Recycling-Making Waste Texture Profitable

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ABSTRACT

Reusing is the method of changing over squander materials that would ordinarily be tossed absent, into unused materials and objects. Reusing squander decreases the sum of hurtful materials delivered and diminishes vitality utilization, subsequently benefitting the environment. Not all materials can be reused, but there are bounty of materials that can and ought to be reused. Recyclable materials incorporate Plastic, Paper, Cardboard, Cans, Batteries, Glass, Dress, Hardware, Wood, Metal. Reusing moderates assets - when we reuse our squander, it is turned into modern things! This means that we do not have to use up increasingly normal assets making modern items. Instep, ready to utilize ancient reused materials to make modern items. A part of water bottles are reused, and you'll be able indeed get note pads made out of ancient tires!. Diminish. Reuse. Reuse. We see the symbol. We listen the tagline all over. However, as it were 9% of plastics get reused and the rest goes to landfills, seas, and dumpsites. As a society, we are falling flat appallingly at reusing and there are a number of reasons for this disappointment. To guarantee that reusing is fruitful, we require frameworks alter. At the exceptionally slightest, shoppers have to be build compelling reusing propensities, companies must diminish plastic generation and take responsibility for their activities, and governments ought to charge companies producing plastic, and force bans on certain sorts of single-use plastics. Whereas there has been progress, usually not continuously as basic because it sounds. Nowadays, as it were 9% of plastics get reused and the rest goes to landfills, seas, and dumpsites. Perused on to memorize why reusing rates are so moo. In the event that you're uncertain approximately whether you'll reuse something or not, there's as a rule data on the bundling, collecting, reusing and reusing.

Keywords: Collection of e-waste material, shredding, sorting of e-waste, recycling the sorted material.

Introduction

Polyethylene terephthalate (PET) is a versatile material and has a broad range of applications such as food packaging, plastic bottle, beverage bottles, clothing, sportswear, agricultural equipment's, nonwovens, sheets and films, straps, resins, packaging materials, reinforcement in building construction etc. Among these products, bottle grade PET is generally used for water and beverage packaging due to its lightweight, inexpensive price, resistance to microorganisms, and light [1]. Bottles of water, soft drinks, and other beverages constitute 83–84% of global PET resin requirement. Furthermore, the projected demand for PET packaging materials is forecasted to reach 20 million tons by 2019 with an annual increase of 4.6% [2]. There are two main types of plastics including thermoplastics and thermosets. Thermoplastics are the plastic materials that can be formed into other products by re-melting or reprocessing into different shapes by the application of heat and pressure. These are easily recyclable into other products. These thermoplastics include polyethylene terephthalate (PET), polyethylene, low and high density (LDPE, HDPE), polypropylene (PP), polyvinyl

chloride (PVC), polystyrene (PS) etc. Thermoset plastic includes components like alkyd, epoxy, ester, melamine formaldehyde, polyurethane, etc. Which upon applying heat can't be soften thus will not allow the formation of different shapes. At present Bangladesh have a very small amount of work going on about recycling of plastic. There are bulk amounts of plastic wastes and no orderly process is present to recycle it. If there is a methodological way to recycle that waste plastic and manufacture different kinds of products it will create more job opportunity and that it can also help the economy of our country. So, in this study we are implementing extrusion process to recycle PET bottle into synthetic fiber as PET bottles are made of thermoplastic resin.

