

# PLASTIC RECYCLING

BUDULAN Ionut, CAZANGIU Andrei și FILIPESCU Octavian  
Facultatea:IMM., Specializarea:Design ., Anul de studii:I, e-mail; sorinbudulan10@gmail.com

Conducător științific: Conf.dr.ing. **Claudia BORDA**, Sl.dr.ing. **Delicia ARSENE**

*ABSTRACT: Plastic pollution can also contaminate the air we breathe every day. When the plastic is discarded, its microparticles reach our sewer system and are then dispersed into the sea. However, a considerable percentage of the particles end up trapped in the sewer system, which is then reused to fertilize our farms and fields. After drying, those particles can be picked up by the wind and dispersed throughout our air system.*

*KEY WORDS : pollution, plastic materials, recycling.*

## 1. Introduction

Lead by the objective to reduce plastic pollution and the generation of plastic waste, over 300 cities in the USA and a couple of states have implemented laws for plastic bags, straws and EPS foam. The National Coalition of Environment Legislation (NCEL) declares that 34 states are considering around 200 legislative acts for managing plastic pollution. Surfrider, Plastic Pollution Coalition have developed kits of legislative tools for communities and states to restrict or outright ban plastic products.

Ever since the 1950, mankind has created approximately 8.3 billion metric tons of plastic. Plastic is now clogging our draining canals and is spreading in parks, reservations and mountains. The effect of plastic ,however, doesn't stop here, because the natural process of drainage continues the spread of plastic in our lakes, rivers and oceans. Scientists claim that about 8 million tons of plastic enter our water systems each year, adding up to a total number of 51 trillion particles so far. This number is far greater than even the number of stars in the Milky Way.

## 2. Current Stage

The equivalent of 65 garbage trucks of plastic waste is thrown in the ocean each day in the United States. Companies that produce and sell plastic and plastic products of single or multiple use continue to claim that recycling is the main solution to plastic pollution. The endless focus on recycling plastic packaging fails in the face of obvious facts :the recycling of plastic after use is, in general, economically not viable. For example cups and caps made out of polypropylene, promoted as recyclable by fast-food companies are not recycled in an ever increasing amount of countries and places on the globe. As such,there is about 6 times more plastic waste being burned than recycled after use.

The most important aspect, is that there is no proof that recycling plastic materials or the access to recycling bins truly reduce plastic pollution. Actually,, in the study *The Behavioral Economics of Recycling* in Harvard Business Review from October 2016, Remi Trudel from the University of Boston ran tests proving that people used more cups and plastic wrapping when recycling bins were available.Following the tests, discoveries were made that suggested the fact that “consumers feel more comfortable using a larger quantity of plastic when recycling is an option.”

Bottle filling stations and taxes on plastic bottles for drinks; The best strategy to reduce plastic pollution for drinks is to make it easier for people to use less single-use bottles, and to make sure that no bottle is left behind. Public water refilling stations are necessary for reducing the consumption of water bottles made of single-use plastic. Towns and their water companies benefit installing refilling stations

which offer the function of refilling, plus a drinking fountain. People are offered high quality, free drinking water, and plastic waste is reduced.

A large part of plastic is considered toxic and as such, this cumulation of plastic wrecks not only mankind, but also our compatriots on this planet, the animals. These toxins can affect hormones related to health and can serve as a magnet, attracting other pollutants which may have more dangerous effects.

Plastic pollution can even contaminate the air we breathe every day. When plastic is thrown away, the microparticles reach the sewage system and are then dispersed into the sea. However, a large number of particles still get caught in the sewage system, which is then treated and then a part of the water with plastic is reused and ends up being used to fertilize farms and fields. After drying, these particles may be picked up by the wind and spread out in the air which we breathe.

Most plastic products never truly disappear; they get smaller and smaller. A lot of these minuscule plastic particles are swallowed by farm animals or fish which mistake them for food, and as such they may find their way into our plates. Also, the plastic residue has also been found in most tap water in the world. By clogging sewers and offering breeding grounds for mosquitoes and other pests, - especially plastic bags- may raise the risk of transmitting diseases, such as malaria.

Plastic plays an important role in our everyday life. Plastic materials are used to create products that we use all the time, such as toys, furniture, containers, clothes etc. Also, the usage of plastic has exponentially increased from what it was 50 years ago, since it is a cheap material and it's easy to give a shape to. The greatest quantity of plastic materials is found in most containers and packaging (soda bottles, shampoo bottles, lids, etc.), but also in more long lasting goods (household appliances) and less long-lasting goods (diapers, bags, mugs and household utensils, alongside medical tools)

The Plastic Material Industry Society of the United States has created a system to code plastic, which is even used today. It was meant to ease the distinguishing of different types of plastics by consumers, for as an efficient recycling as possible. The system is made of numbers from 1 to 7, the easiest to recycle plastic to recycle is type 1 and it mainly contains polyethylene terephthalate (PET), also known as water bottles, pill bottles and many other containers used for goods meant for consumption. Once processed, the PET may become a synthetic fiber for clothes, sleeping bags, rescue vests, car bumpers, etc. Type two means plastic made from high density polyethylene. In this category we have containers and bottles for detergents, bleach, shampoo, motor oil or milk. In the category of plastics which are recycled less often because of its low recyclability level, we have type 3, 4 and 5. Type 3 is PVC (Polyvinyl chloride) used for pipes, shower curtains, medical instruments, etc. Number 4 (low density polyethylene, used for shopping bags and the like) and number 5 (polypropylene used in various plastic wrappings, etc.). Type 6 is polystyrene which is used for coffee cups, disposable cutlery, insulation, etc. It can be reprocessed very easily, especially into a rigid foam used for insulating. The most difficult to recycle plastic is type 7, which is made from a combination of the aforementioned materials or rarely used types of plastic.

