



Design And Fabrication of Medical Waste Disposal Machine

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Abstract— Personal protective equipment has become an important and emotive subject during the current corona virus (COVID -19) epidemic. Personal protective equipment (PPE) is a current hot topic – probably the most talked about and emotive subjects for front line healthcare staff working with patients with corona virus disease (COVID-19), A PPE shredding machine is designed to reduce large PPE kit material objects into a smaller volume, or smaller pieces. Also, we are going to dispose medical waste other than PPE Kit

Keywords— PPE Kit , COVID 19, Shredding machine, Medical Waste, Smaller volume

I. INTRODUCTION

It is not uncommon for personal protection equipment to be used to protect the wearer from dangerous substances. This could be gases, acids, biological contaminants, lead, or any number of other things that can cause people harm. The personal protection equipment is designed to keep these dangerous substances away from the mouth, nose, and skin of the person wearing it. When disposing of the PPE and other medical waste, it is important to take steps to ensure the contaminants aren't released in an area where they could cause harm. The specific method of disposal will depend largely on what type of contamination is involved. For extremely dangerous substances, a hazmat team will have to take custody of the PPE and go through a process tailored to the exact substance. For standard contaminants like, for example, lead, the PPE must be cleaned first to remove this heavy metal. Once properly cleaned, it will be contained and then disposed of properly to avoid the risk of groundwater contamination. Each situation will have a different set of standards, which is why it is important for safety managers to keep up to date with the latest OSHA standards in this area. The whole world today is facing an enormous increase in plastic waste pollution caused by the emergence of the COVID – 19 pandemic. A complex chemical composition of personal protective equipment (PPE) mainly containing polypropylene (PP) complicates the recycling process, and it could take at least 450 years to degrade. Plastic pollution was already one of the greatest threats to our planet before the coronavirus outbreak. Disposal of millions of contaminated PPEs would end up as wastes, which, if improperly managed, can generate tonnes of plastic waste and consequently plastic pollution which is a significant threat to oceans and marine life. Eight million tons of plastic waste already end up in the world's oceans every year, and the impact of COVID-19 will only increase those figures.

II. OBJECTIVE

1. Build a functioning PPE disposal Shredding machine for PPE kit and other medical waste.
2. Redevelop the shredder to improve performance, output quality, assembly and user-friendliness, after testing of the machine.
3. If possible, rebuild the machine with the new improvements.
4. Minimize building cost.
5. Reducing the floor space required

III. METHODOLOGY

1. We started the work of this project with literature survey. We gathered many research papers which are relevant to this topic. After going through these papers, we learnt about disposal.
2. After that the components which are required for our project are decided.
3. After deciding the components, the 3 D Model and drafting had been done with the help of CATIA software.
4. The testing will be carried out and then the result and conclusion will be drawn.

IV. COMPONENTS

After learning about the medical disposal we had decided the components to be used in the machine, Components of machines are as follows

1. *PPE Kit*

Personal protective equipment (PPE) is protective clothing, helmets, goggles, or other garments or equipment designed to protect the wearer's body from injury or infection. The hazards addressed by protective equipment include physical, electrical, heat, chemicals, biohazards, and airborne particulate matter. Protective equipment may be worn for job-related occupational safety and health purposes, as well as for sports and other recreational activities. "Protective clothing" is applied to traditional categories of clothing, and "protective gear" applies to items such as pads, guards, shields, or masks, and others.

2. *Plastic Shredder*

It is a machine used for cutting the plastic in small pieces to make waste management easier. We are making this project model for recycling of plastic wastage in domestic area, industries etc. In these areas the plastic waste is present in large quantity, but the available machines used to recycle this waste are very costly.

3. *Motor*

An electric motor is an electrical machine that converts electrical energy into mechanical energy. Most electric motors operate through the interaction between the motor's magnetic field and electric current in a wire winding to generate force in the form of torque applied on the motor's shaft. Electric motors can be powered by direct current (DC) sources, such as from batteries, or rectifiers, or by alternating current (AC) sources, such as a power grid, inverters or electrical generators. An electric generator is mechanically identical to an electric motor, but operates with a reversed flow of power, converting mechanical energy into electrical energy.

4. *Hopper*

A hopper is a large, pyramidal or cone shaped container used in industrial processes to hold particulate matter or flow-able material of any sort, like dust, gravel, nuts, seeds etc. and can then dispense these from the bottom when needed.

V. DESIGN OF CAD MODEL

There are various softwares available in market but for the design of this model we have used CATIA V5 software, first we have drafted the model on CATIA V5 and made a 3D model of the machine.

