Introducing Recycled Plastics into Big Industry

By Nick Maitrejean

Up until now, the automotive industry has relied mainly on first generation parts; that is, parts originally designed for that purpose and not from recycled materials. As we move into a world that is pushing recycled materials to save the planet, the automotive industry could provide a huge source for using recycled materials. Other industries are already using recycled plastic to recreate objects, such as water bottles or trash cans, and are making small decreases on the amount of waste in the world. Other people have taken advantage of the opportunity to use current technology to develop recycled plastic objects such as the man who made a skateboard out of plastic bags (Stock, 2017). If there was a way to initiate plastic recycling into automotive companies, it would be a huge advancement in the abilities of recycling. This paper will discuss the general process of recycling plastic, the durability of these plastics, and compare the durability to existing materials used in the automotive industry. As these topics primarily discuss the positive outcomes of this idea, discussion concludes with the complications of implementing recycled plastic into vehicles. Current technology has increased the ease of recycling plastic than in previous decades, which could cause the automotive industry to consider adopting the idea of recycled plastic in vehicles if they were able to harness the technology. Transitioning these materials into current industries positively influences our world as it reduces environmental harm.

Process of Recycling Plastic

Sivan (2011) discusses how heat and UV rays work in the degradation process of plastics almost as well as copper-binding enzymes. These two processes are complicated and are not necessarily a step-by-step solution to recycling plastic fast and easy; however, they are proven to work under the correct circumstances. UV rays work naturally in landfills where plastic is dumped to initially degrade plastic by drying it out and causing the substance to lose strength, crack, and break apart into many small pieces (Sivan, 2011). The plastic must be in direct sunlight for this process to happen. As these smaller pieces break down, they are spread out by natural forces such as wind and introduced into the ecosystems of our planet (Sivan, 2011). This is a problem for our planet and a reason behind trying to recycle plastics. Once the UV rays have broken down the plastics or they have degraded by other natural means (such as bacteria), then heat and copper-binding enzymes come into play to fully recycle these materials to be reused. Using heat is the simplest process; apply heat to the small fragments of plastic and it turns into a carbon substance that can then be reused as recyclable material (Sivan, 2011). The only complication with this process is that plastic also burns very easily, so the heat must be applied at the correct temperature for the type of material to melt down.

Also assisting in the heat process of degrading, copper-binding enzymes use copper to assist the degrading process. A common copper-binding enzyme for the recycling process is called laccase

(Sivan, 2011). Laccase is often used in the spreading of aromatic materials like air fresheners (Sivan, 2011). This process is usually conducted in a laboratory where the surrounding variables can be limited and necessary requirements for the degradation process of plastic can be met. The C208 laccase strand, a specific version of laccase discussed by Sivan (2011), is a reliable decomposer under the heat required to degrade the plastic, which makes it one of the most suitable substances to use on large-scale operations (Sivan, 2011). This is very valuable information as automotive companies would want to develop the easiest and fastest way of producing recycled plastics to use for their automobile parts. If they combined both processes (heat and laccase), not only would they initiate recycled plastic into larger automotive parts, but they would be producing massive quantities. This would reduce pollution by the plastic itself, and the automobile companies would have enough recycled material to work with.

Durability of Recycled Plastic

After analyzing the process of recycling plastic materials, the durability of these recycled materials needs to be taken into consideration. Like most components in the automotive industry, parts are created and put through tests to see if they are suitable for the specific application. If plastic were to replace some of the parts of an automobile, it would have to go through tests similar to those which current materials already go through and prove similar results to be considered safe enough to start implementing. Strength is arguably the best way to test for safety in a product, especially in the automotive industry, so the best way to test recycled plastics is to test their strength.

