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Design and Fabrication of Domestic Non Biodegradable Waste Material Recycling Unit

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ABSTRACT: One of the largest environmental problems is the widespread usage of plastics. Only 10% of plastic garbage is recycled, with the remaining 12% being burned. The remainder is disposed of in the environment, which harms wildlife, habitat, people, land, waterways, and oceans. They are also disposed of in seas, rivers, oceans, and landfills, among other places. Therefore, recycling plastic garbage is the only and best option. By doing so, resources can be conserved as well as environmental carbon emissions. As a result, many plastic recycling facilities are created. In the present work for proper and efficient functioning of plastic recycling unit and avoid manual work, small shredder machine is fabricated which consist of Hopper, shredder blade, control unit, frame, spur gear, tray and induction motor.

KEYWORDS: HDPE, Mechanical recycling, Plastic recycling, Shredder machine, Solid edge.

I. INTRODUCTION

Shredder machine is critical part of Food Grade Plastic recycling unit comprises of a shredder blade, motor, gear box and AC connection machine and a shredder machine which is used to reduce the amount of dumping and burning of HDP. In this unit, HDP shredded into small pieces as the large particles of plastic need to be broken down into small pieces to melt easily and reduce storage. If large HDP poured immediately after cleaning, chance of malfunction or struck of plastic recycling unit might be occurred. In order to avoid manual work, malfunctioning of plastic recycling unit, economically small shredding machining is developed with a minimum number of spare parts.

II. IMPORTANCE OF SHREDDING UNIT FOR RECYCLING HDPE

Recycling is one of the most important strategies now available to decrease environmental effects, and it also represents one of the most dynamic markets for plastics today. There are opportunities to reduce the amount of waste that must be disposed of, carbon dioxide emissions, and oil use by recycling. Depending on the kind and use of the plastic, different recycling techniques and recycling volumes vary regionally. Recycling of packaging materials has quickly increased in a number of countries over the last few decades. Improvements in technology and procedures for the collection, sorting, and reprocessing of recyclable plastics are opening up new prospects for recycling thanks to the collaborative efforts of the general people, industry, and governments. Recycling plastics is one technique to reduce the impact on the environment and resource depletion. Fundamentally, high recycling rates allow for the production of a given level of product or service with less material input than would otherwise be required. Reduction in use, reuse, repair, and re-manufacturing all fit within this category. By using less energy and resources per unit of output, recycling can consequently increase eco-efficiency. Recycling is using materials that have already entered the garbage stream to make new products. The terminology for recycling plastics is complex and occasionally perplexing due to the wide variety of recycling and recovery processes. These can be divided into four groups: quaternary (recovery of quaternary materials), tertiary (recovery of chemical constituents), secondary (mechanical reprocessing into products requiring fewer qualities), and primary (mechanical reprocessing into a product with equivalent features) (recovery of energy). Primary recycling is frequently referred to as "closed-loop recycling," and secondary recycling is referred to as "degrading". Tertiary is recycling, also known as chemical recycling or feedstock recycling, is the process of de-polymerizing a polymer to its chemical constituent. Energy recovery, energy from trash, and valorization are all forms

of quaternary recycling various methods recycling as shown in Table 1. So, various literatures are reviewed to study the process of recycling.

Kalpana Patil [1] studied Recycling is a topic that has been hotly contested for many years. There are two perspectives on this matter. The argument in favor of recycling focuses on the harm that garbage and emissions do to the environment. The argument in opposition is that recycling involves higher expenditures than it generates in revenue. Despite being one of the nation's greatest industrial cities and receiving increasing attention for its role in the release of greenhouse gases from industry and the waste system, it only recycles 5% of its plastic garbage. This is a crucial issue because pollution levels are high and efforts must be made to regulate them by all departments.

Vannessa Goodship [2] they flow and melt when heated, and then solidifies when cooled. A thermoplastic material must be remelted in order to be processed again because this heating and cooling cycle can be done numerous times. Large volumes of HDPE, LDPE, PP, and PS materials are utilised to manufacture a variety of consumer goods, including lids, carrying bags, and fast food packaging. With carbonated, PET is employed. Shoes, bottles, and flooring are all made of PVC. Thermosets cannot be re-melted and instead breakdown after being processed by initial melting in a way similar to that of thermoplastics. This is due to the chemical cross-linking that occurs during the curing process.

Milivoje M. Kostic et al. [3] Dies with an annular die outlet are used to create both pipe and tubing. A pipe product is one that has an outer diameter more than 1 in. and a tube diameter less than 1 in. These goods' dies come in two varieties: 1) Linear deaths (also called spider dies).

S M Al-Salem et al. [4] Regardless of a society's understanding of sustainability and technical advancements, plastic solid waste (PSW) poses challenges and opportunities. This study reviews current developments in PSW recycling and recovery. The waste produced from polyolefin sources, which make up a significant portion of the plastic products we use every day and have a single life cycle, is given specific attention. The primary (re-extrusion), secondary (mechanical), tertiary (chemical), and quaternary (energy recovery) methods and technologies for the four PSW treatment paths are covered in detail and addressed. Primary recycling, which entails the re-injection of clean scrap from a single polymer into the extrusion cycle to create products of the same material, is frequently used in the processing line itself but is rarely used by recyclers as recycling materials rarely possess the same properties as primary waste.

