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Green Products - Paper vs. Plastic

The continuous debate of paper vs. plastic is one that sparked my interest as I began to read Cradle to Cradle, written by McDonough and Braungart. I was surprised and confused as to why the construction of this book had a different look and feel than any I had ever read before. Cradle-to-Cradle is constructed of a synthetic material, which is made of plastic resins and inorganic fillers. (www.mcdonough.com) This made me question my assumption that paper is the more sustainable product when compared with plastic. Why did this book, with the purpose of teaching a new sustainable way to live, choose to build their educational manuscript out of a material that was not as sustainable as the traditional material? Maybe my assumption was wrong. This essay will examine the effect both paper and plastic have on the environment as a whole, from its production, use and reuse, or recycled phase.

Plastic as we know it today is made from polyethylene; a synthetic petroleum based polymer. (americanchemistry.com) Plastic began as a less expensive alternative for rubber, made from an organic material created from cellulose. Over the past century, plastic has transformed into a strong and flexible material that takes part in our everyday life in countless forms, from food packaging to the clothes we wear. Plastic has given people a more flexible way of life, but at what cost to the physical environment that we live in?

The production of plastic is one that is said to use 8% of the world's oil. (wasteonline.org) Oil and natural gas is broken down with the intentions of creating hydrocarbon monomers. These hydrocarbon monomers are linked in various ways to create different polymers to support the world's plastic needs. This production creates two major plastic groups; one is thermoplastic (celluloid), which fosters recycling. The second is thermosets (formaldehyde), which cannot be recycled. (Americanchemistry.com) There are four typical manufacturing methods used to turn both of these plastic groups into the everyday products that people have grown to take for granted.

Extrusion-Plastic pellets are loaded into a machine and fed into an extruder. The plastic is heated and moved through the extruder, the liquid plastic is then forced through a small opening at the end of the extruder. As the plastic is forced

out of the extruder, it is cooled by air or water and set into shape. This is the process used to make plastic bags.

Injection Molding is similar to the extrusion process, but the plastic is forced into a cool, closed mold to set. Once the plastic has cooled, the mold opens for the finished product. This is the process to make yogurt containers.

Blow Molding is a process used in conjunction with the previous two processes. During the mold stage of either process, compressed air is blown to form a hollow interior. This process is used to make carbonated soft drink bottles.

Rotational Molding is when the plastic granules are placed in a mold that is rotated on two axis in an oven. The granules are melted and rotated until evenly dispersed on the inside of the mold. This is the process usually used to make toys. (Americanchemistry.com)

These methods of manufacturing have a great impact on the environment. These methods include the use of non-renewable natural resources, such as water and oil, an extreme amount of energy used to heat the manufacturing equipment while introducing toxic additives both into the environment as well as to the people working on the manufacturing process. (Ecologycenter.org) The production of these natural resources, combined with these additives, causes harmful emissions such as nitrogen oxide and sulphur dioxide. (Chester.gov) Plastic also has some important positive impacts on the environment. Plastic is a very efficient use of a small fraction of the world's oil supply. In 2004, the corporation of Comprehensive Analysis conducted a study to test the efficiency of plastic. This study proved that using plastic packing materials saves about 101.3 million barrels of oil, and the amount of greenhouse gas emissions saved is the equivalent to 12.3 million passenger cars per year. (Recycleyourplastic.ca) This small 8% fraction of oil that is used creates a product that efficiently and easily helps transport other products as packaging, or as a lighter, more fuel efficient alternative. From an economic standpoint, this plastic product make a great deal of sense.

Paper is also a product that helps to enhance our daily lives in ways that we take for granted, from the cup of coffee you stop for on the way to work, to the book that you read to unwind from your day. Do we ever stop to think about the resources that were used to make these products, and the impact it has on our environment? Paper is a natural renewable resource that can be recycled, so it shouldn't have much of a negative effect on the environment, right? There are two basic forms of paper production, also known as *pulping*.

Kraft Pulping - This form of production uses sulphur to remove the pulp from the trees. Kraft pulping produces the most durable paper, which is used for magazines, printing and grocery bags. Once the pulp is milled, it is usually bleached with a harsh chemical such as chlorine. Unfortunately, even with all the negative effects from this chemical process, we are still only able to use 50% of the tree. The other half of the tree is just disregarded in a landfill or burned.

Mechanical pulping- this process enables us to use about 90% of each tree, which is a great improvement form Kraft pulping. The downfall to this method is that an enormous amount of energy and water are used and the fibers are not as strong, therefore the paper will not hold up as well. News-paper is typically made from this process.

The tree pulping and paper producing process in recent history has been "the third largest industrial polluter to air, water and land in both Canada and the United States". (rfu.org) The water consumption near paper mills has caused serious damage to the habitats that surround the mills. Paper mills have an effect on the water levels as well as poisoning the water with the liquid effluent that is let into the water ways. 141 billion gallons have been let into water ways each year from mills. (Environment Canada, Environmental Effects Monitoring Report) Harsh chemicals are used to bleach the pulp as well as to protect it from bacteria growth. These chemicals add to the problem of air pollution with carbon monoxides, sulfur dioxides and nitrous oxides. (cwac.net) Paper mills have such a strong use of energy, sometimes their dependence on public sources of energy is too much and they are forced to build their own power plant.

