An Investigation into the Use and Effects of Bin Liners

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ABSTRACT

The use of bin liners have recently became popular as a safe and convenient way to handle garbage. Invented back in 1950, bin liners come in a variety of types that include plastic, cotton, paper, and recently being made of biodegradable materials. They may come in many different sizes, each with a different price and may be used in both personal and commercial settings. Bin liners, although having their pros also have many cons. Some of these downfalls include economic, environmental and social issues. The sight of litter from the increased amount of plastic bags promotes insecurity and unpleasantness in the social community. Most bin liners are also expensive not only to the consumer but to manufacture. Environmental issues include global warming from the production of plastic bags, litter, and the long half-life of many plastic bags. In response, there is currently an increasing movement towards a green world to reduce the amount of plastic bin liners used. Doing so will help preserve the Earth and make it a cleaner and pleasant world to live in.

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Figure 1: The relative contribution of different environmental impacts of a HDPE bag.

GLOSSARY

Green house gases	emissions given off during production processes of plastic bag liners as well as breakdown of paper bin liners
High-density polyethylene	high density plastic for conventional plastic bags
Life cycle assessment	the assessment the life cycle of products; provides useful information and some conclusions as to which phases are responsible for the most significant environmental impacts
Low-density polyethylene	low density plastic for more heavy-duty plastic bags
Polylactic acid	a bio-based polymer used to create biodegradable plastic bags; a renewable resource
Polyhydroxyalkanoates	polymers produced by micro-organisms
Polyethylene	a gelatinous substance used to create plastic bags

LIST OF ABBREVIATIONS

GHG	greenhouse gases
HDPE	high-density polyethylene
LCA	life cycle assessment
LDPE	low-density polyethylene
PP	polypropylene
PLA	polylactic acid
PHA	polyhydroxyalkanoates
PE	polyethylene

1.0 INTRODUCTION: WHAT ARE BIN LINERS & WHY ARE THEY USED

Bin liners, as the name suggests, are used to line rubbish and recycling bins and may also be called “bin bags”. The use of bin liners have only really been popular in the past couple decades and are a convenient and safe way to handle garbage. Bin liners are lightweight; help minimize odor and keeping wet or messy garbage together, and serves to keep the waste container sanitary. Bin liners were created in 1950 with credit going to Canadians Harry Wasylyk, Larry Hansen, and Frank Plomp (Wikipedia, 2014).

The majority of bin liners are made of plastic and many reuse the plastic grocery bags obtained while shopping to line waste containers. Other types of bags include paper (whether from new or recycled sources) and biodegradable plastics that may break down easily over a short amount of time. Bin liners are fairly stable in sanitary landfills and the use and convenience has helped manage waste for many people. Bin liners are used in both personal and commercial settings.

However, there are also many downfalls with the increased used of bin liners. Noticeable litter is one of the major issues as increased use may lead to an increase in litter seen in public. Global warming is also another major issue due to the production costs of plastic bags. Other environmental factors include the fact that most plastic bags may take up to a thousand years to break down and may be harmful to marine and land animals that mistaken plastic bags as food. Manufacturing of many paper bags leads to increased logging and decreases the amount of forests in the natural environment.

Due to the increased use of plastic bin liners causing a high growth in environmental, economic, and social problems, many societies and countries around the world have imposed changes in an attempt to find a greener alternative. Many switch from plastic to paper bags for food scraps and reusable cotton bags for groceries instead of plastic bags. This naturally decreases plastic consumption and implicitly the carbon footprint on the environment. Some even opt to not use bin liners in waste containers or recycle newspaper by folding it into an enclosed container to hold food scraps. The education of people about the effects of increased use in bin liners may also help alleviate the rising problems of plastic bin liner use. The overall expected effect is a decrease in global warming as well as economic and environmental problems.

2.0 TYPES OF BIN LINERS

Bin liners can come in different forms from the most commonly used plastic to the green alternatives of paper and biodegradable/compostable plastic products made from plant polymers. Many retailers sell bin liners and offer products that come in a variety of material and sizes. EcoSafe sells biodegradable bags that may range from $10 to $50 depending on the size needed to both personal and commercial parties. Brabantia is also another company that tries to specialize in green alternatives by offering paper bin liners in conjunction with the conventional plastic. The Bag to Earth company specializes in only paper bin liners, with a motto asking society to "help the Earth help itself" by reducing the amount of plastic bin liners used.

2.1 PLASTIC

2.1.1 High-density polyethylene (HDPE) bags

DPE bags are the most commonly used type of plastic bags. They are most sold or provided by super markets when customers pick up groceries. Many people reuse HDPE bags as a cost effective source of bin liners. They are usually vest-shaped, thin and lightweight. The degradation of these bags usually occurs under natural sunlight, heat and/or mechanical stress, and the environmental weather (Edwards, 2011).