Kusekar S.K et al. [5] Compound die enable us to make large quantities of components. We can boost production with automation and multi-stage heating coils. The findings above directly contradict the notion that businesses may further cut these low production costs through recycling. Anh T. M. Le et al. [6] There are many various technologies that can offer a very high efficiency and quick heating time for the oven's heating process, including microwave, heating element, inductor, and infrared. However, each system has unique drawbacks that impact how plastic is heated during recycling.

III. METHODOLOGY

One of the biggest problems our country is dealing with is plastic pollution. Given that it hurts not just humans and animals but also the ecosystem, we have picked it as our subject. In order to develop this topic, a literature review was conducted, and it was found that single-use plastics account for a significant portion of the plastic waste that accumulates. Single-use plastics have high mechanical properties, which make them slow to decompose, and they also emit harmful fumes when burned. After taking everything into account, it was determined that the optimum method for reducing plastic pollution is mechanical recycling of waste plastic. In order to achieve the best results, it is known from the literature described above that the homogeneity of the recycled plastic must be maintained. It is also recommended that the collected plastic be sorted and cleaned. When plastic is recycled, contaminants and cross contamination may cause the material's qualities to deteriorate and generate hazardous gases. According to a field study on plastic trash generation done in the villages of Innoli, Pavor, and Gramachaavadi, these villages create roughly 2 tons of HDPE waste. An industrial visit to the Baikampaddy industrial region was conducted to evaluate the mechanical shredding process. The limits of carrying out mechanical shredding were discovered, as shredding equipment demands vast installation spaces and are expensive for villages to produce or buy. So, the main goal of the design of the shredder unit was to make the recycling unit inexpensive while also reducing its overall size. To do this, a straightforward mechanical process was added to prevent difficulties, cut costs, and maintain the machine's operational safety. Finally, an inexpensive, portable, and reliable shredder device for high density plastic was created.



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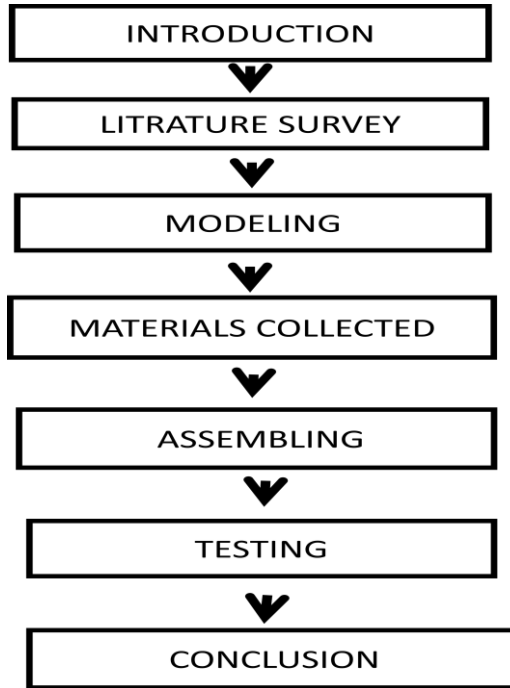


Figure 3.1 Flow Chart

IV. DESIGN

The concept model designing is an important part before fabricating a product. A Small, fully working, robust Shredder Machine was designed with the help of Solid Edge designing software. The 3D assembled machine model is shown in Fig

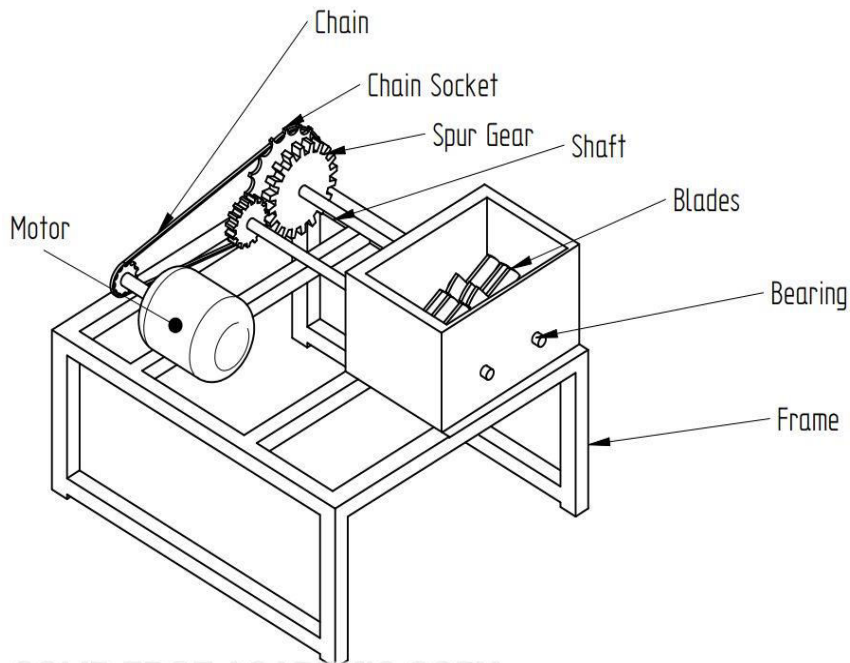


Figure 4.1 3D model



Figure 4.2 design of shredder machine.

V. CONCLUSION

According to cost and safety considerations, the design and fabrication shredder unit was optimized, as illustrated in Fig. 4. With no sacrifice to machine quality, only a few mechanical components are used in the design. Reduced material and machining costs due to integrated die. The produced machine is reliable and simple to install. The successful fabrication and installation to cut High density plastic. Manual cutting of HDPE will avoid for villagers and it also plays critical role in mal functioning of plastic recycling unit.

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