Bajracharya et al. (2014) describe the results of their research on the durability of virgin plastic versus recycled plastic and reinforced recycled plastic. One of the first ideas they elaborate on is the overall strength of the material. The data displays that the tensile strength of the virgin material against the recycled material maintained about the same level throughout multiple compounds of plastic (Bajracharya et al., 2014). Tensile strength is the amount of stress the material can handle while being pulled apart. Each of the original compounds had a specific tensile strength, and each recycled version of the original compounds produced almost the same strength (Bajracharya et al., 2014). In terms of using recycled plastic for vehicles, this is a very positive outcome. Parts that already contain plastic on vehicles could be produced using recycled plastic resulting in the same structural integrity. Another aspect covered by Bajracharya et al. (2014) is the elongation of these materials at their maximum tensile strength or breaking point.

The most basic recycled plastic compound they tested resulted in a 449% elongation from start to breaking point (Bajracharya et al., 2014). If plastics were able to endure compressing and stretching as much as this test result indicates, they might be even more useful than the material that is currently being used. Many vehicles sit through very hot days and very cold days in the United States, thus the materials used within these vehicles need to be able to stretch and compact with the changing temperature. As recycled plastic is able to adjust this much, it is a highly plausible option for future materials in the automotive industry. One of the drawbacks considered in this study was processability, mainly that of substances containing reinforcement with fiberglass (Bajracharya et al., 2014). This means it is more difficult to produce the reinforced recycled material because it contains more materials. More materials used means a more strenuous process to develop the product, which results in more time and money used. The overall results in both categories, nonreinforced and reinforced, demonstrated that the comparison of recycled plastic versus reinforced recycled plastic produced similar amounts of strength (Bajracharya et al., 2014). With this information, producing nonreinforced recycled plastic may be the better option because producing reinforced recycled plastic involves a more rigorous process and shows strength numbers that are only slightly higher than that of nonreinforced plastic.

Janajreh (2015) explores the idea of recycling plastic more than once, similar to the experiments conducted by Bajracharya et al. (2014) without the different compounds and testing how it performs under strain for each time it is recycled. The overall experiment was done with an original plastic source that contained mostly PVC, a common plastic found in waste dumps, and examines the performance of the original material. The experiment then examines the material after it is recycled once, and examines it once more after it is recycled a second time (Janajreh, 2015). The results of this experiment show that the first recycling phase was stronger than the original in terms of strain (the amount of force applied until the material breaks) and the second recycling phase was stronger than the first (Janajreh, 2015). In other words, as the plastic was recycled, it produced a stronger compound both times. Another diagram in this report shows the amount of strain on the plastic as it is being stretched to test strength, demonstrating the displacement of the pressure on the piece of plastic they tested (Janajreh, 2015). It seems that this type of plastic (PVC) before and after recycling displaces force across almost all the material, which could be why it produces the strength ratings it does. A material that spreads the force across the whole piece is stronger because it uses almost all the material, instead of just using the material that is directly involved in the test. This is another good sign for the automotive industry in terms of implementing recycled plastic because none of the material would be wasted when the components required strength while in use in the vehicles. These test results indicate that after recycling plastic twice it maintains its strength (Janajreh, 2015).

Not only could recycled plastic be implemented into vehicles, but once those vehicles no longer run, the recycled plastic could be taken out of those and recycled again to be used in another vehicle. There is no evidence that this increase in strength trend continues, according to this study, so a probable stopping point would be after the second recycling phase (Janajreh, 2015). However, keeping track of vehicles that are on the first or second phase would be difficult, so recycling only once would seem to be the best use of recycled plastic. A way around this difficulty would be to add labels to certain parts that indicate what recycling phase they are on. If this process was implemented, then the idea of recycling plastic twice and using it both times would become an option. This would improve the decrease on plastic waste as the plastic would not be simply thrown back into the dump after using the recycled version. The next step towards recycled plastic components is comparing it to existing materials.

Comparison to Existing Materials: Does It Hold Up?