2.1.2 Low-density polyethylene (LDPE) bags

LDPE bags are a heavy-duty type of plastic bag. They are usually purchased from retailers are may be used to hold wet or heavy trash that would normally tear through conventional plastic bags. They may come in a variety of sizes depending on the need of the customer. The production of HDPE and LDPE plastic bags are done by forcing gelatinous polyethylene (PE) material through holes to create strings. The strings are then cut, heated, and molded to make bags (Edwards, 2011).

2.1.3 Polypropylene (PP) bags

PP type bags are made with spun bonded non-woven technique. These types of bags are sturdier than LDPE bags and intended to be reused. Stability is provided with a semi-rigid insert into the bag itself (Edwards, 2011).

2.2 PAPER

Paper bags are more environmentally friendly as paper biodegrades much more easily than plastic materials. They may be made from new or recycled

materials and are meant for holding food scraps as the entire bag may be tossed in a compost area with the food to break down.

2.3 COTTON

Cotton bags are woven from cotton such as calico (an unbleached cotton) and are designed for multiple uses. In many places cotton bags are usually used for groceries and less for garbage.

2.4 BIODEGRADABLE/COMPOSTABLE

Biodegradable, or biopolymer, bags are a more recent development. They tend to be more expensive then regular plastic bags and may only be purchased from retailers. The biopolymers consists of polylactic acid made from plant-based starches decompose easily when combined with carbon dioxide, methane, water, and inorganic compounds or biomass. Types of polymers used for biodegradable bags may be from renewable plant sources or from those produced by microorganisms (polyhydroxyalkanoates, or PHAs).

3.0 EFFECTS OF USING BIN LINERS

Bin liners have had effects seen in the economic, environmental and social aspects of the community. The costs of production, global warming, litter, and effects on wild life are some of the impacts that bin liners have had on the world that people reside in.

3.1 ECONOMIC EFFECTS

The use of bin liners have increased steadily in the past couple decades. Economic costs include not only costs for production, but also recycling and collection. The promotion of biodegradables and new types of plastic creates a need to invest in recycling facilities. Costs are need for facilities, workers, and vehicles for plastic collections whether from plastic specific dumpsters or curbside collection.

Litter has a role in economic costs, as tourism is a vital role in the livelihood of many countries. Litter negatively impacts tourism in both land and marine environments. Litter incurs insecurity and unpleasantness to the people in the community. More litter lowers tourism and therefore brings down money made by countries. Litter in the marine environment also incurs costs on fisheries and maritime activities because they need to invest in cleaning and disentangling garbage from their equipment.

3.2 ENVIRONMENTAL EFFECTS

Life Cycle Assessments (LCAs) are a useful tool for determining the environmental impacts of bin liners on the environment. For many products, the most major impacts are due to production costs and resources. The secondary packaging and end of life have minimal impacts (see Figure 1 below).