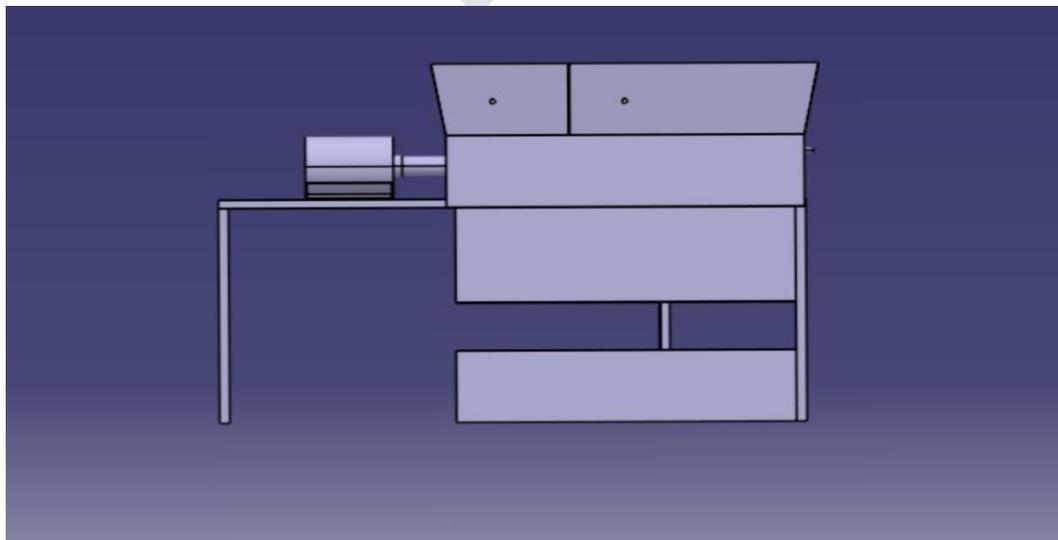


Fig. 1 Front View of Machine

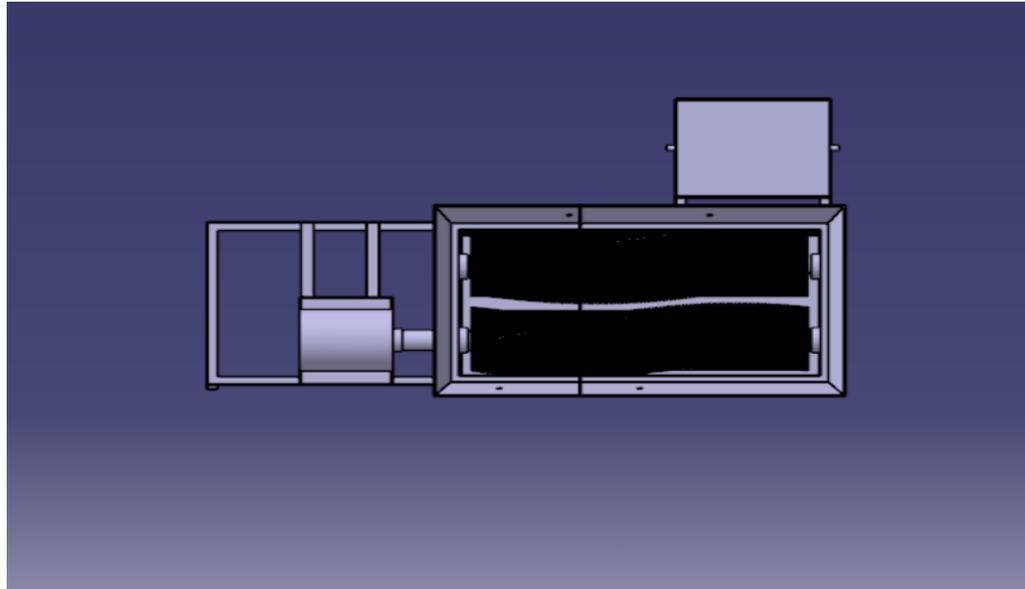


Fig. 2 Top View of Machine

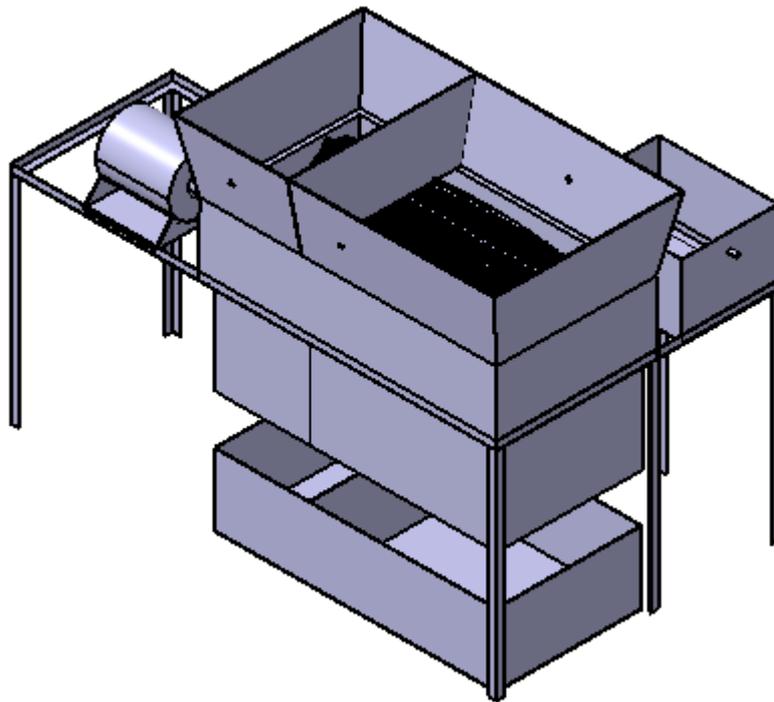


Fig. 3 CAD model of Machine

TABLE 1
MATERIAL SELECTION

Sr No.	Description	Materials
1	Shredder Blades	Mild Steel
2	Shaft	Carbon C11 Grade
3	Electric Motor	12V 2A (60 RPM)
4	Structural Frame	Mild Steel
5	Hopper	Mild Steel Sheet