To compare recycled plastic to existing materials, it is necessary to dig deeper into the materials that are currently being used. Aluminum is one of the materials currently being used and is starting to become more popular in the automotive industry because it is lightweight and durable enough to replace steel in certain settings. A study by Hirsch (2014) explores the current uses of aluminum in structural vehicle components. The information collected and presented in this study shows that aluminum is a very trustworthy option in the automotive industry in terms of weight reduction and structural integrity (Hirsch, 2014). Aluminum alloys are strong enough to support the weight of the vehicle, heavy enough to maintain a stable center of gravity to prevent rolling, and cheaper than steel so it can be introduced to the customers at a reasonable price (Hirsch, 2014). Since aluminum is a metal and can withstand a somewhat significant amount of heat, it can be used in almost every part of a vehicle from engines to frames to body panels (Hirsch, 2014).

Plastic, however, cannot withstand the amount of heat that aluminum can because it melts faster. Due to this property, plastic could not be used to replace every part of an automobile that aluminum is currently used for, specifically engine components. However, it could be used in applications where heat is not as much of a factor such as body panels or interior components like dashboards. Replacing aluminum or other light metal components with plastic would be a good way for automotive companies to save even more money, assuming the recycling process has been refined. Although plastic seems like a viable option to replace certain aluminum parts, multiple considerations explain why the automotive industry has not yet moved towards incorporating recycled plastic, leading into the counterarguments for this movement.

Conclusion: A Better Option for Other Industries

There are some counterarguments to take into consideration after exploring the possibilities of this idea. The biggest problem is the difficult process of recycling plastic. Plastic is one of the most difficult synthetic materials to degrade by natural means (Sivan, 2011). It involves laboratory processes that take time and money to develop, making it extremely hard to refine this process into something that is an efficient solution. Being that it is a difficult task, it may not be pursued as a viable option by many people and organizations. Another complicating issue is the recent mass production of plastics. More and more industries are turning to plastic because it is inexpensive. Since there is more plastic being produced, there ends up being more plastic dumped into waste areas, taking up space and harming the environment because it does not naturally degrade very well. Along with these ideas is the issue that plastic does not quite fit into the automotive industry for the structures that were discussed in this paper besides interior components. Recycled plastic is not quite as durable as aluminum, and therefore would not make a very good replacement material. It is also not as heavy as aluminum and could cause a bad center of gravity if it were used for vehicle frames or other structural components. Plastic cannot handle the temperatures aluminum can, which also leads to a downfall in the progression of this product in the industry. These counterarguments account for most of the reasons the automobile industry has not switched over to using recycled plastic for their vehicles.

Recycled plastic could very well be an option for automotive companies to incorporate into their vehicles in the future, however, today's technology does not allow it to happen. While it seems like it could work for multiple uses inside the vehicle and a few exterior parts due to the strength and elasticity, the recycling process is too strenuous and not simplified enough for automobile companies to initiate this movement. In the future, when there is more information available and new ways of developing recycled plastic, there may be an implementation of these materials into the automotive industry. All the motivators for a beneficial incorporation of recycled plastics exist today: environmental awareness, consumer price benefits, and advancements in technology for the companies themselves. Future technology will allow these motivators to set this movement into motion, and recycled plastics may indeed make their way into the automotive industry. As for the present time, after considering how recycled plastic could be used in vehicles, there may be new possibilities available to reduce plastic waste that would reduce pollution to our planet. Recycling material for one industry is beneficial, but it can be applied anywhere. There may be other applications for this idea to develop in other industries. If other industries were to take the information about the strength and elasticity of recycled plastics demonstrated from the studies by Janajreh (2015) and Bajracharya et al. (2014), they may be able to find ways to implement recycled materials into their own companies. Since they would be using existing recyclable material already available, it would have the same effect as the automotive industry using it in terms of environmental awareness. The primary reason for implementing recycled plastic into existing industries is to reduce pollution, and although the automotive industry may not be able to do it as of today, other industries should consider looking into the idea.

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