

# DESIGN AND FABRICATION OF CRUSHER MACHINE FOR PLASTIC WASTES

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**Abstract** - The paper is about design of a Plastic Bottle Crusher which would help to crush the used Plastic bottles and would thereby help in waste management and disposal. This project aims to design a portable Plastic Bottle crusher that could be installed anywhere and would aid crush of used bottles. This project involves the process of designing the crusher considering forces required for crushing and ergonomic factor that an operator needs. The design of this machine is such that it would require optimum load to crush bottles and will thus not strain the user or operator. After the completion of design process, it could be manufactured and transformed into a Recycle aid able machine. The crusher thus would help in recycling plastic waste. It would also help in reducing the volume of waste generated and will thus help in effective waste management. The crushing of used water bottles will also ensure that the bottles are no used beyond the shelf life of its plastic. Therefore this project will prove to be a useful asset in many ways.

**Index Terms** - Bottle Crusher, Can Crusher, Crusher, Crusher Design, Jaw Crusher

## I. INTRODUCTION

Plastic recycling is the process of recovering scrap or waste plastic and reprocessing the material into useful products. Since plastic is non-biodegradable, recycling is a part of global efforts to reduce plastic in the waste stream, especially the approximately eight million metric tons of waste plastic that enter the Earth's ocean every year. This helps to reduce the high rates of plastic pollution.

Plastic recycling includes taking any type of plastic sorting it into different polymers and then chipping it and then melting it down into pellets after this stage it can then be used to make items of any kind such as plastic chairs and tables. Soft Plastics are also recycled such as polyethylene film and bags.

The project is about design of a Plastic Bottle Crusher which would help to crush the used Plastic bottles and would thereby help in waste management and disposal. A crusher is a machine designed to reduce large solid material objects into a smaller volume, or smaller pieces. Crushers may be used to reduce the size, or change the form, of materials so they can be more easily and efficiently used in the purpose intended to. Crushing is the process of transferring a force amplified by mechanical advantage through a material made of molecules that bond together more strongly, and resist deformation more, than those in the material being crushed do. Crushing devices hold material between two parallel or tangent solid surfaces, and apply sufficient force to bring the surfaces together to generate enough energy within the material being crushed so that its molecules separate or change alignment in relation to each other. The equipment mainly includes the cutting machine and the crushing machine, whose basic

principle is to destroy the material's integrity depend on the shear strength and the impact strength.

### a. Statement of Problem

Today most of the world's plastic waste still goes to landfill. Plastic waste disposal is one of the cumbersome process which is very less efficient. In most of the functions, parties, events etc, water has been served in bottles of different sizes. These used bottles occupy very large disposal space which usually overflows the dustbins provided at these places and are mostly goes to landfill. Used Plastic bags, pieces of plastic sheets and bottles of diverse sizes, colors and textures are found flying around freely, scattered in the streets, swimming in the gutters, posing a serious environmental threat. These keep the environment dirty and cause blockages to our sewer system. Several attempts were made to discourage plastic bags and other plastic products but yield no result due to its versatility in daily use. Nowadays the trucks are overloaded with plastic wastes especially bottles which leads to accidents causing severe casualties.



Fig -1: Overloading of plastic wastes

### b. Objective of Project

The objective of the project is to

1. Conceptualize the idea of crushing the waste plastic material and packing
2. To reduce the carriage problem
3. To fabricate and test the prototype.

**c. Scope of Project**

The scope of the project is to reduce the space consumed in trucks so that more plastic wastes can be transported without overloading the vehicle. This helps in reducing accidents. It can also be applied in housekeeping techniques. The crushing of used water bottles will also ensure that the bottles are no used beyond the shelf life of its plastic. The crusher will help in managing and recycling plastic waste. It would also help in reducing the volume of waste generated and will thus help in effective waste management.

**II. LITERATURE SURVEY**

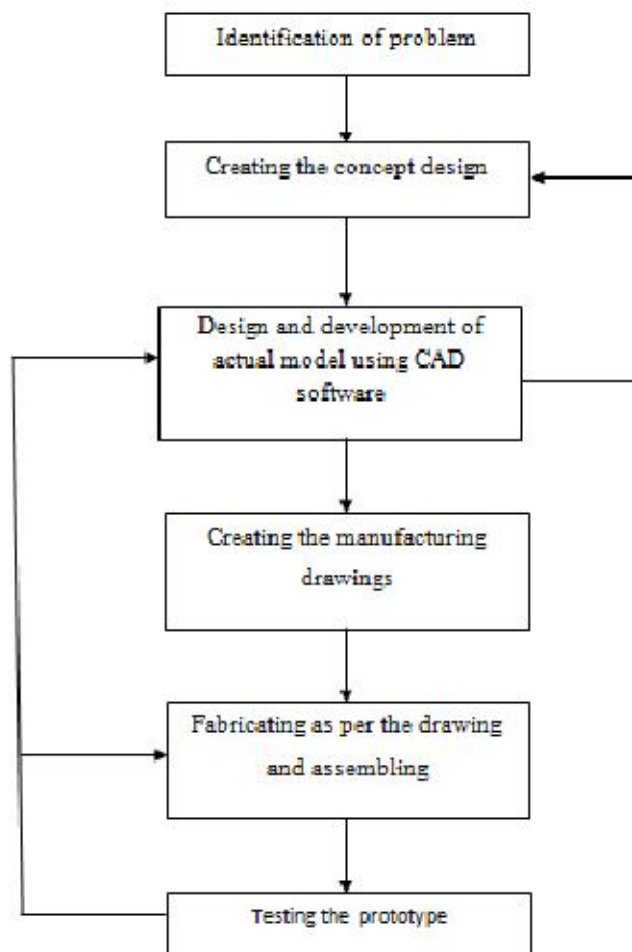
Yeshwant M. Sonkhaskar, Amit Choubey, Amritpal Bhamra, Raghav Singhal, Anurag Sahu and et al., Has been explained about design of a Plastic Bottle Crusher which would help to crush the used Plastic bottles and would thereby help in waste management

and disposal. This project aims to design a portable Plastic Bottle crusher that could be installed anywhere and would aid crush of used bottles.