Working Model

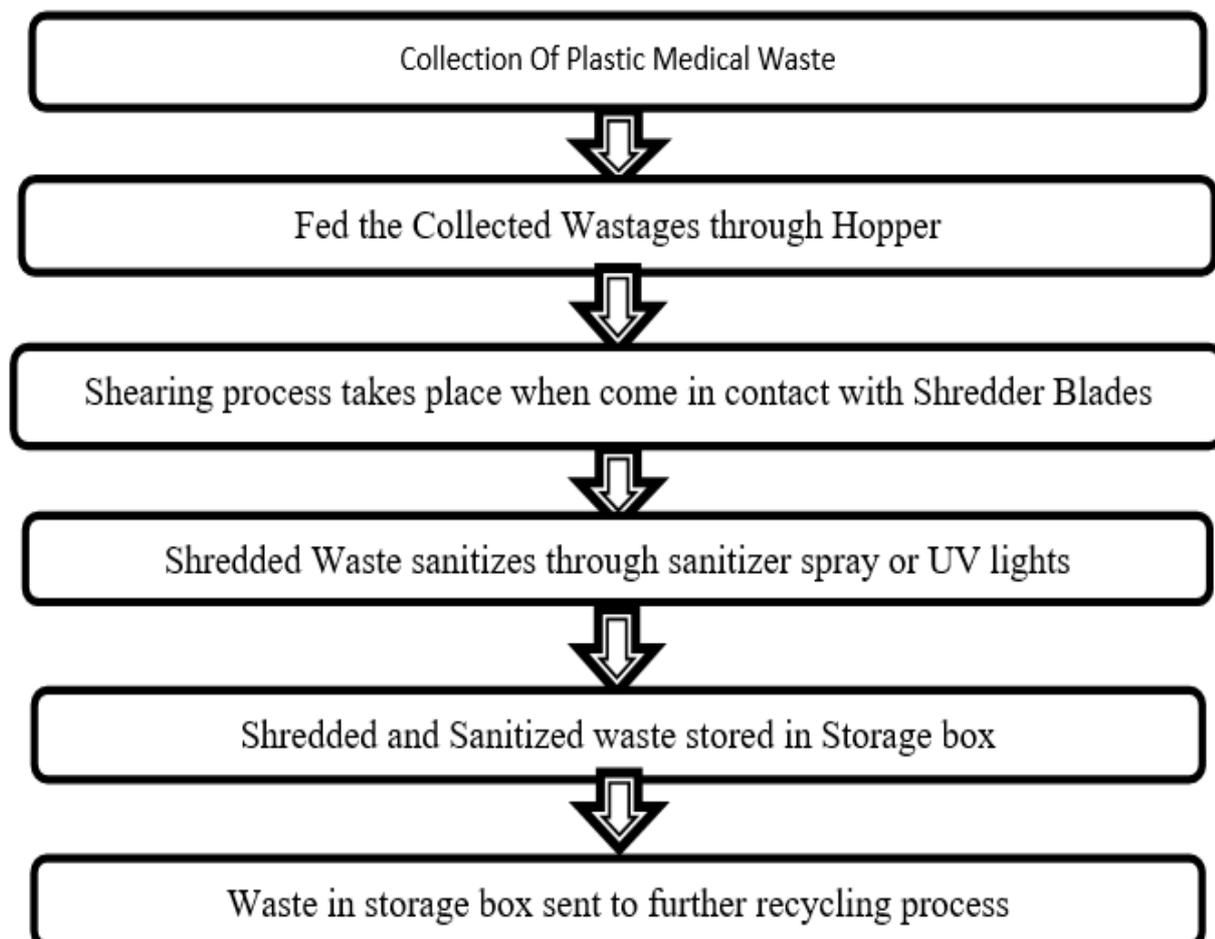


Fig. 4 Working Model of machine

Fabrication Techniques

Following operations were while fabricate the project

1. Cutting

Fig. 5 Cutting Operation

Cutting is the separation or opening of a physical object, into two or more portions, through the application of an acutely directed force. Implements commonly used for cutting are the knife and saw, or in medicine and science the scalpel and microtome. However, any sufficiently sharp object is capable of cutting if it has a hardness sufficiently larger than the object being cut, and if it is applied with sufficient force. Even liquids can be used to cut things when applied with sufficient force (see water jet cutter). The material as our required size. The machine used for this operation is power chop saw. A power chop saw, also known as a drop saw, is a power tool used to make a quick, accurate crosscut in a work piece at a selected angle. Common uses include framing operations and the cutting of moulding. Most chop saws are relatively small and portable, with common blade sizes ranging from eight to twelve inches.

2. Drilling

Fig. 6 Drilling Operation

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 multi-point. 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 (swarf) from the hole as it is drilled. In rock drilling, the hole is usually not made through a circular cutting motion, though the bit is usually rotated. Instead, the hole is usually made by hammering a drill bit into the hole with quickly repeated short movements. The hammering action can be performed from outside the hole (top-hammer drill) or within the hole (down-the-hole drill, DTH). Drills used for horizontal drilling are called drifter drills. In rare cases, specially-shaped bits are used to cut holes of non-circular cross-section; a square cross-section is possible.

3. Welding



Fig. 7 Welding Operation

Welding is a fabrication or sculptural process that joins materials, usually metals or thermoplastics, by using high heat to melt the parts together and allowing them to cool causing fusion. Welding is distinct from lower temperature metal-joining techniques such as brazing and soldering, which do not melt the base metal.

In addition to melting the base metal, a filler material is typically added to the joint to form a pool of molten material (the weld pool) that cools to form a joint that, based on weld configuration (butt, full penetration, fillet, etc.), can be stronger than the base material (parent metal). Pressure may also be used in conjunction with heat, or by itself, to produce a weld. Welding also requires a form of shield to protect the filler metals or melted metals from being contaminated or oxidized.

