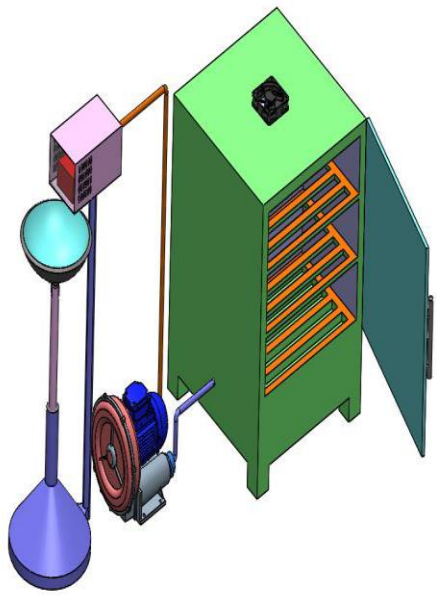

Fig 8.2 Image of waste dryer

9. RESULT

After complete the machine, it was taken to test the entire performance of the equipment. The experiment had been done at kairali line a residential area in udayanapuram gramapanchayath, kottayam district. During this experiment 2kg of biodegradable waste are dried through manual method and 2kg of wastes dried through waste drier. After successfully completing the experiment, we observed that our machine is saving up to a 50% of time to dry same amount of waste at same environmental condition. Another benefit obtained from the machine is that it will reduce the overall foul smell emitting from the waste dryer. Another use waste dryer is that it can be used to dry such thing like turmeric, chilly and so on which can be dried through heat can be dried through our machine. By using this it can effectively reduce time for drying it. In case of waste drying it can be dried and preserved for a long period of time and it can be used as fertilizer in agriculture field, it reduces the usage of chemical fertilizer also. In urban areas it is very difficult to decompose the waste particle and by drying and preserving it as a fertilizer will reduce the problem faced by the urban peoples

10. CONCLUSION AND FUTURE WORK

We studied the harmful effects of the bio-degradable waste and learned about its non-degrading property. Thus, the major problem caused is the pollution caused in the surrounding and to living beings. We brain stormed to tackle this problem and considered various methods to treat the bio-degradable waste and concluded to dry the waste and make a new useful product from it. This reduces the waste being discharged to the surroundings. We made a recycling machine for this purpose which recycles household bio-degradable waste and is very easy to use. The amount waste generated from this is very less compared to large scale recycling plants. The installation of this unit in each home in a locality can reduce waste pollution to considerable level and it does not require additional transportation and handling cost. We produce different varieties of product by just the changing the die design. Waste materials are usually found littering all over the places in our urban cities and villages. A Waste Drying machine was therefore designed and manufactured using locally sourced and available materials. The manufactured Waste Drying machine was found to very useful absorbing the huge waste materials in our country. The method adopted was conducting a detailed study on the amount of waste produced in campus and neighboring areas. Also, we tabulated the amount of waste generated from the hostel rooms, houses and weighed it after segregating it into bio-degradable and non-biodegradable. The average waste was calculated from this sample assuming it to be a true reflection of the waste generation for the entire region.

In future we planned to include a inbuilt grinder with the machine. Now we have noticed a small disadvantage like separation of wastes manually into bio-degradable, but in future we hope that with the help of artificial intelligence we separate the waste itself by machine. Also try to improve the efficiency of machine even more as possible.

REFERENCES

1) Mohammed M, Ozbay I, Durmusoglu E. Bio-drying of green waste with high moisture content. Process Saf. Environ. Prot. 2017;111:420-427

2)Nunes CA, Ribeiro TI, Nunes J. Comparative analysis of dehydration methods for apple fruit. Revista de Ciências Agrárias 2015;38:282-290.

3) Shao LM, Ma ZH, Zhang H, Zhang DQ, He PJ. Bio-drying and size sorting of municipal solid waste with high water content for improving energy recovery. Waste Manage. 2010; 30:1165-1170.

4) Song X, Ma J, Gao J, et al. Optimization of bio-drying of kitchen waste: Inoculation, initial moisture content and bulking agents. 2017;19;496-504.

5) Tom A P, Pawels R, Haridas A. Biodrying process: A sustainable technology for treatment of municipal solid waste with high moisture content. Waste Manage. 2016;49:64-72

6) Yuan J, Li Y, Zhang H, et al. Effects of adding bulking agents on the biodrying of kitchen waste and the odor emissions produced. J. Environ. Sci. 2018;67:344-35