

Design and Development of Mechanism for Waste Segregation

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Abstract— The conditions, issues and problems of waste management in the industrialized and developing worlds are different. Though the developed countries generate larger amounts of wastes, they have developed adequate facilities, competent government institutions and bureaucracies to manage their wastes. Developing countries are still in the transition towards better waste management but they currently have insufficient collection and improper disposal of wastes. Clear government policies and competent bureaucracies for management of solid wastes are needed urgently especially in countries where there is rapid population growth through urbanization into peri-urban areas. Services and programs that include proper waste disposal for management of hazardous biological and chemical wastes, minimization and recycling will be needed. Disposal of wastes is commonly done by dumping (on land or into water bodies), incineration or long term storage in a secured facility. All these methods have varying degrees of negative environmental impacts with adverse environmental and health risks if wastes are improperly disposed or stored.

Key words: Problem, Waste Management, Wastes, Recycling

I. INTRODUCTION

In the current world situation with the growing population waste has become large in quantity. It has become important to manage this waste effectively. Waste management is collection, transportation, and disposal of garbage, sewage and other waste products. Waste management is the process of treating solid wastes and offers variety of solutions for recycling items that don't belong to trash. It is about how garbage can be used as a valuable resource. The common method of disposal of the waste is by unplanned and uncontrolled open dumping at the landfill sites. This method is injurious to human health, plant and animal life. Currently there is no system of segregation of dry, wet and metallic wastes at a household level. The purpose of this project is the realization of a compact, low cost and user friendly segregation system for urban households to streamline the waste management process.

The waste hierarchy refers to the "3 R's" reduce, reuse and recycle. Which classify waste management strategies according to their desirability in terms of waste minimization. The waste hierarchy remains 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 waste; see: resource recovery. Energy can be recovered from processes i.e. landfill and combustion, at this level of the hierarchy. The final action is disposal, in landfills or through incineration without energy recovery. This last step is the final resort for waste which has not been prevented, diverted or recovered.

II. OBJECTIVES

A. Primary Objectives

- Protect human health
- Protect Environment
- Conserve resources

B. Secondary Objectives

- Easy segregation of waste
- Effective time management
- Since it's automated, keeps humans away from various health hazardous
- Efficient utilization of the later segregated dry wastes

III. PROBLEM IDENTIFICATION

A growing population and economy, which means increased volumes of waste generated. This puts pressure on waste management facilities, which are already in short supply. Increased complexity of the waste stream because of urbanization and industrialization. Disposal of wastes is commonly done by dumping (on land or into water bodies), incineration or long term storage in a secured facility. All these methods have varying degrees of negative environmental impacts with adverse environmental and health risks if wastes are improperly disposed or stored.

IV. METHODOLOGY

The main problem being the improper disposal of waste. Solid waste is essentially garbage waste produced in homes, businesses and industrial sources. Solid waste production in India is growing in volume and in toxicity. More and more of our everyday products contain toxic chemicals, such as mercury or PBDEs, and these toxic products are combined with a plethora of other are producing chemicals, which eventually impact public health and the environment. We live in a time of throw-away consumerism- a time when companies one time use DVDs so that consumers don't have to deal with the "hassle" of renting and returning. The waste stream grows in volume and toxicity because corporations continue to profit by producing seemingly useless products, and they are not pressured to prioritize recycling, reuse, or substitute less toxic alternatives in their ingredients. The alternate designs are then analyzed and evaluated to obtain the expected output.

The concepts that were used for the project were:

- Concept 1: Waste Segregator Using Shredder
- Concept 2: Waste segregator Using Metal Sensor
- Concept 3: Waste segregator using Moisture Sensor
- Concept 4: Waste segregator Using Springs
- Concept 5: Design and development of mechanism for waste segregation

The concept 5 was selected because of the cost effectivity and performance of functions.

V. DESIGN AND DRAFTING

Waste consists of metal components, plastics, bottles, paper, and biodegradable materials like vegetable and fruit waste. Wet waste collected can be used to generate energy like biogas. This system intends to separate the waste that is suitable for energy generation.