Square pipes of different lengths to make frame. The machine used for this operation is electric arc welding. Electrical arc welding is the procedure used to join two metal parts, taking advantage of the heat developed by the electric arc that forms between an electrode (metal filler) and the material to be welded. The welding arc may be powered by an alternating current generator machine (welder). This welding machine is basically a single-phase static transformer suitable for melting RUTILE (sliding) acid electrodes. Alkaline electrodes may also be melted by alternating current if the secondary open-circuit voltage is greater than 70 V. The welding current is continuously regulated (magnetic dispersion) by turning the hand wheel on the outside of the machine, which makes it possible to select the current value, indicated on a special graded scale, with the utmost precision. To prevent the service capacities from being exceeded, all of our machines are fitted with an automatic overload protection which cuts off the power supply (intermittent use) in the event of an overload.

VI. CONCLUSIONS

The shredder of the Medical Waste shredding machine should be able to cut all the PPE kit material and medical waste including plastic. The knowledge of all the research papers are to be incorporated within the prototype. All the pros are to be put to maximum and testing have to be conducted to make sure there is no contamination of PPE kit waste and medical waste outside the machine to ensure the safety of an individual. All the parts should be durable and of above average quality as it will be running carrying contaminated waste.

VII. FUTURE SCOPE

1. By increasing the cutting speed, the efficiency can be increased. Also, by using more number of cutter blades the output efficiency & productivity can be increased.
2. The machine can be made movable in the Hospital by providing wheels of tire to it which can move more freely without any problem in the Hospital.
3. Finite Element Analysis of all components of machine will be done. also, any other issues coming while handling the machine will be eliminated thoroughly.
4. In Future certain design changes will be done according to commercialisation of project.

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