

PLASTIC BAGS AND A LOOK AT ALTERNATIVES.

A look at why plastic bags are bad for the environment and what alternatives are out there for the retailers of British Columbia.

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Introduction

Single use plastic bags have become a common daily artifact; they are ubiquitous. From holding your groceries to holding your trash, they are immensely useful given their low cost. However, these bags have now become a major environmental headache. What was once an economical storage solution is now threatening many aspects of the environment.

Since the turn of the millennium, many campaigns around the world have been successful in persuading the general public to decrease the use of plastic bags. One of the most famous and studied cases took place in Ireland. In 2002, the Irish government levied a 15 cent Euro tax on all single use plastic bags in the country at the point of saleⁱ. This tax was, by many measures, a success: it was self-sustaining, as the program was funded by the generated, and by 2007, plastic bag use was down by 94%ⁱⁱ.

Several legislations have been just as successful. In one case in 2007, San Francisco's municipal government placed an outright ban on non recyclable single use plastic bagsⁱⁱⁱ. The effects were further-reaching than just the ban of plastic bags; it was also commendable in that the city managed to get lobbyists, big businesses and the general public to accept this ban. Legislation is notoriously hard to pass and San Francisco managed to make it happen.

Economic incentives and legislation aren't the only effective campaigns. In Suginami city, Japan, local officials started an intensive public campaign to urge its citizens to reduce their use of plastic bags and to bring their own reusable bags instead^{iv}. It started in 1995 and by 2005, it was estimated that 35.2% of shoppers brought their own bags and resulted in a 30% overall drop in plastic bag use^v. This shows that effective public campaigns can educate people enough for them to make their own choices in regards to plastic bag usage.

While all the campaigns mentioned here were effective in reducing the use of plastic bags, people still a suitable replacement for them. If plastic bags are not the answer to the new environmental stance that people have, then what is the most economical and environmental alternative for British Columbia?

The Plastic Bag

Currently, plastic bags are made of ethylene, and are known as polyethylene-based bags. What makes the plastic bag environmentally unfriendly is the non-renewable resource of petroleum required to produce them, the toxic chemicals they contain, and the thousands of years necessary to degrade them.

First, we will examine the carbon footprint of a plastic bag. A carbon footprint is the measure of the total greenhouse gasses, in kg of CO₂, involved in the product, use, and decomposition of the bag. It often involves two types of measurements: the primary carbon footprint and the secondary carbon footprint^{vi}. The primary footprint is the CO₂ that is under our direct control during manufacturing and transport of the plastic bags. The secondary footprint is the CO₂ that is indirectly released during the use of the bag, when it decomposing or during its life cycle.

Mok, et al. used a baseline of 1095 plastic bags used per person per year in order to determine the total carbon footprint of plastic bags per person per year. This number was calculated from their literature study where the number of three plastic bags per day for the average Hong Kong/Chinese resident. In Canada, many people easily exceed that quota of usage. The figure given was 12.8 kg of CO₂ emitted per year^{vii}. For reference, burning 1L of gasoline releases 2.61 kg of CO₂^{viii}.

In terms of total energy used to produce and ship plastic bags, the common propylene plastic bag made using petroleum ranks as the most efficient. In two separate studies, the same results were corroborated. In the first study, commissioned by the Progressive Bag Alliance, the total energy required to produce 1000 plastic bags was 509 MJ^{ix}. The second study, Tabone, et al. used a life cycle analysis of

twelve polymers, seven derived from petroleum, four derived from biological sources and one derived from both, to determine which ones were best for the environment. Indeed, the study found that polypropylene used only 67.6 MJ eq/L of unmolded plastic pellets^x. This second study also concluded that from cradle-to-gate, polypropylene ranked number one of twelve in terms of production efficiency.

However it is widely known that plastic bags are very damaging to the environment. Plastic bags take such a long time to decompose that the Progressive Bag Alliance study listed them as non degradable, and even when they do "breakdown," small particles are still left behind^{xi}. Plastic bags are often ingested by marine life and, in another anecdotal example that took place in Bangladesh, plastic bags clogging sewer drains caused monsoon floods to be even more devastating than they already were^{xii}.

Another major problem with plastic bags is that many cities refuse to recycle them due to high cost and little economic benefit. This is because "recyclable" plastic bags are never truly recyclable. They can only be "down-cycled" meaning that recycled plastic bags can only be used to make more plastic bags which can then no longer be recycled^{xiii}. In fact the City of Vancouver does not recycle plastic bags. Even in markets where plastic bag recycling is an option, very low recycling rates occur. For example, in Australia only 2.7% of plastic bags were recycled in municipalities that did offer such an option^{xiv}.