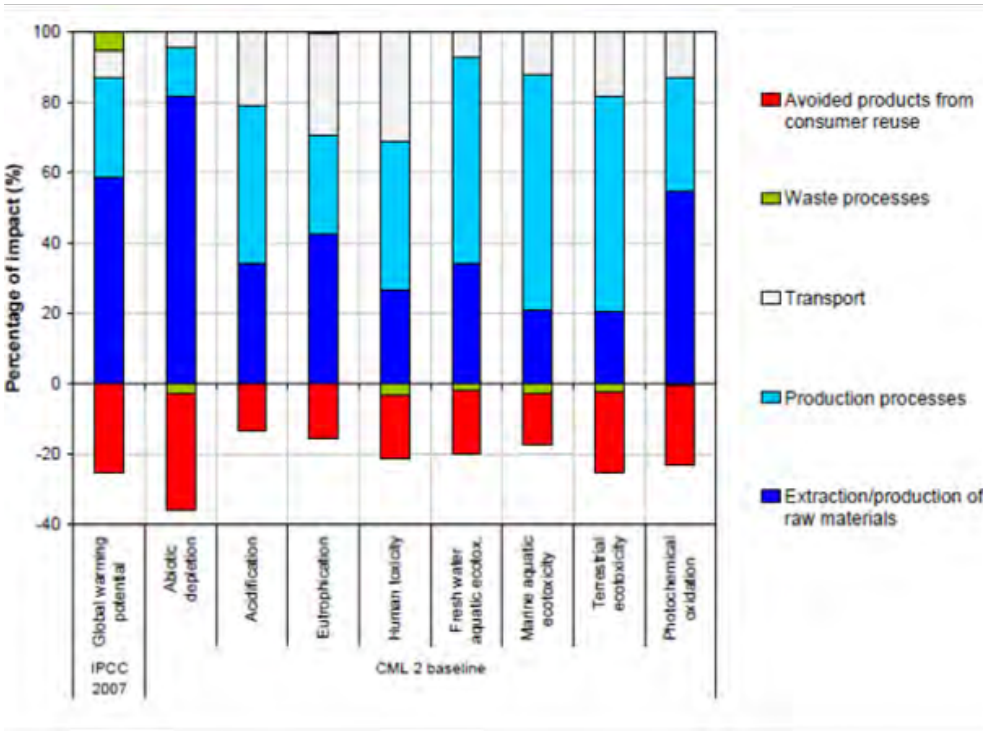

Figure 1: The relative contribution of different environmental impacts of a HDPE bag (BIO Intelligence Service, 2011).

On average, about 2 kg of oil is burned to produce 1 kg of plastic (polyethylene) for use in production of plastic bags. Each kg of oil will produce about 3 kg of carbon dioxide for a total of about 6 kg of carbon dioxide per 1 kg of plastic produced. Depending on the weight and thickness of the bag, one plastic bag can produce up to 200 to 300 grams of carbon dioxide. So while the mid and end life cycles of plastic bags do not have huge impacts, the production contributes a major portion of the carbon footprint to global warming. The end-of-life phase of plastic bags are a factor in the amount of litter that is seen around the community. While using less plastic may reduce the carbon footprint, thinner bags could potentially lead to "double bagging" as fragile and thinner bags are more prone to ripping. The increased use of all types of plastic bin liners leads to increased litter. Litter is "defined as the pollution of roads, car parks, beaches, parks, other public spaces, public transport, etc. with carelessly or deliberately dropped or ignored waste" (BIO Intelligence Service, 2011). Marine and land animals mistaken litter as food may be harmed after ingesting plastics.

Biodegradable bags are marketed as a good replacement for traditional HDPE plastic bags. However, they do not break down as rapidly in the environment as expected. Their impact depends highly on the type of material they are manufactured from and where in the environment the bags are used. They require more resources to produce, in turn raising the output of greenhouse gas emissions. Some biodegradable bin liners degrade faster in

water while others are better degraded in direct sunlight. Only under composting conditions do biodegradable bags break down easily. When littered, they have the same impact as regular HDPE plastic bags (ICF International 2010).

Paper bags are also a more biodegradable option, but the increased use may lead to more logging of trees for more paper. This has a negative effect on the forests in the community. Forestry also affects the land animals that live in forested areas. Paper bags also have higher green house gas (GHG) emissions leading to great atmospheric acidification, water consumption, and ozone production (ICF International 2010).

3.3 SOCIAL EFFECTS

To the community, many people consider even small amounts of litter to be unpleasant. It impairs the quality of life, creates insecurity, and damages the image of urban and rural environments (BIO Intelligence Service, 2011). Excessive amounts of litter can also have negative impacts on human safety and health.

Health effects include potential harmful monomers or materials that go into creating plastic bags and other bin liners that end up as litter. Litter from bin liners that clog sewer pipes can create breeding grounds for mosquitoes and parasites that raise risk of spreading diseases. Plastic bags that on the street may be mistake by young children as toys and can cause harm if not properly disposed of.

4.0 HOW CAN THE PROBLEM BE SOLVED

UBC's Composting program is a close looped system that uses in-vessel composting technique. It has the capacity to process 5 tonnes of organic waste and turns it into compost in two weeks. The compost is then cured in a pile for 90 days before being applied to the campus. This is an amazing program that is helping UBC reach the zero waste goal, but the bin liners that are currently used by the different participating faculties sometimes jam the in-vessel composting machine's axles creating delays and problems. We are trying to find a solution to this problem.

UBC being at the forefront of the push for sustainability, the aim is to reduce and reuse as much as possible. Composting the massive amount of organic waste generated on campus is an integral part of a zero waste goal.

Having a guideline to determine what the faculties that are currently sending compost to UBC Composting Program can use as composting bin liners will ensure the ease of the composting process and make certain the bags used are indeed compostable. It defeats the purpose of composting if the food is sent through in a non-biodegradable bag or a bag that requires much longer to decompose than the food scraps.

There are two recommendations for UBC Composting program.

1) The use of paper bags lined with biodegradable resin has the ability to hold the food inside the bin without breakage and decompose at a fast rate when put into the in-vessel composter. The material of paper and a thin coat of resin will be easy to handle for the paddles that are inside the composting vessel that loosens up the organic waste. Although much more expensive than standard biodegradable bags, the fact that it will not jam the axles will save money from repairs and downtime of the composter. Being stronger than standard biodegradable bags, the decreasing chance of breakage will make clean up much easier. The absence of breakage will decrease the pungent odour produced by organic waste.
2) Another more radical method we propose is to forego the use of bin liners altogether and changing all the composting bins into a bin with a heavy-duty lid that has an airtight seal. The production of any bin liner requires energy and resources, and it just seems counter intuitive to have to produce something solely for the purpose of it being able to be decomposed.

