

An Investigation into UBC Plastic Cutlery and Alternatives
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An Investigation into UBC Plastic Cutlery and Alternatives

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Abstract

UBC has committed its entire campus as an experiment in sustainability. This includes the community, land, assets, and utilities towards sustainability research, teaching, and learning. This commitment has been made in hopes of creating new opportunities to inspire dialogue and discoveries in sustainability. Sustainability is important in order to meet society's needs without compromising the needs of future generations. The path of unsustainability can potentially lead to devastatingly negative consequences. One point that UBC is looking into being more sustainable is cutlery. All AMS Food Services use the same plastic cutlery at the moment. It is important that the current cutlery and alternatives be assessed in order to determine the most sustainable choice to maintain UBC's commitment to sustainability.

A plastic assessment is performed based on the Triple Bottom Line for cutlery. UBC's current plastic cutlery is assessed for its sustainability performance in regards of the material it is composed of, recycling rates, cost, and social aspects. The same assessment is performed on other cutlery alternatives that include biodegradable cutlery, wooden cutlery, and cutlery brought from home. All of the assessments are then compared to each other to determine the most sustainable option. A social experiment to study the behavior of people recycling cutlery around campus is also performed.

The result of the assessment is to keep the current BSI recyclable plastic cutlery as it is 100% recyclable and low in cost. The other alternatives have advantages and disadvantages compared to the BSI cutlery but none are significantly greater at the price range to replace it. UBC faces issues with their current system in regards to recycling the current cutlery. Not enough people dispose of their recyclables correctly due to insignificant signage as discovered through the social experiment. Solutions to this issue are more detailed signage or individual plastic recycling bins for different types of plastics.

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Glossary [1]

Recyclable	Recyclable products can be turned into new items. Recyclable items include plastic, glass, cardboard and metal. Recyclable materials are turned into new products.
Compostable	Compostable items break down into something that can provide valuable nutrients to soil. Compostable items should not release metals or any toxic elements.
Biodegradable	Biodegradable items completely break down into the environment in a short period of time.
Degradable	The term “degradable” simply describes something that can break down through chemical reactions.

List of Abbreviations

SEEDS	Social Ecological Economic Development Studies
UBC	University of British Columbia
BSI	BSI Biodegradable Solutions
PP	Polypropylene
PS	Polystyrene
PLA	Polylactic Acid
TBL	Triple Bottom Line

1. Introduction

Sustainability is a growing topic of interests for students, faculty, and partners in the community at UBC. UBC aims to create dialogues and discoveries in sustainability. A way in which it can achieve this goal is through the use of sustainable cutlery. This report aims to perform a plastic assessment of cutlery. The assessment begins by firstly examining UBC's current plastic cutlery choice and how it's recycled. The report then investigates alternative cutlery choices. Next, a social experiment is performed to examine the social aspect of recycling on campus. Finally, a recommendation is offered by evaluating the results of the plastic assessment and making a selection based off of the Triple Bottom Line (TBL).

2. Plastic Assessment

2.1. Current Plastic

UBC is currently using recyclable Polypropylene (PP) based cutlery from BSI Biodegradable Solutions (BSI). The specific product used is the BÉSICS® PP Recyclable plastic forks, spoons, and knives [2]. They are purchased at the price of \$20.43 per 1000 units. This cutlery has a Chasing Arrow rating of 5 which means that it is fully recyclable (Figure 2.1a).



Figure 2.1a - BSI BÉSICS® PP Recyclable plastic forks, spoons, and knives

2.1.1. UBC Sustainability

UBC tries to be as sustainable as it can be and takes actions to meet those goals. Being a research university, it allows for area to do special experimentation on how new technology and strategies can enhance sustainability. One person who is very involved in the continued process of making UBC as sustainable as possible is Victoria Wakefield [3]. She is currently the Purchasing Manager for Student Housing & Hospitality Services and

previously worked as the Logistics Manager at UBC Sustainability. She was responsible for many changes in some of the ways UBC handle the materials it uses and how they are disposed of as well as creating initiatives to encourage sustainability. Regarding cutlery, she was one of the main drivers who decided on using recyclable plastics from BSI after doing further research on the use of compostable plastics which were used previously and were found to not degrade even after a year. She has also been looking into other types of materials such as wood and bamboo but found that they are not economically viable and the added deforestations for something like cutlery was excessive and not worth it. She has also been working on improving the other things used throughout campus such as containers and other plastics.