Biodegradable Plastic bags

A common alternative that is marketed as more environmentally friendly alternative to the single use polypropylene bag is the biodegradable plastic bag. The important thing to note about these bags is that there are many different types. Since this technology is so new most bag manufacturers have their own proprietary blend.

Biodegradable plastic bags are promised to break down in a year or two, as opposed to the hundreds of years that plastic bags take to break down. There are a few main types of biodegradable plastic bags,

but the type with the largest worldwide adoption is the oxo-degradable bag, which contain a pro-degradant that helps catalyze the breakdown of the plastic from years to months^{xv}. The most common additive to the pro degradant is manganese, however the exact concentration or combination of metals and chemicals that make up this pro-degradant is still very dependent on each manufacturer^{xvi}.

The creation of biodegradable plastic bags takes up a large amount of energy. In fact it takes up to 1380 MJ of energy from oil, electricity and other sources, to produce 1000 biodegradable plastic bag^{xvii}. This is more than double what conventional plastic bags require. Biodegradable bags also require more water during production.

With the wider adoption of biodegradable plastic bags, more studies have been done to see whether or not these bags hold up to manufacturers claims. A Swedish study looked at two types of biodegradable plastic film produced by a German firm. The researchers found that when the plastic was in high humidity environments, such as those found in landfills, the composting time was slowed significantly^{xviii}. A second study done by the Biodegradable Plastics Institute discovered that cold temperatures also slowed decomposition^{xix}. These findings are particularly disconcerting as Vancouver is a very cold and wet area. In these conditions biodegradable bags could take just as long as polyethylene bags to decompose thus negating their benefits.

The Biodegradable Plastics Institute further tested the plastic to analyze it's chemical content and it found that the bags contained heavy metal levels that far exceeded accepted levels. Levels of lead were found to be four times accepted US levels and twelve times higher than levels accepted in Japan and the EU^{xx}. Another heavy metal, cobalt, was find to occur 7 times higher than accepted levels in Canada^{xxi}.

The presence of such high levels of toxic metals is of concern as decomposed bags can end up groundwater or used in fertilizer.

Another problem facing biodegradable bags is that they are not accepted into recycling programs in Canada. The Fundy Region Solid Waste Commission in Saint John, NB put out a press release stating that biodegradable bags cannot be accepted in recycling or compost programs^{xxii}. Places in Australia that recycle plastic bags do not recycle biodegradable bags as well because the recycled plastic is inferior to that of the regular polyethylene plastic bags^{xxiii}. The EuPR, the body that represents plastics recyclers in the EU, condemned biodegradable bags, and released a statement stating that while new technology is always nice to see, not all of it is always beneficial and in this case oxo-biodegradable bags fall under the not-as-beneficial category^{xxiv}.

Oxo-biodegradable bags may seem to be a inferior option, but the technology is so new that many of the problems facing the bags today can be addressed by bag manufacturers. A journal article written by Ren for the International Center for Science and High Technology offers some suggestions that would improve biodegradable plastic bags. He suggests that the industry to should create standards and a standardized testing method and they should also create guidelines, standards and technical assistance on how to properly compost the plastic. The industry should also create a document outlining what the composted bags can be used for and should lobby for government adoption and tax breaks for businesses that use biodegradable plastics. Finally the general public should be educated on the differences between biodegradable plastics and regular polyethylene plastics^{xxv}.

A second type of biodegradable bag made of starch can be another option. These bags have already been accepted into San Francisco's compost program. A study done by Tabone, D. et al., found that of the twelve plastics they tested, the two biopolymers made of starch ranked number one and four on their green design metric^{xxvi}. This green design metric measured waste prevention, material efficiency, avoidance of hazardous materials, pollution, maximized energy efficiency, use of renewable resources, recyclability, biodegradability, local source usage and cost efficiency. Unfortunately as of now only PLA-

G, the number four ranked biopolymer, is being used to produce bags. If the market is there Natureworks, the number one ranked plastic by Tabone et al, could be used for plastic bags.

