
Towards The Design of A Plastic Extruder For Melting Shredded Selected Plastic Waste on A Continuous Uniform Constrain

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ABSTRACT

Plastic materials are useful for a variety of purposes and therefore demands optimized and effective production sequence to ensure their availability. In this paper, we set out the design approach and propose the development of a plastic extrusion machine. Our intention is to design a machine with the capabilities to perform the melting of the shredded selected plastic waste on a continuous uniform constrain with the aid of an electric motor coupled with a transmission gear in controlling and transmitting the motion force produced by the motor. We reviewed related works, chronicled several extrusion machines, provided our working principle frameworks, research directions as well as design concepts. Further efforts on the design and fabrication was reported and future modification was recommended.

Keywords: Thermoplastics, Polymer, Extrusion, Design, Plastics, Materials, Availability, Production

Aims Research Journal Reference Format:

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1. INTRODUCTION

Extrusion as a polymer processing technology first emerged at the start of the nineteenth century. The screw press was created by Mc Pearson in 1818. With the growth of the rubber sector, that significantly improved. In 1820, Thomas Hancock created a device that recycled rubber items by using gears. Edwin Caffé improved the device. Rubber vulcanization was created in 1833 by Charles Good-year. The screw extruder, developed by Matthew Gray in 1879, completely changed the polymer industry. The twin screw extruder was invented by Roberto Colombo. Plastic pollutants produced by the human beings causes harms to other living beings and environments. The ratio of amount of plastic recycled to the amount of plastic produced is very less. This work is about the Design and Fabrication of Plastic Extrusion Machine. It consists of components like hopper, screw, barrel, die and mould.

The hopper, which is moved by a spinning screw driven by a motor, is fed with the recyclable plastic. The plastic is heated outside by the band heaters, which melts it before it passes through the die. To get the desired result and prevent melted plastic from adhering to the barrel, the necessary temperature must be set. Utilizing two distinct plastics could result in a combination of both. Therefore, it is crucial to keep the temperature constant during the procedure.

- Plastic extrusion process is an assembling procedure where waste plastic is melted and shaped into a constant hot rolled structure, like, deck, mesh wires, wire protection and deck.
- A certain kind of plastic resin is melted, processed and re-melted in order for this procedure to work. The resins often arrive in the form of beads or pellets, allowing for usage in extrusion equipment. The machine receives the thermoplastic beads after they pass through a hopper.



Figure 1: Plastic Waste

1.1 ClassificationOf Polymers

Thermoplastics: Thermoplastic polymers are the plastic material that can be melted and softened on heating and can be set again to preferred shapes when cooled. Example: Polyethylene, Polyesters, PVC, poly acrylics, Polypropylene, Nylon, Polystyrene Celluloses, Polyamides.



Figure 2: Material Made From Thermoplastic

THERMOSETTING PLASTICS: Thermosetting plastics are long chains of cross-linked molecules. The rigidity of this structure is high. These plastics cannot be reshaped on heating, also hardens on heating.



Figure 3: Material Made from Thermosetting Plastic

1.2 Problem Statement

One of the main causes of environmental issues is plastics. Although, plastic is widely used in our daily lives, it is difficult to dispose and usually takes up a lot of space. The ability to recycle plastic, however, is its main benefit. Although, it has several drawbacks, many industries, including those in the automotive, packaging, medical, etc., employ it because it is convenient to use and easier and less expensive to produce. Given the demand for plastic in numerous applications, the need for design and fabrication of plastic extruder is intensified to reduce pollution and also enhance the major requirement usage of our daily needs, also counterbalance economical rate relating to materials selection purchase.

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1.3 Aim and Objectives

Aim

The aim of this work is to design and fabricate a plastic extrusion machine

Objectives

The following are the objectives of the project

1. To design a plastic extrusion machine with improve efficiency
2. To increase productivity with less cost since plastic waste servers as the materials require
3. To find a feasible solution, in reduction of pollution problem in the environment by the plastic waste.
4. To understand the basic processes involve in Plastic Extrusion Process

1.4 Scope and Limitation of the Study

The scope of this project generally is getting all the necessary materials needed for the construction of this project which includes mild carbon steel, cast iron rubber and other materials included in chapter three. This Plastic Extrusion Machine is limited to one finished molding pattern. The extruded melted plastic is expected to cool in a 30cm long and 5cm by 5cm square pipe.