Dr Muhammad Maqbool Sadiq, Muhammad Rafique Khattak and et al., Plastic waste is silent threat to the environment and their disposal is a serious issue for waste managers. Now a day society does not have any alternative to plastic products like plastic bags, plastic bottles, and plastic sheets etc. In spite of all efforts made to limit its use but unfortunately its utility is increasing day by day. To circumvent this issue many efforts were made in the past to reuse the plastic waste but no significant results were achieved. Zainab Z. Ismail et al. They have conducted comprehensive study based on large number of experiments and tests in order to determine the feasibility of reusing plastic sand as partial replacement of fine aggregate in concrete.

Youcef Ghernouti et al. The study present the partial replacement of fine aggregate in concrete by using plastic fine aggregate obtained from the crushing of waste plastic bags. Plastic bags waste was heated followed by cooling of liquid waste which was then cooled and crushed to obtained plastic sand having finesse modulus of 4.7.

**III. METHODOLOGY**



**Fig -2: Block Diagram of Methodology**

#### a. Problem Identification

The existing crushers are heavy ones and these crushers are excessively used for crushing materials at big industries and manufacturing plants for crushing cars, stones, metal components etc., Moreover, these crushers are hydraulically and pneumatically operated and are feasible if very high amount of crushing forces are required for crushing a material. The operating costs of these crushers are very high as it requires continuous power, continuous maintenance as this involves hydraulic fluid or compressors kits etc., these type of high end crushers are not necessary for small recycling plants and is not affordable to many people. It requires proper maintenance as the hydraulic fluid needs to be changed constantly on time basis. It also requires skilled labor for operation.

#### b. Concept Development

We have come up with a concept of designing a crusher in such a way that even a layman can operate it. The manufacturing cost as well as the maintenance cost is very less as compared to that of hydraulic machines. This crusher can crush the waste effectively and also the operating time is very less as compared to the existing ones. This crusher would best suit the small recycling plants and small industries. The maintenance and manufacturing cost is less since it does not use hydraulic or pneumatic fluids.

#### c. Detail Design with Fabrication Drawings

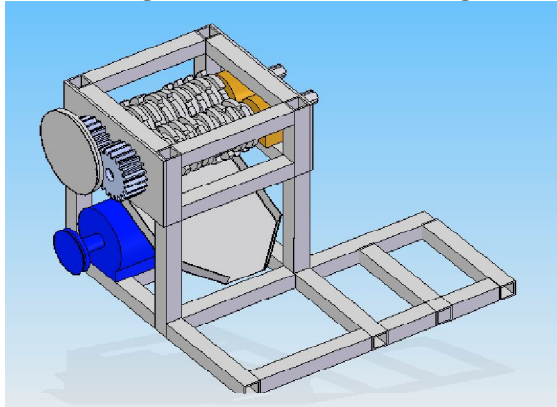


Fig -3: CAD Model

The design of the project was prepared using a CAD model. Each part of the model was prepared in Solid Edge and then assembled as shown in Fig-3.

#### d. Fabrication Procedure

After the design was created the fabrication of the model was done as per the design. The motor is mounted at the bottom which is a driving member which drives the pulley by means of a V belt. The pulley drives the shaft mounted with cutters which performs the crushing action

#### e. Testing the Prototype

After the fabrication of model was completed the prototype was tested by feeding the plastic bottles. The bottles got crushed and the design was successful.

### IV. PROTOTYPING AND TESTING



Fig -4: Actual Working Model

We faced many challenges while fabricating the model. 0.25HP motor was used initially in order to reduce the costs but the power was not sufficient enough to crush the plastic bottles. Due to insufficient power the machine would also get jammed and would stop working. In order to make the model crush the plastic bottles we used a motor of higher power i.e., 0.5HP. Later the machine started to crush the plastic bottles easily. The plastic bottles are fed from the top where the crusher crushes the plastic bottles. After getting crushed they come out through a sliding tray.

### CONCLUSION

#### a. Environmental Impact

Waste is now a global problem, and one that must be addressed in order to solve the world's resource and energy challenges. Plastics are made from limited resources such as petroleum and huge advances are being made in the development of technologies to recycle plastic waste among other resources. To recycle the plastic one has to collect it and transport it to recycling center. It is necessary to transport a huge volume of plastic at once by shredding them into pieces. Our machine helps in increasing the volume of transportation by reducing the volume of plastic bottles by shredding them into pieces. This helps in reducing the emissions at the time of transportation and also used to recycle plastic wastes.

#### b. Human Safety Aspects

Shredding the plastic by human interference is very dangerous as it can damage or hurt the humans while shredding the plastics into pieces. It is necessary to develop a plastic bottle shredding machine. This will help in shredding the plastic bottles into pieces with the help of cutters and motor. This prevents

dangerous situation which could happen with human interference.

**c. Ethical Practices**

Ethical practices are very essential while executing the projects. One has to take the responsibility to develop a product. The product has to be developed by considering various criteria like forces, power required, materials etc. Detail knowledge about technical aspects is necessary while developing the model.

**d. Costs Consideration**

It is very important to consider the final cost of any newly developed products. In cost consideration one has to consider the cost of both the material and manufacturing. The product should be developed using low cost, high strength materials and should also be light in weight. By considering these criteria

the machine can absorb vibrations due to high strength, portable due to light weight and affordable for all class of people because of low cost.

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