Problem Statement

Since plastic is a non-biodegradable product and cannot be dumped in the ground, plastic recycling is a very important issue in protecting the nature. Use of plastic is increasing and plastic waste becoming a major obstacle to greener technology. Waste plastic is often the most visible component in waste dump and landfill. Recent studies says to us that plastic bottle remains for 450 years long on the earth and since plastic waste is growing rapidly hence the improper disposal of plastics causes problems as distant as breast cancer, reproductive problems in humans and animals, genital abnormalities and much more. Plastics wastes are found in different forms which almost 5% of the municipal solid wastes which is toxic in nature. It is a common sight in both urban and rural areas to find empty plastic bags and other type of plastic packing material littering the roads as well as drains. If current trends continue, our oceans could contain more plastic than fish by 2050. While the United States, Japan and many European countries generate significant amounts of plastic waste, they're also relatively good at managing it. About half of all of the plastic waste that ends up in the oceans comes from just five countries: China, Indonesia, the Philippines, Thailand and Viet Nam. These countries are experiencing rapid economic growth, which is reducing poverty rates and improving the quality of life for hundreds of millions of people. But as these economies grow, consumption booms — and so does the use of plastic goods [3]. A million plastic bottles are bought around the world every minute and the number will jump another 20% by 2021, creating an environmental crisis some campaigners predict will be as serious as climate change. New figures obtained by the Guardian reveal the surge in usage of plastic bottles, more than half a trillion of which will be sold annually by the end of the decade. The demand, equivalent to about 20,000 bottles being bought every second, is driven by an apparently insatiable desire for bottled water and the spread of a western, urbanized "on the go" culture to China and the Asia Pacific region. Most plastic bottles used for soft drinks and water are made from polyethylene terephthalate (Pet), which is highly recyclable. But as their use soars across the globe, efforts to collect and recycle the bottles to keep them from polluting the oceans, are failing to keep up.

Fig 1. 1: Global PET bottle production

In the UK 38.5m plastic bottles are used every day – only just over half make it to recycling, while more than 16m are put into landfill, burnt or leak into the environment and oceans each day. “Plastic production is set to double in the next 20 years and quadruple by 2050 so the time to act is now,” said Tag Holm. Animals like birds or fish can mistake plastic in the ocean for food. In addition, because plastic can come in sizes large or small, even the smallest organisms like plankton could be affected. When an animal consumes enough plastic, their digestive. systems could get clogged up, eventually starving them to death. Sometimes, the uneven shape of plastic pieces could even choke animals, like sea turtles, to death.

Fig 1. 2: Effect of plastic pollution on animals

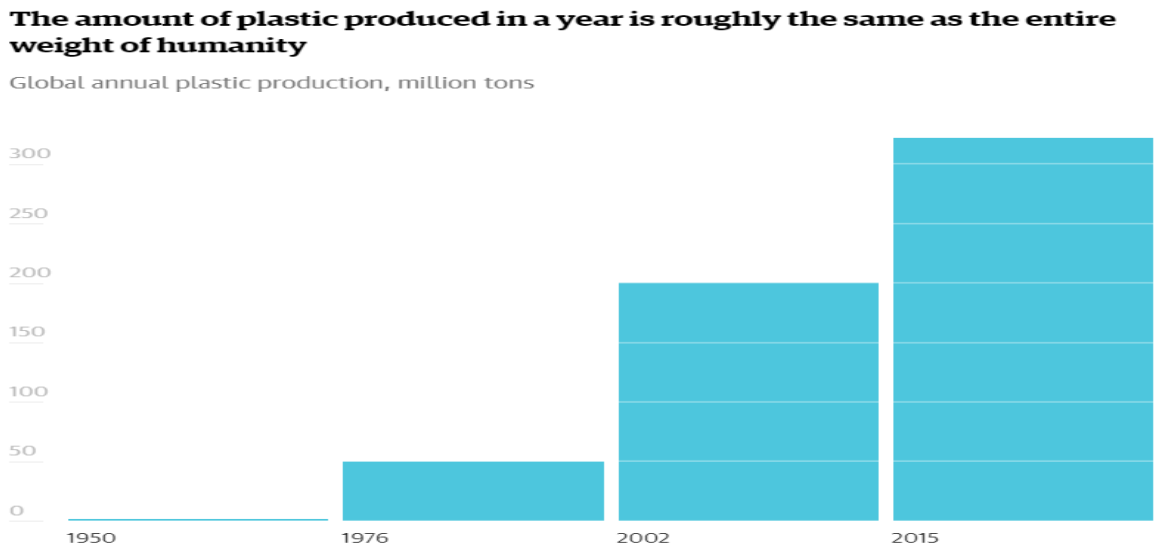


Fig 1. 3: Global plastic production

Organization of the Report

This thesis is organized with five chapters. First chapter is about research background, Problem statement and objective of this study. In chapter 2, elaborated literature review is presented about harmful effect of plastic pollution and how effectively we can recycle plastic bottle. Chapter 3 contains materials, design of machine and methods for this study with detail experimental setup. Chapter 4 includes experimental result, presented with data collection and analysis of obtained results respectively. Conclusion of this research work is drawn in chapter 5 along with our limitation and potential possibilities for further study.