1.5 Justification of The Study

The following are the justification of the study

1. To create an incentive motive for other researchers who tends to know more on this study and also be used for non-researchers to build more on their research work.
2. Collection of plastic waste materials and reuse, thus reducing pollution
3. To increase productivity
4. Highly preferable due to their price value, availability and properties

2. RELATED WORKS

An article on PLASTIC FIBERS by Charles & Walter (1959).

The system of this turn of events demonstrates how to create ultrafine strands with improved characteristics, properties, and applications by separating a mixture of at least two typically solid, frequently incongruent thermoplastic saps to form a composite monofilament with the minor fragment being the pitch material from which the super fine fibers are outlined, and the many tar portion being dissolved out with a dissolvable during which the minor part is dissolved. The thermoplastic coverings that could be applied in the current development join all of the conventional solid fiber - outlining saps from which typical size strands for usage in the material and paper ventures could be delivered by conventional mollify ejection assignments.

EXTRUDED PLASTIC WASTE by Mark (1988)

According to this research, the framed sections are made up of a variety of plastic materials, with a significant portion of the shape component comprising plastic waste particles and contaminating impact particles running there through and entrenched in that. Up to 70% of the formed portion may have plastic waste particles with a stream point above the optimal planning temperature of the body's plastic material. The plastic waste particles have a stream point of very 800°C and a length of less than 6 mm. A portion of the plastic waste particles have dividers that are 0.5 mm thick, while the other fraction of those particles have dividers that are less than 0.5 mm thick. Plasticized plastic material particles are combined with contaminations, waste plastic, and planned temperatures between 250and 210°C.

Process for creating moulded or extruded objects from waste containing plastic materials byJean-Pierre (2011)

The methods and device proposed in this research allow for the use of garbage including plastic components without causing further pollution. The use of materials that are inactive with regard to disintegration, are properly protected, and can be machined to create items that will be utilized again in industry is another way to recycle such trash.

According to the invention, these items, among others, that will be discussed below, are produced using a method of the above-described kind that includes the following series of steps: a central actual treatment, drying if the water content of the raw materials is greater than typically 8% by weight, preheating to a temperature of 80 to 160 °C., mixing at a temperature of 210 to 250°C., and mixture trim or ejection. The items that have been removed or framed properly satisfy the prerequisites that have just been mentioned; they are also prudent given that they were made from recycled rubbish. In addition, exceptional functioning tests have demonstrated that the initial arrangement of thermoplastic materials was repetitious within the production cycle, which isn't true for other well-known methods, which offer problems when the (PVC) content is excessively good.

EXTRUDED COMPOSITE PROFILES by Joe & Charles (1993).

This development shows that removable composite items that are strong, have beautiful fiber embodiment, and exhibit relevant actual qualities may now be delivered on a regular basis without the need for novel treatments, plasticizers, or the presence of experienced personnel. In a perfect world, the composite materials produced by the method for creation would include polyethylene and, also, between 10 and 15 weight percent polypropylene, along with a messed-up period of amazingly altered cellulosic fibers. The composite materials discovered during this process are crucial for producing manufactured wood goods, such as building materials (housetop shingles, siding, floor tiles, outlining, moldings, essential fragments, steps, entrance and window sills and groups); home and nursery items (producer, containers, scene tiles, decking, outside goods, fencing, and play area equipment); and furniture.

Method and apparatus for recycling plastic waste into a skinny profile” Gary (1992).

This study demonstrates how the improvement relates to a technique and tool for highlighting a removed plastic wood object from a feed stock of combined plastic waste. An extruder bundle and an outlining part are joined by the mechanical as it comes together and expands. The extruder bundle joins a compound extruder that, through a quick advance inside a careful pitch conveyance, packs and melts the waste material. The melt is transferred from the compound extruder into a hot relax extruder that is designed to prevent the breaking up or mixing of the modified gums. The new condensate transport integrates a decreasing pitch along with anything other than a condensed advancement fragment and metering region. Through a cross-head terminate, where a movement of ravings are brought into disintegration, the new relax is then sketched into an ideal profile.

3. OTHER TYPES OF PLASTIC EXTRUSION MACHINE

Plastic trash is gathered for recycling or reuse through the plastic extrusion process. Extruding machine kinds are based on the machine's intended use during design. The following are the other four varieties of plastic extruding equipment:

3.1 Plastic Sheet Extrusion Machine



Plate 1: Plastic Sheet Extruder Machine

This kind of plastic extrusion machine is made to process plastic waste in order to produce molded plastic sheets, typically in the specified size as planned and made.