Paper Bags

Paper bags have been around for a long time. In fact polyethylene bags came to replace paper bags in the first place. Therefore the same reason that caused retailers to switch over to paper bags still holds true. Paper bags are not as strong as plastic bags, they perform poorly in wet weather, are expensive, weigh more, are still single use and take longer to fill. A report by the Government of Australia concluded that if a person used on average ten bags per week, 22.5 kg of paper would be used and in contrast only 3.12 kg of polyethylene would be used^{xxvii}. This same study also stated that the manufacture of paper bags consumes more water and generates more water borne wastes. In fact a life cycle analysis done on paper bags reached the conclusion that paper bags take three times as much primary energy in comparison to polyethylene bags^{xxviii}. The report done for the Progressive Bag Alliance also echoes these findings, with 1219 MJ of energy required to produce, use and dispose of 1000 paper bags vs 457 MJ for plastic bags^{xxix}. As well paper bags generate 70% more air pollutants and 50% more water pollutants during manufacturing^{xxx}.

On the other hand, paper bags are the only option that can be fully recycled and composted. The paper from paper bags can be recycled up to six times and the recycled paper can be used to make a whole host of paper products^{xxxi}. With the improvement to paper recycling technology and that recycled paper bags require less energy to make than virgin paper bags, switching back to paper bags can be a very viable option^{xxxii}.

Woven Tote Bags and PP Fiber "Green Bag"

The general consensus in nearly all articles dealing with the problem of plastic bags is that the woven tote bag and the PP Fiber "Green Bag" is the best option when it come to environmental friendliness. One of these bags can be used for an extremely long time thus negating the need to keep mass producing bags. The study done on carbon footprints in China, India and HK estimate that in a year a person will go through 11 PP fiber bags or 21.9 woven bags, this is opposed to the 1095 plastic bags that they estimate a person uses in a year^{xxxiii}. This effectively cuts down at the very minimum half of the amount of resources, in kg, 1095 plastic bags would use, about 6.57 kg for plastic bags vs 2.75 kg for woven fiber bags and 718.32 grams for PP fiber bags^{xxxiv}.

The PP fiber bag is composed of polypropylene, and is currently the popular choice that is being pushed onto consumers in Ireland and Australia while the woven fiber bags, made of organic fiber, are easily found in most retailers around the world. What makes these bags so desirable is that they eliminate waste, are cheap to produce and are easily recyclable. Woven tote bags are mainly made of cotton, although there are alternatives that can be made of hemp or other organic fibers. Hyder Consulting did a comprehensive study on different bag materials and found that the PP Fiber bag ranked number one in the categories of material consumption, global warming potential, energy consumption, water use, litter marine biodiversity and litter aesthetics while the woven tote bag ranked number two overall^{xxxv}.

While there are many benefits to the reusable shopping bag, there are some glaring concerns. In a study done at the University of Arizona, random reusable bags were taken at supermarkets in Arizona and California. These plastic bags were then swabbed and tested for food borne illnesses. Researchers found that over 50% of bags contained coliform bacteria and 12% of bags contained E. Coli, bags that carried meat as well as veggies had a 10 fold chance of carrying harmful coliform bacteria^{xxxvi}. The researchers also tested bags that were hand washed after use and found that washing was 99% effective in removing all types of bacteria from reusable shopping bags^{xxxvii}. Unfortunately the study also asked the

shoppers, from whom the bags were collected from, if they washed their bags and only 3% of shoppers responded with a yes^{xxxviii}. Fortunately this problem is easily alleviated by educating the public, or printing warnings directly onto the bag.

Another significant critique of the reusable shopping bag is that most people do not carry them around all the time. A large enough percentage of shopping is done spur of the moment and in fact this issue regarded as a significant concern in a report on plastic bags produced by the Government of Australia^{xxxix}. Thus while the PP fiber bag and the woven tote bag are clearly the most environmentally friendly option, other choices also have to be offered at the point of sale by retailers for customers who don't have their reusable bags with them.

Discussion and Conclusion

Currently single use disposable plastic bags are the bags of choice because they make the most business sense. As it was proven in Ireland, levies are a very powerful tool in persuading businesses and consumers to change their habits. The levy in Ireland managed to reduce plastic bag use by 90%, which is by far the most effective solution in the bid to eliminate plastic bag use^{xl}.

Unfortunately in BC, individual cities cannot enact bylaws to ban plastic bags^{xli}. Cities can only ask people to voluntarily opt to not use plastic bags and for businesses to offer alternatives. This situation has led to smaller municipalities with larger community involvement such as Squamish and Tofino to enact voluntary measures while larger cities such as Vancouver stall on such issues^{xlii}.

I believe that if bylaws cannot be passed in BC to eliminate plastic bags, the onus passes onto businesses to take it upon themselves to eliminate plastic bags from their stores. In my analysis below I have included suggestions and reasons to why certain options are better for different types of businesses.