The main objective of the project is to design and develop a system which could separate metal, plastics, big components, dry and wet waste. Wet waste collected can be used to generate energy like biogas. The waste collected is put in the opening of the system. This is the first stage of the segregation where the magnets are placed on the metal separating plate. Magnets attract all the metal particles hence separating metal from the waste. Metal waste gets stuck to the metal separating plate due to the magnetic field. 100x100 mm opening restricts all the materials like bottles glass etc. hence all the materials bigger in size is collected in the first stage itself so that they can be expelled out. Metal, glass, plastic bottles and other components which are bigger in size is separated in the first stage itself. Segregated waste moves into the second stage of segregation where the light and dry particles are sucked using a suction pump leaving wet waste behind. Once the dry waste is removed out leaving behind only the wet waste (generally biodegradable waste), the dry waste separator plate is rotated so that the wet waste is sent for energy production/ biogas chamber for generation of biogas. There is a switch when pressed, the plate rotates emptying the waste to the collector. Plate is rotated with the help of motor. This plate can be even programmed, like every time the system gets full, the plate rotates. This can be done using a load cell detecting the weight of the system. Once the weight increases beyond the threshold weight, the plate rotates emptying the waste to the collector. In this system, having said that the wet waste gets into energy conversion chamber, we have just created a storage tank that would collect the waste. This could be even developed with a channel to the chamber. In this system we are using a manual suction pump to suck the dry waste. It is only to ensure that the all the dry particles are collected. This can be even done automated, but we need to have a higher suction pump which would add to the cost. The big materials collected in the first stage like bottles paper etc., can be sent for recycling.

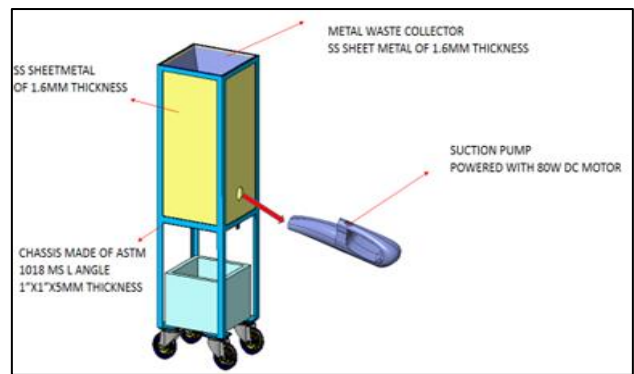
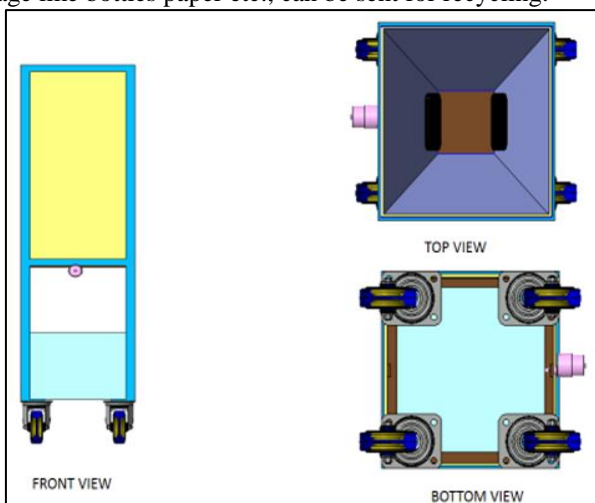


Fig. 1: Design and Drafting

VI. TESTING

Testing is the process of evaluating a system or a component with the intent to find whether it satisfies the specified requirement or not. The testing has been carried out once the prototype has been fabricated. The prototype has been tested at every stage during the fabrication.

The magnets were first tested to check the attraction capacity, the four magnets attracted the metallic wastes. The model was then tested to check the efficiency of segregating dry and wet waste. The dry waste was pulled out using vacuum and the wet waste collected on the plate was rotated and collected in a bin. The plate was fixed to a motor running at 60 rpm and then collected to a battery.

A. Material Properties

- ASTM mild steel 1018 l angle 1"x1"x5mm thickness
- Density- 7.87 g/cm³
- Yield strength- 370mpa
- Modulus of elasticity-205gpa
- Motor specification: 12v 84w 5kgcm torque, 60 rpm
- Battery specification: 12v 7ah

VII. RESULTS AND DISCUSSION

A. Application

- This apparatus can be used in every house to segregate the waste.
- This can be even used in industries to separate the waste and use it for generation of power

B. Advantages

- This device can separate dry, metal and wet waste easily.
- This is very cost effective and compact
- This device overcomes the problem of separating the wet and dry waste.

C. Limitations

- The magnets used do not attract aluminium, copper, lead (minority waste)
- The sucking of dry waste needs to be manually operated through a hose
- The dry waste that are sucked into the vacuum pump, needs to be removed manually.
- The movement of the plate is manually operated via switch.
- Lastly, this mechanism aims at achieving only 50% efficiency.

VIII. CONCLUSION AND SCOPE FOR FUTURE WORK

The prototype has been designed and fabricated according to the design and it is functioning as desired. By developing this apparatus and using this, waste is no more waste. There is a huge potential of generating power.

The wet waste collected can be channelized into a decomposer, which can be then used to generate biogas. The dry waste can be used to form briquettes to generate energy. Dry waste like plastic bottles, metal pieces can be recycled. Every household can generate power within the house with ease. There is a huge potential to generate electricity if the waste is segregated. Large industries could be set to generate electricity from waste. Every household can sell the waste than waste is actually no more waste.

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