2.1.2. BSI Biodegradable Solutions

BSI is a provider of sustainable food supplies in Vancouver, BC, and they are the company which UBC purchases its cutlery from. In particular, they specialize in compostable products. They provide three options for cutlery: polypropylene, polylactic acid, and wood, the first being recyclable, the second being biodegradable, and the third being compostable. Based on discussion with Emily McGill (Compost Specialist) from BSI [4], it was found that BSI chooses PP as a recyclable material for use in cutlery as it is allegedly the most recyclable plastic polymer. An alternative to PP is Polystyrene, however most facilities in Vancouver do not recycle it. In regards to biodegradable material, the two types of PLA that BSI carries are crystallized PLA and mineralized PLA. These are the most compostable polymers on the market, based on research done by BSI. In addition, it was found that that the PLA cutlery from BSI costs approximately 1.4 times the amount of PP cutlery, and the wooden cutlery costs approximately 4 times the amount of PP cutlery.

2.2. Current Recycling Methods

The plastic recycling procedure contains two main components: sorting and processing. Sorting is done both manually and automatically. Discarded materials are placed on conveyor belts where any non-recyclable materials can be manually removed. The

recyclable material can then be sorted with various equipment such as magnetic separators and optical sorters. The sorted material is then sent to processors. The method for processing plastics is typically as follows [5]:

- Shredding: Plastic materials are reduced to a more manageable size through shear or saw, producing small flakes
- Contaminant removal: Impurities such as paper are removed from the stream of plastics using a cyclone
- Floating: Plastic flakes are further sorted in a floating tank according to their densities, and are washed and dried
- Milling: Separated polymers are milled together
- Extrusion: Flakes are heated to their melting point along an extruder to produce strands
- Cooling: The plastic strands are water-cooled and cut into pellets, ready for reuse by industry

The method varies among materials, but the above steps usually apply to thermoplastics. Many recyclers start with Milling as a first step. In addition, depending on the specific polymer and intended re-application, the procedure can end at the stage that produces clean flakes or the stage that produces clean pellets. The flakes and pellets may not necessarily be reused for their original application due to the quality of the recycled material.

2.2.1. Cascades Recovery Inc

Cascades Recovery is one of the main sorters for recycled material in BC. They receive discarded materials from consumed products, sort them, and determine the plan of action that will allow for a given material to be recycled in the best manner possible. Plastics in particular are baled and sent to the appropriate processor for plastics. For the Lower Mainland that processor would be Merlin Plastics Supply Inc.

2.2.2. Merlin Plastics Supply Inc

Merlin Plastics is a plastics processor in BC which deals with all types of discarded plastics. They recycle the discarded plastics into pellets and flakes for reuse by industry. From discussions with Brian Strong [6], it was found that PP in particular has difficulties associated with its recycling due to the small volume that Merlin Plastics receives. The PP needs to be stockpiled until there is sufficient amount for recycling. PP could be mixed in with other plastics and recycled that way, however the resulting material would be of lesser quality. The material produced would consist of many areas of different polymers without bonds between them [7]. In addition the recycled PP cannot be used for things like cutlery again due to health concerns and are instead reused in areas like the automotive industry.

2.3. Alternative Cutlery

Besides PP, there are several alternative options that can be used for cutlery, including both plastics and non-plastics. Polystyrene (PS) is another type of plastic polymer widely used for cutlery, although it is not preferable as it is not considered recyclable. Other options include, wooden cutlery as well as polylactic acid (PLA), a biodegradable material, which UBC shifted away from. Below, an analysis is performed on each option as well as a discussion of possible advantages and disadvantages associated.

2.3.1. Biodegradable Plastic Cutlery

As mentioned, UBC's food services previously used biodegradable plastic cutlery, but have recently shifted away from using them. While the name suggests it to be least environmentally damaging, there are a few issues that contributed to UBC's decision to move away from it.

