RECYLING OF WASTE PLASTIC USING EXTRUSION PROCESS

Prashant Kumar[1], Ranjit Kumar Yadav[2], Ravi Kumar[3], Shivangi Maurya[4]
Subodh Chand[5],Sudhir Yadav[6], Prof. (Dr.) V.K. Saini[7]

[1] *UG, Student, Mechanical Department,IMS Engineering College,Ghaziabad,Uttar Pradesh,India*
[2] *UG,Student,Mechanical Department,IMS Engineering College,Ghaziabad,Uttar Pradesh,India*
[3] *UG,Student,Mechanical Department,IMS Engineering College,Ghaziabad,Uttar Pradesh,India*
[4] *UG,Student,Mechanical Department,IMS Engineering College,Ghaziabad,Uttar Pradesh,India*
[5] *UG,Student,Mechanical Department,IMS Engineering College,Ghaziabad,Uttar Pradesh,India*
[6] *UG,Student,Mechanical Department,IMS Engineering College,Ghaziabad,Uttar Pradesh,India*
[7] *Proff.Mechanical Department, IMS Engineering College,Ghaziabad,Uttar Pradesh,India*

ABSTRACT

The main aim of this work is to reduce the plastic waste that is rising in the present world and to achieve this; a system is designed and fabricated incorporating a plastic extruder which plays a prominent part in recycling waste plastic into useful products. This study uses waste plastics and converts them into useful product with the help of an extruder, thereby reducing the plastic waste which is a key factor for environmental pollution. Presently waste plastics are effectively converted into useful materials like coatings of wire pipe, bricks, interlocks, roof tiles, railway sleepers, paving slabs, retaining blocks etc., using either single origin plastic waste material or a mixture of different plastic wastes along with waste rubber powder as filler.

The waste plastics are used to convert it into pellets or powder and this act as raw material. The conversion takes place by forming a homogeneous molten mass in the extruder and forcing it under pressure through an extrusion die orifice that defines the shape of the products cross section. The formed material, or extrudate, is cooled and drawn away from the die exit at a controlled rate. The extrudate can then be wound on a spool, cut to a specified length, or directed into another in-line process.

Keyword: *-Recycling, Density of polymers, Sorting, Washing, Shredding, Shredder, Extruder.*

1. INTRODUCTION

Plastics currently play a massive role in our daily lives. Plastics are utilized in virtually all areas of manufacturing. Tons and tons of plastic products are molded on a daily basis, even as the waste continues to build up. From water bottles, to credit cards, to the dashboard of a car, plastic is often a primary component. Due to the fact that most plastics are not biodegradable, an enormous sum of plastic waste continues to build up worldwide, with industrialized nations contributing the largest amount of plastic waste.

For more than 50 years, global production and consumption of plastics have continued to rise. An estimated 299 million tons of plastics were produced in 2013, representing a 4 percent increase over 2012, and confirming and upward trend over the past years. In 2008, our global plastic consumption worldwide has been estimated at 260 million tons and, according to a 2012 report by Global Industry Analysts, plastic consumption is to reach 297.5 million tons by the end of 2015 [1].

There are three major forms of plastic that contribute to plastic pollution: micro plastics as well as mega- and macro-plastics. Mega- and micro plastics have accumulated in highest densities in the Northern Hemisphere, concentrated around urban centers and water fronts. Plastic can be found off the coast of some islands because of currents carrying the debris. Both mega- and macro-plastics are found in packaging, footwear, and other domestic items that

have been washed off of ships or discarded in landfills. Fishing-related items are more likely to be found around remote islands. These may also be referred to as micro-, meso, and macro debris.

Plastic is now an integral part of the everyday activity of human life and one cannot out rule out the advantages of plastic but the disadvantages can be reduced to some extent if certain tips to deal with plastic waste are followed.

1.1 PLASTIC RECYCLING

Separating the plastic products from the garbage and at home and handling over this plastic for recycling can reduce the impact of environmental pollution due to plastic waste. Plastic recycling industry is now a aprox. 65 billion rupees industry in developed economies. Recycled plastic is usually used for laying down roads in place of bitumen, bottles, benches etc. Buying recycled plastic also helps with plastic management.

2. STAGES IN PLASTIC RECYCLING

Before any plastic waste is recycled, it needs to go through five different stages so that it can be further used for making various types of products.

1. SORTING: It is necessary that every plastic item is separated according to its make and type so that it can be processed accordingly in the shredding machine.

2. WASHING: Once the sorting has been done, the plastic waste needs to be washed properly to remove impurities such as labels and adhesives. This enhances the quality of the finished product.

3. SHREDDING: After washing, the plastic waste is loaded into different conveyer belts that run the waste through the different shredders. These shredders tear up the plastic into small pellets, preparing them for recycling into other products.

3. PLASTIC SHREDDER AND PLASTIC EXTRUDER

3.1 PLASTIC SHREDDER

Plastic Shredder Machine is also called **Plastic Recycling Machine**. It is mainly used to reduce volume of plastics and primarily for recycling. Due to environmental crisis, it is necessary to recycle plastic waste. Hence use of plastic shredder machine in today's scenario is very much essential. This Plastic Shredder Machine can be used to shred plastic waste such as plastic jars, pet bottles, containers, blister packs of medicines, etc.