Literature Review

Economic and population growth and industrialization in the world together cause an increase in the amount of plastic waste. Plastic pollution is the accumulation of plastic objects and particles (e.g. plastic bottles, bags and microbeads) in the Earth's environment that adversely affects wildlife, wildlife habitat, and humans [5]. As a consequence of all these, while the more intensive use of natural resources is inevitable, the plastic wastes created by the ever-increasing consumption tendency have reached the huge amounts that threaten the environment and human health due to their quantity and harmful contents. For this purpose, plastic waste policies should be developed and waste management studies should also be carried out, especially in the field of recycling these plastic wastes, because of long decomposition time of these wastes in the environment causing landfill and water logging problem [6, 7]. Waste management system enables collection, categorization, reduction, recycling, and reuse of plastic waste. At present, countries' intensive efforts on waste management are striking. Currently, there is an increasing focus on the importance of recycling and reuse in an effort to save the environment from the harmful substances that result from plastic waste disposal. Many cities have created a new system for waste collection where recyclables go in one bin, non-recyclables in another and food scraps go in a third. Also, in an effort to reduce the disposal of plastic bottle in landfills the city of Toronto, for example, requested all retailers to charge customers a fee for these bottles and have been encouraging retailers to use bottles made from biodegradable material and customers to use reusable bottles [8]. The thought of plastics first came in the late 1950s and early 1960s. The idea of plastic recycling on the other hand began to take shape in the 1990s in United States and elsewhere. At that time this process was run only to destroy the plastic wastes. Between 1960 and 1970, the average person bought between 200 and 250 packaged drinks ever year, Elizabeth Royte reported in her book Bottlemania, citing data from the Container Recycling Institute. Most of those purchases, she added, involved refillable. bottles. As of 2017, on a global scale a million plastic beverage bottles were purchased every minute, according to data from Euromonitor International's global packaging trends report, published in 2017 by The Guardian. Today, plastic bottles and jars represent about 75 percent of all plastic containers, by weight, according to the Plastics Industry Association. Now-a-days many products are coming out of recycling plastic PET bottle.

Methodology

Introduction of Extrusion Process

Plastic extrusion is a manufacturing process in which raw plastic is melted and formed into a continual shape. By feeding plastic material (pellets, granules, flakes) from a hopper into the barrel of the extruder the process can be started. A cylindrical rotating screw shaft is placed

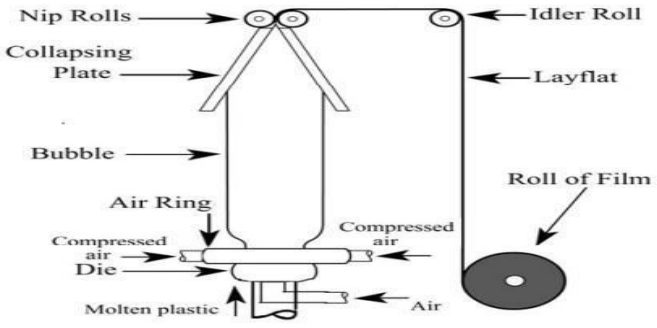
inside the barrel which forces out molten plastic through a die in our case we blow the molten plastic with air to make continual fiber. The extruded material takes shape according to the cross-section of die. The material is gradually melted by the mechanical energy generated by turning helical screw shaft and by heaters arranged along the barrel. The molten polymer is then forced into a die, which shapes the polymer into a shape that hardens during cooling. There are two types of plastic extrusion.
1. Ram Extrusion.
2. Screw Extrusion.