Biodegradable Plastic (PLA)	
Pros	Cons
<ul style="list-style-type: none"> - When handled properly, the material fully degrades into environment, resulting in minimum waste. - Temperature resistant. Can withstand up to 90 °C. - Appeal to individuals. Marketing advantages. 	<ul style="list-style-type: none"> - More costly than PP. - Some PLA contains metal, which will be released to the environment - With lack of awareness, PLA usually end up getting composted, leaving residue.

2.3.2. Wooden Cutlery

Wood can be used for both long-term and short-term cutlery. Much like biodegradable cutlery, wooden cutlery has minimum impact on environment. Wooden cutlery can be constructed from bamboo, birch, maple and more.

Wooden Cutlery	
Pros	Cons
<ul style="list-style-type: none"> - It is 100% compostable. - No chemicals involved. - Marketing advantages. - Burnable, reducing waste total. 	<ul style="list-style-type: none"> - Contributes to deforestation. - Wood is absorbent, soaking in bacteria from food, thus should not be reused. - Risk of breaking and causing splinters. - More costly than both PP and PLA. - Only ideal for simpler meal.

2.3.3. Bring Your Own Cutlery (BYOC)

The perfect world solution would be for everyone to bring their own cutlery. This would abandon the need for UBC food services to purchase large amount of cutlery from external sources, and reduce cutlery waste significantly. On the other hand, it will require an awareness program for students.

Bring Your Own Cutlery	
Pros	Cons
<ul style="list-style-type: none">- No need for waste management.- Financial advantage.	<ul style="list-style-type: none">- Requires extensive awareness.- Requires more effort on individual's part.- Difficult to implement with the amount of students on campus.

2.3.4. Brands Comparisons

As explained earlier, UBC purchases cutlery from BSI Biodegradable Solutions. The cost is low at roughly \$0.02 per piece, and is considered recyclable in many facilities in Vancouver. Following is a short comparison of different brands of disposable cutlery.

Products Comparison	
BSI BÉRICS® PP Recyclable	<ul style="list-style-type: none"> - \$0.02 per piece - Made from PP which is fully recyclable - Local Canadian product
Wal-Mart (“Great Value”)	<ul style="list-style-type: none"> - \$0.03 per piece - Plastic - Can be recycled in some facilities
Taterware Cutlery	<ul style="list-style-type: none"> - \$0.05 per piece - Made from biodegradable potato starch - Heat resistance; can withstand +/- 220 F (approximately -128 to 100 C)
World Centric	<ul style="list-style-type: none"> - \$0.17 per piece - Made from 70% non-GMO PLA and 30% talc - Heat resistance; can withstand up to 100 C - 120+ days to compost in a facility
Aspenware Wooden Cutlery	<ul style="list-style-type: none"> - \$0.25 per piece - 100% compostable & biodegradable - Local Canadian product - Made from trembling aspen, birch and poplar (all three have short life cycles, and are fast growing species)
Bambu Veneerware	<ul style="list-style-type: none"> - \$0.54 per piece - Made from certified organic bamboo - Sturdy for most foods - Free of chemicals or pesticide
Dixie® Medium Weight PP	<ul style="list-style-type: none"> - \$0.019 per piece - Uses PP, fully recyclable - Slightly cheaper than current used cutlery

As seen from the table above, the current BSI cutlery considerably cheaper than other options, with Dixie Medium Weight PP being the only comparable product cost-wise. There are some other interesting options as both Aspenware and World Centric offer

cutlery that are both compostable and biodegradable. However, as the table suggests, the cost remains to be the obstacle.

2.4. Social Experiment

In order to determine the social implications of recycling methods on campus, an experiment was conducted to find out what actions students take when recycling cutlery. The hope is to learn their behaviors or motivation behind it as well as to see if they are properly recycling their materials and whether or not the particular signs used were effective. In addition, the results may be used to further develop ways to make recycling more accessible or to see if there is more needed to be done in other areas.