3.2 Roof Tile Extrusion Machine

The Roof Tile kind of plastic extrusion machine is intended to handle plastic waste in order to produce molded roof tile sheet plastic that is also the specified size and according to plan.



Plate 2: Roof Tile Extruder Machine

3.3 Plastic Pipe Extrusion Machine

The essential factor of Plastic Pipe Extrusion Machine is the ability to process the plastic waste, in other to obtain a molded plastic Pipe, usually in prescribed size as scheduled and designed.

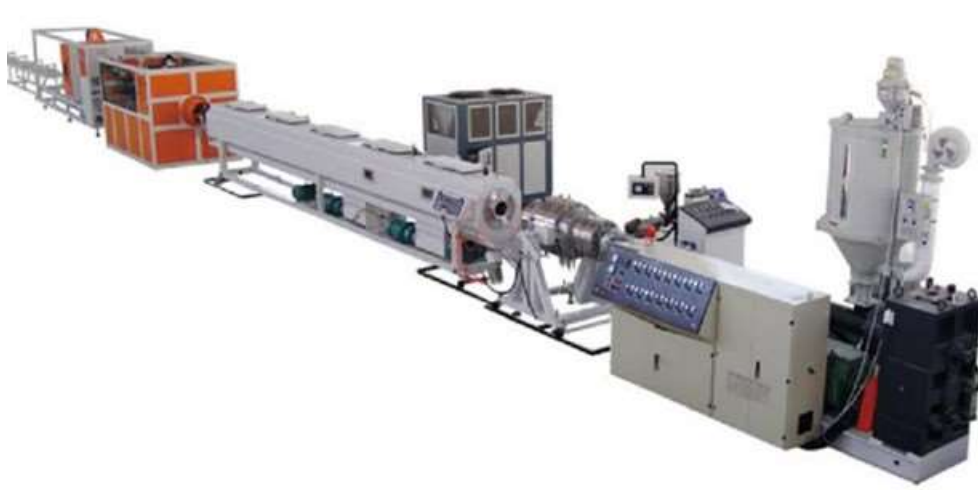


Plate 3: Plastic Pipe extrusion Machine

3.4 Plastic Profile Extrusion Machine

These are plastic waste processing extrusion machines that produce molded plastic profiles used for file storage or tool storage.



Plate 4: Plastic Profile Extrusion Machine

4. WORKING PRINCIPLE

The Plastic Extrusion Machine is proposed to be electrically operated, the machine consist of Electric Motor, a Gear box or transmission box, a transmitting shaft, barrel, a grooved hopper, heating element, nozzle and a control panel. The design of the extruder is very similar to extruders used in the industry. The working principle of this designed extruder is as follows:

The extruder is fed through the hopper with the shredded plastic or the granulate, after which the Shaft transports the plastic shredded material into the barrel by the rotating motion. Due to the heating system the thermoplastic material melts and is forced out on a die, generating a filament with 3 mm diameter cross section. The turning motion of the shaft is ensured by an AC motor that is connected to the driven shaft with a special connector through the reducer. Therefore, melted liquid plastic material is subjected to cool in the 30cm long and 5 x 5cm square pipe, to obtain a solid finished product for further machining process.

4.1 Diagram



Figure 4: Working Principle/Framework

4.2 Design Flow

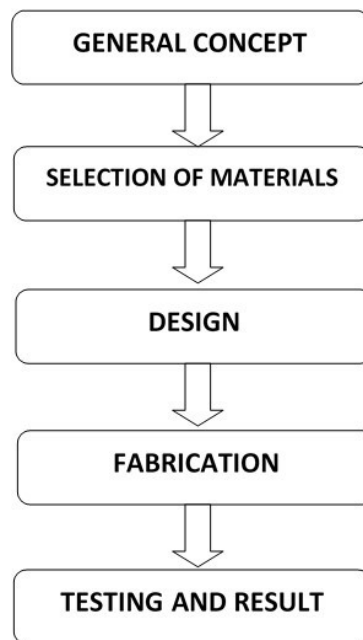


Figure 5: Methodology Flow

5. CONCLUDING REMARKS

We learn about earlier studies, models, and designs that are relevant to our initiatives through past literature. In order to start and develop our project, our design was therefore digitalized using drawing software called AutoCAD. The dimensions was finalized in accordance with the present needs, and materials was chosen following a careful analysis. Fabrication was done according to the planned design and several tests carried out to evaluate the working efficiency of the machine.

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