Waste plastic shredder is a machine that reduces used plastic bottles to smaller particle sizes to enhance its portability, easiness and readiness for use into another new product. The design principle of this machine was got from the ancient tradition method of using scissors to cut materials into reduced form and scratching used by rabbits when digging or tearing. These two traditional methods were applied in the design of the machine by fabricating cutting blades to cut the waste plastic while some of the cutting blades have sharp curved edges to draw-in the plastic into the cutting blades teeth. The waste plastic shredder comprises of four major components, namely; the feeding unit, the shredding unit, the power unit and the machine frame.

3.2 SHREDDING PROCESS

The large particles of plastic need to be broken down into small pieces to reduce storage and transportation space requirement. Such broken down HDPE, PP, and LDPE plastics can be sold as raw material for plastic production without any further processing. On the other hand, it can be re-extruded to produce pellets for plastic manufacturing. For PETE crushing can also be done to reduce the storage space requirement and easy transportation for further processing. A crusher should be used for this purpose and the resultant broken pieces of plastics should be the size

of 2 – 0.5 cm. It is important to prevent mixing of plastic types to maintain the quality and value of the plastic. Mixed crushed plastics can be used only for low value and low quality products such as junction boxes used in electrical work or plastic lumbers. The crusher should comprise of a rotating set of blades, feeding hopper, and motor. The size of the feeder depends on the maximum size of plastic that needs to be crushed.

4. PLASTIC EXTRUDER

Plastic extruders are also extensively used to reprocess recycled plastic waste or other raw materials after cleaning, sorting or blending. This material is commonly extruded into filaments suitable for chopping into the bead or pellet stock to use as a precursor for further processing.

At the front of the barrel, the molten plastic leaves the screw and travels through a screen pack to remove any contaminants in the melt. The screens are reinforced by a breaker plate since the pressure at this point can exceed 34 MPa. The breaker plate assembly also serves to create back pressure in the barrel. Back pressure is required for uniform melting and proper mixing of the polymer, and how much pressure is generated can be "tweaked" by varying screen pack composition (the number of screens, their wire weave size, and other parameters). This breaker plate and screen pack combination also does the function of converting "rotational memory" of the molten plastic into "longitudinal memory".

After passing through the breaker plate molten plastic enters the die. The die is what gives the final product its profile and must be designed so that the molten plastic evenly flows from a cylindrical profile, to the product's profile shape. Uneven flow at this stage can produce a product with unwanted residual stresses at certain points in the profile which can cause warping upon cooling. Almost any shape imaginable can be created so long as it is a continuous profile.

The product must now be cooled and this is usually achieved by pulling the extrudate through a water bath. Plastics are very good thermal insulators and are therefore difficult to cool quickly.

Fig. 1 Plastic extruder after fabrication

4.1. PROCESS

In the extrusion of plastics, the raw compound material is commonly in the form of hurdles (small beads, often called resin) that are gravity fed from a top mounted hopper into the barrel of the extruder. Additives such as colorants and inhibitors are often used and can be mixed into the resin prior to arriving at the hopper. The process

has much in common with plastic injection molding from the point of the extruder technology though it differs in that it is usually a continuous process. While pultrusion can offer many similar profiles in continuous lengths, usually with added reinforcing, this is achieved by pulling the finished product out of a die instead of extruding the polymer melt through a die.

The material enters through the feed throat (an opening near the rear of the barrel) and comes into contact with the screw. The rotating screw (normally turning at up to 120 rpm) forces the plastic beads forward into the heated barrel. The desired extrusion temperature is rarely equal to the set temperature of the barrel due to viscous heating and other effects. In most processes, a heating profile is set for the barrel in which three or more independent controlled heater zones gradually increase the temperature of the barrel from the rear (where the plastic enters) to the front. This allows the plastic beads to melt gradually as they are pushed through the barrel and lowers the risk of overheating which may cause degradation in the polymer.

Extra heat is contributed by the intense pressure and friction taking place inside the barrel. In fact, if an extrusion line is running certain materials fast enough, the heaters can be shut off and the melt temperature maintained by pressure and friction alone inside the barrel. In most extruders, cooling fans are present to keep the temperature below a set value if too much heat is generated. If forced air cooling proves insufficient then cast-in cooling jackets are employed.

4. RESULT

The outcomes from this study are given below:

1. This work will positively result in reduction in the plastic waste which is scattered in environment all over the world.
2. This can play an important role in making pollution free environment as important in building healthy society.
3. This project has important significance in increasing employment in country by providing income source.

With the help of this process many products can be produced, which are following:

1. Fruit box

Fig. 2 Fruit Pot

2. Making of handle by coating

Fig. 3 Making of handle by coating

3.Pot

Fig. 4 Pot

4. CONCLUSION

This study will help the local problems like Unemployment, Entrepreneurship and Plastic waste of Indian society as well as world. In short this project can be used for various problems as a solving tool.

We are facing many local problems like plastic waste problem from many decades and now this problem become worse so this problem gives a little help to this problem.

Unemployment is also an important factor on which this project is focused on and gives a solution to this problem. From this project one can produce products from waste and earn some money.

Making environment pollution free is another benefit by scrapping plastic waste from the environment and making a step for healthier society.

5. REFRENCES

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