2.4.1. Social Experiment Procedure

The experiment was conducted by tallying up the number of people who dispose of their food products in recycling, composting, or garbage. It was carried out in the Student Union Buildings (SUB) cafeteria between 1:00 pm and 2:30 pm. In particular, attention was paid to recyclable cutlery when students came to dispose of their waste. The results of the experiment can help to better understand areas that need improvement. If the students are recycling, the social aspects to recycling can be considered to be adequately met and attention can fully shift to the recycling process and need for further development of recycling facilities. If the students are not recycling, further motivation and accessibility is needed.



Figure 2.4.1a - Waste bins located in Student Union Building cafeteria

2.4.2. Social Experiment Results

After tallying 41 people, it was found that 14% of them recycled their plastic cutlery. Of those who don't, a significant number of them had trouble figuring out where cutlery should go even though it is labelled "Recyclable". This may be due to the label being covered up when holding the utensil. The majority of people (51%) were found to simply put all their items in the waste basket regardless if the item can be recycled. Due to UBC's increased use of compostable food items like paper and containers we found 28% of people composted items when appropriate. An additional 7% recycled non-cutlery plastics which brings the total percent recycled to 21%. This shows even though some students are disposing of their waste properly, many are not and UBC needs to continue to make it more accessible and easy for the user.

Social Experiment Results

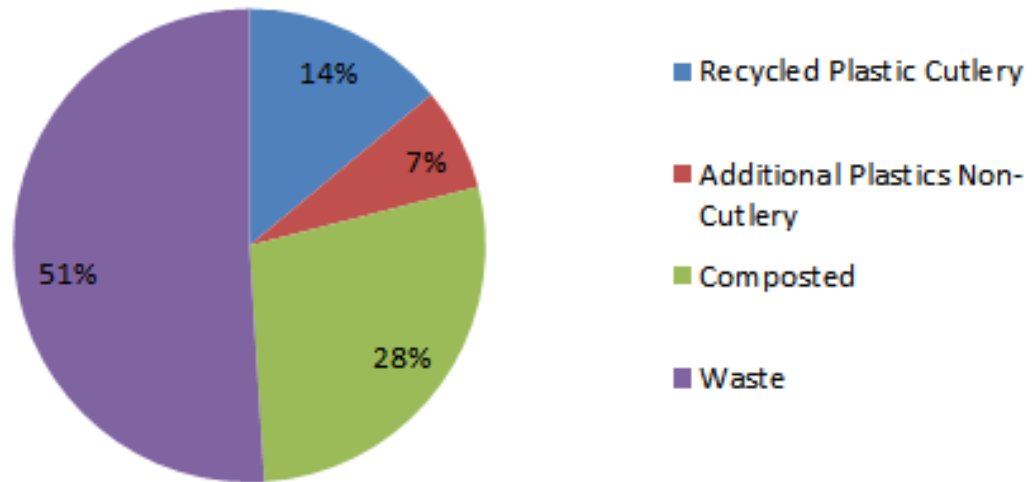


Figure 2.4.2a - Results of the social experiment with survey size of 41

3. Conclusion and Recommendations

3.1 Conclusion

The current plastic cutlery from BSI is a good choice compared to other options based on TBL because it is low in cost and 100% recyclable. The issue with this cutlery is that even though Merlin Plastics can recycle Polypropylene it is not done often since it requires a large enough quantity to recycle which is difficult to obtain. This difficulty is due to the different types of plastics that are recycled together but can't necessarily be processed together. The assessment of different types of cutlery based on TBL revealed that each option has a trade-off between economy and environment. While some cutlery options are more sustainable they are also more costly. On the other hand, the cheaper cutlery options are not as environmentally friendly. With this in mind, it is advisable to select a cutlery option based on the individual cutlery model and manufacturer based on environmental and economic factors of TBL rather than by just its disposability. The social experiment revealed that many people at UBC are not disposing of their recyclables correctly. It also revealed that recycling at UBC should be more visually apparent in regards to what can be recycled.