### **3. Recycling of plastic**

Our storage space for garbage is rapidly dwindling. The growth of human population means that livable terrain is becoming more and more valuable. The adequate management of waste by reutilizing plastic materials can save a significant amount of space, up to 7.4 cubic meters of space can be saved by recycling one ton of plastic. Millions of barrels of oil are used to fuel the demand of plastic materials in a single year. Recycling plastic materials is the most solid option when it comes to also reducing the consumption of fossil fuels. Because oil is a finite natural resource, recycling plastic and recovering as much material as possible, the amount of oil consumed can be significantly reduced. Also, the recycling of plastic saves about 7.200 kilowatt-hour of electric energy.

3D printers use electricity to melt plastic or other materials when printing. If this is a negative impact on the environment or not, will depend on where the electricity comes from, much like an electric car. If you produce your own energy using solar power, the impact will be next to none. When they are used industrially, 3D printed pieces can have a great impact, especially when it comes to transport. For

example, a 3D printed auto component which is hollow instead of being filled with metal or plastic is a lot lighter, and the weight of the component dictates how much energy is being consumed during the life of the component. Additive construction also allows an increased complexity, and GE used this to great effect for higher quality engines and less work required, alongside less defects. All these lower the impact made upon the environment.

The biggest problem we face when 3D printing is the recycled filament, namely the mess. Cleaning of plastic bottles for recycling into filament requires a lot of effort. Now imagine you do this with tons of plastic which also come from dumps where they were contaminated with all kinds of impurities.

We must also keep in mind that different kinds of plastic produce different types of filament. High density polyethylene – shampoo bottles, for example- are rather easy to turn into filament, but is difficult to print with because it shrinks a lot more than other plastic materials as it cools. On the other hand, PET plastic prints well, but is fragile, which makes it difficult to turn the filament into a spool.

Recently, we have seen different kinds of researchers explore the main source of 3D printing material, made from plastic containers, left on the battlefield, which, we hope, can be repurposed in other activity sectors. There is also, Ethic Filament, a company whose purpose is promoting the concept of recycling for making ethically sourced 3D printing filament, which is then sold to improve the life quality of people in the entire world. There is also the Perpetual Plastic Project (PPP), which is a machine that can directly recycle old plastic cups in 3d printing gadgets, or other products, depending on what is needed.

The recycling of plastic into filament usually requires it being cut into small parts and then pushed through a screw extruder. A different approach adopted by the PetBot company, which cuts PET bottles into long strips and then turns them into filament. The cutting of the strip and the extrusion take place in two completely separate processes, on the same machine. A pet bottle is prepared by cutting off the bottom, and the open edge is then pushed by bearings, where a cutter turns the bottle into a long strip, while a rotating spool rolls it. The spool made of the strip is then moved to the second stage of the machine, which then pulls the strip through a hot end, similar to a 3D printer.



Fig.1. Recycling of plastic by turning it into filament from PET bottles.

While the majority of conventional extruders push the plastic through a screw nozzle, PetBot warms the strip with just a little over the glassy transition temperature, which allows the coil to slowly pull the strip through the nozzle, without breaking. A ventilator cools the filament right before it goes on the 2<sup>nd</sup> spool, the same step-by-step engine is used for both stages of the process.

This model is a lot simpler in comparison to a regular screw extruder, but it is not without flaw or compromises. First and foremost, the length of the filament is limited to the material from a single bottle. Obtaining longer length filaments would mean you would need to melt the strip after cutting or to melt the filament after extruding, which isn't as easy as it looks. The process would probably be limited to a large bottle of water, with smooth exterior surfaces to allow the width and the thickness of the strip to be as consistent as possible.

#### 4. In conclusion

When we recycle, used-up materials become new products, reducing the need to consume more natural resources. If the materials used are not recycled, there will be new products created by extracting more natural resources from Earth, such as mining and forestry. Recycling helps to conserve natural resources and protects natural habitats for the future.

The reduction of waste, recycling and composting are efficient ways to reduce greenhouse gas production, such as carbon dioxide and methane. Because recycling implies using a less amount of energy for obtaining and manufacturing new material, there will be less carbon emissions.

Recycling is fundamental in promoting a circular economy, this being the new paradigm of durability, capable of reducing the negative effects done to the environment, and to contribute to creating new opportunities for jobs. According to Greenpoint Management, in the case of Romania, 10.000 tons of recycled wastes means 16 new job spots.

Recycling must be viewed as a collective responsibility, of each of us, in order to assure a durable and safe future. The responsibility of economic agents is to offer us the means to do so, but each person must contribute and offer initiative. Meanwhile, recycling brings many benefits, both to us and our environment.

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