Ram Extrusion

A ram extruder is an extruder where, instead of extrusion screw, a ram or plunger is used and a plunger goes through a barrel and pushes out the material under pressure. The ram extruder was the earliest extruder to be used in the plastics industry. This typical process is applied for producing profiles, sleeves, rod, block, tubing, lining sheet bars, etc. The ram extrusion process is very effective for specific materials like PTFE which are not extruded successfully using screw extruder because of its low friction. In this process plastic material in powder form is gravity fed into a chamber. In the extraditing chamber the resin powder is heated on sintering temperature. Ultra-high molecular weight polyethylene becomes gelatinous as it melts so it can be extruded with this type of processes. A hydraulic ram pushes the resin materials like PTFE.

Blown Film Extrusion

In the blown film process, the die is like a vertical cylinder with a circular profile. The molten plastic is pulled upwards from the die by a pair of nip rollers. The compressed air is used to inflating the tube. Around the die, an air-ring is fitted. The purpose of an air-ring is to cool the film as it travels upwards. In the center of the die, there is an air inlet from which compressed air can be forced into the center of the circular profile, and creating a bubble. The extruded circular cross section may be increased 2-3 times of the die diameter. The bubbles are collapsed with the help of collapsing plate. The nip rolls flatten the bubble into double layer of film which is called lay flat. The wall thickness of the film can be controlled by changing the speed of the nip rollers. The lay flat can be spooled in the form of roll or cut into desired shapes. Bottom side of the lay flat is sealed with the application of heat, and cut across further up to form opening; hence it can be used to make a plastic bag. The die diameter may vary from 1 to 300 centimeters. Generally, polyurethane plastic is used in this process.



Data Collection And Calculation

Calculation of Current consumption

We are using 3 types of electrical component which are listed below- 1. Induction Motor. 2. Three Barrel Heater. 3. Air Compressor.
4.1.1 Electricity consumption of Induction Motor From motor specification list we get, Voltage – 220 v Current – 4.25 amp So, Power = V × I =220×4.25 = 935 watt = (935÷1000) kW = 0.935 kW Electricity Consumption = Power × time = (0.935 × 1) kW h = 0.935 kW h
4.1.1 Electricity consumption of Barrel Heater As we have three-barrel heater, measuring heater resistance and ampere with the help of multimeter we get,41 R1 = 144 Ω, I1 = 0.67 amp R2 = 136 Ω, I2 = 0.56 amp R3 = 136 Ω, I3 = 0.56 amp So, Voltage = I × R So, V1 = 96.48 v , V2 = 76.16 v , V3 = 76.16 v Again, Power = V × I Power consumption of barrel heater B1, B2, B3 is 64.641 watt , 42.649 watt, 42.649 watt accordingly. So, electricity consumption of barrel heater B1, B2, B3 is 0.065 kW h , 0.043 kW h, 0.043 kW h accordingly. Electricity consumption of Air Compressor From Air Compressor specification list, we get, Power – 0.55 kW Voltage – 220 v Current – 4.2 amp Electricity Consumption = Power × time = (0.55 × 1) kW h = 0.55 kW h.

CONCLUSION

Population growth and rapid pace of urbanization pose several environmental challenges for Bangladesh. One of the challenges is the waste management, and especially plastic waste management. Mechanical recycling of PET bottles is the most preferred recovery route for relatively clean plastic waste stream. It is well suited for developing countries like Bangladesh since it is less cost-intensive. Collection process is the key to successful recycling of PET bottles and plastic waste. It lies on consumers that must become educated and motivated through designed community educational program so that identification and collection of recyclables containers becomes a routine activity. Result shows with the abundance of plastic bottle waste we can make synthetic fiber in a very cheap price compering with the other fiber. Currently we have some limitation in fiber collecting method. The fiber should be collected in a perforated large industry grade bag as the molten plastic is blown with the air compressor. Our future work is consisting of adding industry grade air blower, stainless steel barrel to house helical screw shaft and a breaker plate to get continuous fiber profile.

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