Just as there are many different manufacturing methods for plastics, there are as many ways to recycle them. The three different forms of recycling plastic each serve a separate purpose and have their own advantages and disadvantages.

Mechanical Recycling - For this process to be successful, products must be separated and cleaned before the process can begin. The process itself includes the shredding and melting of the product to be reused as something new, which inevitably still creates some waste.

Chemical Recycling - This process causes a change in the chemical make up of the existing product. This is a change which enables the product to be used in the same way once it is recycled.

Feedstock Recycling - This is also a change in the chemical makeup of the plastic product. The difference with this form of recycling is that the new product has

a different use then its original intentions. (Plastic Waste-Feedstock Recycling, Chemical Recycling, and incineration. A. Tukker)

The majority of plastics that are manufactured today are thermoplastics, with the intention that they will be recycled, whether it is into the same product or something new. This process of recycling the thermoplastics is not simple since there are many different subcategories of thermoplastics, which must be separated before recycling can begin. For me, the idea of an easily recyclable plastic item is important, but unless it is recycled into the same product, there is always going to be some waste. This waste will end up in the landfill for the next hundred years since plastic is not biodegradable; it is photodegradable. Photodegradable products can be broken down when they are exposed to the ultraviolet radiation from the sun. (businessdictionary.com) If the plastic is covered in a landfill, it is not being exposed to the amount of sun it needs for this process to take place. An important idea when thinking about this process is to incorporate the idea of long-term use recyclable products. Plastic products should not be disposable; they should have a life cycle that lasts many years, and then able to be recycled. The "single-use" item uses a great deal more energy in comparison to a multi-use item with all of the transportation needed to get to its final destination, only for it to be disregarded. However, the recycling process does have positives. The process of recycling plastics saves about 1.8 billions tons of oil every year (chester.gov)

Like the process of recycling plastics, the paper recycling process has positive aspects as well as negative ones. The majority of energy that is used to produce paper is consumed at the very first stage, harvesting the pulp. When recycling paper, that initial step is cut out, and as a result, it uses up to 70% less energy. 30,000 liters of water are saved for every ton of paper that is recycled and the amount of air pollution is cut down by 95% because most recycled paper is not re-bleached. Air pollution is also cut back tremendously because the paper is not biodegrading in the landfill, which in turn, gives off greenhouse gases, such as methane, while it rots. There are also negative aspects to the recycling of paper. The first idea is the concept of "de-inking". The purpose of paper is for communication, whether it be to write a letter or to advertise. Just about all paper, when it is at the point of recycling, will need to have the ink removed. This can be done in two ways; washing, which use chemicals and an extraordinary amount of water, or floating, which uses air and can usually remove half the ink. Another disadvantage to recycling paper is that it can only be recycled 3 or 4 times before the fibers are too weak to be used. (Wasteonline.org)

This question of paper vs. plastic can be contemplated in our everyday lives as we consume products ranging from grocery bags to books. From the research I have done, I would say that each material has similar disadvantages and advantages. My main concern would be to consider which option is less harmful rather than being more beneficial. Both products use natural resources, contribute to air pollution and contribute to the landfill for varying amounts of time. Although one can only be recycled 3-4 times, while the other is made to constantly be recycled, both eventually produce some waste for the landfill.

My research has focused on the traditional paper vs. plastic debate, but there is soon to be a new debate. With the development of biodegradable plastics, produced from non petroleum based products a question of its impact on humanity is going to develop. Biodegradable plastics made from sugar cane, soy or corn may not have as much of an impact on the world's oil consumption, but it will have an impact on the food shortage in certain areas of the world.

Where does the paper production go from here? What I understand to be the biggest problem with the production and recycling of paper products is the energy and resources used to make virgin paper, as well as the chemicals used to recycle the paper, that are then let lose into the environment. For me, an obvious step that can be taken is to improve the recycling process. The majority of the energy consumed in making paper comes from the pulping process; the greatest benefit would be to enhance the strength of the paper fibers by using less abrasive and harsh chemicals there fore enabling a longer recycling life with less waste and less new paper produced. One way I see to do this would be to control the chemicals that are needed for the "de-inking" process. This can be done with the development and research of more organic inks such as soy. Soy has been proven to be removed in a less abrasive and more efficient way, which causes less paper damages and enables paper fibers to be reused more often, as well as the use of less abrasive chemicals that are being released into the environment. (asasea.com soy ink environment)

I have come to a conclusion that at this point in time, there are not any benefits to the environment from the production process of paper or plastic goods. Plastic seems to have less of an impact on the environment in comparison, but still a negative impact. However, Plastic indirectly has a positive affect on the environment with its ability to make products more flexible, lighter and therefore more efficient. The process of paper production has a long way to go.

Sitations

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