3.2 Recommendations

The results of the social experiment suggests if better signs were used more people may recycle their cutlery. A mock up of the sign currently used with an updated redesign is shown below (Figure 3.2a). One possible way for UBC to increase PP yield and reduce mixed plastics is to introduce separate recycling bins for different types of plastics which would help would help to eliminate the problem in the first step of recycling process as well as provide much more awareness to the issue. This solution may not be feasible and possibly cause more confusion so more efficient sorting of plastics before UBC sends them off to Cascade may be easier especially the ones labelled Chasing Arrow 5; PP which requires to be recycled by itself in order to produce a usable plastic.

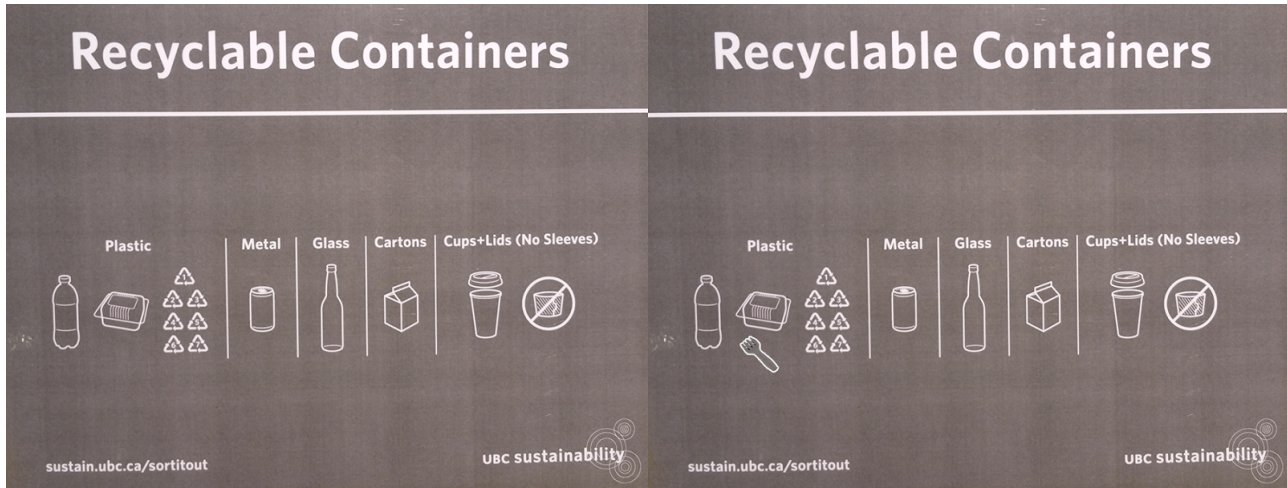


Figure 3.2a - Before and after of recyclable sign with added cutlery

It was found that the recyclable PP cutlery supplied by BSI currently used is already a very sustainable product being both environmentally friendly to a degree and cost efficient. In regards to TBL, this product provides a good balance between the environmental, economic, and social aspects where its sturdy design and useful “Recyclable” labelling makes it as clear as possible for people to properly dispose of as far as the product itself goes. Another product which was found to be more environmentally friendly is World Centric compostable cutlery, which only takes about 120 days to compost unlike the previous compostable cutlery which was researched by Victoria Wakefield to not decompose after a year. The World Centric cutlery though is much more expensive than the BSI counterpart. These recommendations provide ample ways UBC can go about being more sustainable in regards to the cutlery that is used and how they are disposed of using varying degrees of effort and resources.

Reference

- [1] Green Plastics (2012, August 17). The Difference Between Degradable, Biodegradable, and Compostable. Retrieved March 30, 2015, from <http://green-plastics.net/posts/85/the-difference-between-degradable-biodegradable-and-compostable/>
- [2] BSI Biodegradable Solutions (2015). Cutlery: Recyclable Cutlery. Retrieved April 1, 2015 from http://www.biodegradable-solutions.com/product_detail.php?cat=cutlery&subcat=recyclable_cutlery
- [3] Victoria Wakefield. Purchasing Manager, Student Housing & Hospitality Services, University of British Columbia. Vancouver, BC. March 6, 2015.
- [4] Emily McGill. Compost Specialist, BSI Biodegradable Solutions. (April 7, 2015). Email Message.
- [5] Al-Salem, S. M., Lettieri, P., & Baeyens, J. (2009). Recycling and recovery routes of plastic solid waste (PSW): A review. *Waste management*, 29(10), 2625-2643.
- [6] Brian Strong, Merlin Plastics. Telephone conversation. Vancouver, BC. March 21, 2015.
- [7] Goodship, V. (2007). Plastic recycling. *Science progress*, 90(4), 245-268.
- [8] Plastic Recycling and Resin Identification Codes. Retrieved April 1, 2015, from <https://www.complerecycling.com/resources/plastic-recycling/codes>
- [9] Prepared by Moore Recycling Associates for the Canadian Plastics Industry Association (February 2014). *2012 Postconsumer Plastics Recycling in Canada*. (April 7, 2015)