   This will have a high starting capital cost, but the fact that no liners are needed will make the money back fairly quickly the longer the program is in place. A quick rinse after each time it is emptied is all it needs. Despite

an airtight seal, odor will inevitably leak out, but the fact that no liners balances that disadvantage out.

4.1 UBC student residence programs

Compost bins are provided as a room inventory for students of on-campus residences to encourage the composting of organic wastes. However, many students do not use it for quite a few different reasons. The bins with food scraps and other organic wastes produce awful odors that students simply do not want to deal with. The cost of biodegradable bin liners for the compost bin is something that students on a tight budget cannot afford to add to their list of expenses. And simply being busy will make the students skip composting their organic wastes.

In the higher and larger student complexes, garburators are being installed to make disposing of organic wastes a much simpler matter by simply grinding it down a chute for organic wastes.

Since if the problem with composting was that students were lazy, they wouldn't compost even if bin liners were not a problem, we will only be focusing on the bin liners being expensive for cash strapped students. In order for students that are willing to compost, but do not want to pay for bin liners, here are two options we feel are realistic:

1) Flyers can be put onto student dorm's doors that show steps to fold newspaper into a bin shape that allows for its use as a temporary bin liner that can also biodegrade fairly quickly and at no cost to the student if free newspaper is readily available.
2) UBC can provide bin liners for each compost bin provided monthly and have part of the fee for the liners included in the monthly rent for living on student residences. This way the price would seem much less and many students will participate in composting since they are already paying for the liners.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Through the investigation required to complete this report and its associated assignments, much have been learned about the impact of bin liner choice on the environmental, social, and economic level. The effect of bin liner can be the deciding factor whether some students will choose to compost or just throw their organic waste together with other garbage. There is a certain threshold for most students where if the amount of effort required to compost their organic waste is reached, students would simply forego the whole process altogether. The goal to increase composting amongst student residences would have to include accessibility and ease of being able to compost and separate garbage efficiently.

For student residents it was recommended above that UBC should incorporate the cost of compost bin liners into residential rent in order to promote composting. As for UBC faculty composting, recommendations include development or purchase of a large fleet of airtight compost bins of various sizes to replace all current compost bins that do not require the use of liners. The bins can be cleaned by a quick rinse of water. This is one method to reduce the amount of greenhouse gas emissions by reducing overall bin liner use.

Students and other residents could also be educated about the effects of increased use of bin liners, the costs, and the benefits of managing garbage without using bin liners. There are some very interesting tips on the Internet about separating garbage and keeping green (see appendix: 10 Tips for Managing Garbage) that do not require the use of bin liners. Students may also reuse newspaper to create their own origami bin liners (appendix: Newspaper Origami Bin Liner).

This report was done in hopes that the research will help raise ideas and awareness to alleviate the costs in all three aspects of bin liner use and create a greener society at UBC, Vancouver, and the rest of the world.

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7.0 APPENDIX

7.1 10 TIPS TO MANAGING GARBAGE WITHOUT PLASTIC BAGS

10 TIPS TO MANAGE GARBAGE WITHOUT PLASTIC BAGS

1. Separate your garbage (into more than one bin)

2. The bins do not need to be bins

3. Composting is not as scary as it sounds

4. Learn your recyclables from your non-recyclables

5. Be selective about what you buy

6. Rinse your garbage (if possible such as milk cartons)

7. Buy meat cuts that do not have bones

8. Keep your food scraps container clean

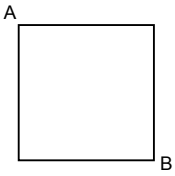
9. Start a garden

10. Your garbage can be cleaner and more manageable without plastic bags

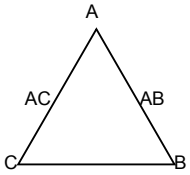
7.2 NEWSPAPER ORIGAMI BIN LINER

Organics Origami – Paper liner for Kitchen Container
For best results use 3 – 4 sheets of newsprint

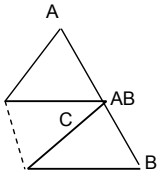
1) Start off with a square, then bring point B to A



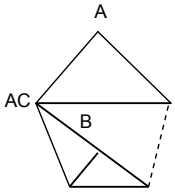
2) To form a Triangle



3) Bring point C to AB



4) Bring Point B to AC



5) Fold A points down on both sides