The Government of Australia has worked closely with the Australian Retailers Association to classify businesses into two groups. Since Australia is very similar to Canada, and BC, thus I feel their categorization is very useful when it comes to BC's context as well. In group one are businesses that are national chains, or businesses that are sponsored by wholesalers or are run under banner groups^{xliii}. Group two businesses are all other businesses that don't fall under group one, thus group two includes true independent stores, which for example are small mom and pop stores, most corner stores etc^{xliv}.

In keeping in line with how businesses are grouped in Australia, I will start my analysis with group two or equivalent businesses here in BC. These retailers are what people see as the mom and pop stores or independents. While these stores contribute the least the plastic bag problem, they are the most likely to change. The biggest issue facing these retailers making the change keeping costs down and maintaining their presence in the community in which they are located. A few case studies in Australia show that making the switch away from plastic bags has actually improved both of these categories^{xlv}. Some very effective strategies have been selling PP fiber bags to customers at cost, gifting free reusable bags with a certain purchase limit, selling PP fiber bags and giving customers 10% off the next time they bring their bag back or donating 20 cents to an environmental cause every time a customer refuses a plastic bag^{xlvi}. In six of the seven case studies, retailers have actually benefited financially from switching away from plastic bags^{xlvii}. Since most small retailers cannot buy plastic bags in large enough orders that count as bulk, it actually costs them more to supply plastic bags to consumers when compared to group two retailers. By effectively phasing out the plastic bag passing the cost of reusable bags onto consumers in creative ways retailers save themselves money. Their public image also improves with plastic bag elimination. One retailer said that they have seen an increase in foot traffic from people who support their cause, other retailers state that people have appreciated the elimination of plastic bags and are more likely to return to the store^{xlviii}. Ultimately the choice of the alternative to the plastic bag depends on what the retailer is selling, four of the seven case studies offered PP fiber reusable bags

because their store sold larger goods and items, two stores chose to go with 100% recycled paper bags because they sold small food items and selling large PP fiber bags did not suit their products^{xlix}. However the consensus was towards the PP fiber bag because it was cheap, easy to switch over to and improved the store's public image.

Group 1 businesses or chain retailers are the largest contributor to the plastic bag problem. They sell the most goods by volume and are more likely to use plastic bags because it is the cheapest method of storage. However implementing solutions here are far more costly and time consuming. Large retailers have been using plastic bags for decades and most of their check out systems have been designed to be used with plastic bags. As seen at Safeway, IGA, Save-On, The Gap, Futureshop etc check out efficiency has been built around the plastic bag. For these retailers minimizing costs and maximizing profits is the main and only objectiveⁱ.

As Tucker noted in his study of grocery stores, many of these stores don't see eliminating plastic bags as their problem. Managers of these stores feel that if consumers did not want plastic bags they would bring their own alternatives. However some large chains such as IGA have already been pushing the PP fiber bag offering customers 3 cents, the cost of a plastic bag, every time a customer uses a reusable bag^{li}. As well stores like Thrifty's have switched over the paper bags at an additional cost to the consumer but have resorted to giving them away for free after customer complaints^{lii}.

It is very difficult to offer a single solution to large retailers. Nearly all the retailers interviewed by Tucker note that no matter which alternative they switch to there will be an increased cost, paper bags cost 25 cents each while plastic only costs 3 cents^{liii}. With the interviews group two retailers find that customers that pass through their stores are receptive of the lack of a convenient option for goods storage while on the other hand group one retailers received a backlash for such a shift. Thus it seems that just offering reusable options is not a viable option. Indeed the most effective solution would be to give

reusable bags a more prominent location in stores and for all retailers to offer PP fiber or woven tote bags. If these bags become the norm, such as plastic bags have become, then people will no longer have the need to use plastic bags.

Based on my research and analysis the winner is the PP fiber and woven tote bag. These bags are the number one when it comes to the reduction of litter, recyclability, reducing society's dependence on petroleum, lowering our carbon footprint. Of course bagless retail would be the best option, but since that requires a complete change in our retail habits, pursuing the re-usable shopping bag option is currently the best option. Even though plastic bags only consist of 3% of total litter, changing our dependence on them will go a long way to improving our environment and protecting our resources^{liv}.

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ⁱⁱ Convery, Frank et al. "The most popular tax in Europe? Lessons from the Irish plastic bags levy." *Environ Resource Econ* (2007) 38:1–11

ⁱⁱⁱ Romer, Jennie Reilly. "Evolution of San Francisco's Plastic-Bag Ban, The." 1 Golden Gate U. Envtl. L.J. 439 (2007)

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