Appendix A


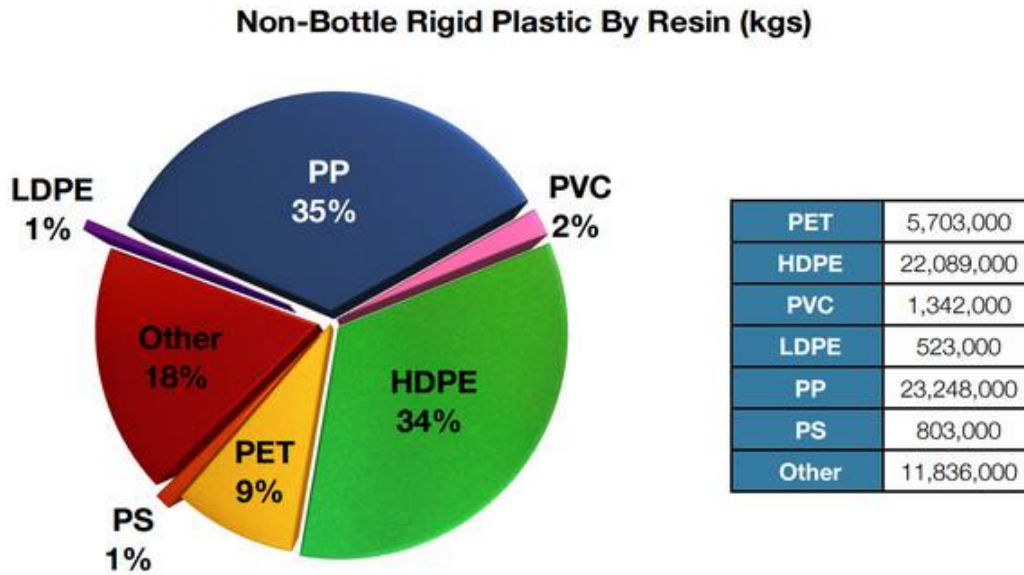
	Polymer	Characteristics	Typical Usage
1	Polyethylene Terephthalate (PET)	Most commonly used. Can be fully recycled	Films, food packaging, polyester, soda bottles
2	High-Density Polyethylene (HDPE)	Most commonly used. Can be fully recycled	Soda bottles, plastic bags, containers
3	Polyvinyl Chloride (PVC)	Considered toxic. Low recycle rate	Cables, electrical boxes, fencing, pipes
4	Low-Density Polyethylene (LDPE)	Reusable but not always recycled. Not rigid.	Food containers, lids, plastic wraps, tubing
5	Polypropylene (PP)	Difficult to recycle. Tough and lightweight	Cutlery, shipping pallets, storage bins
6	Polystyrene (PS)	Difficult to recycle. Cheap but possible health risk	Cutlery, thermal insulation, protective packaging
7	Acrylic, polycarbonate, polylactic acid etc	Usually not for reuse	N/A

Figure 4.1a - Resin Identification Code [8]

Appendix B



Data from the report *2011 National Mixed Rigid Plastic Bale Composition Study* performed by Moore Recycling Associates for APR were applied to mixed rigid bales to provide the resin breakdown above. With the exception of Tubs and Lids bales, for which there is Canadian composition data, the bales were U.S.-sourced.

Figure 4.2b -Non-bottle plastic by resin (kgs) [9]