Plastic collection point simulation

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Rémy Greinhofer <remy@greinho.fr> / Kristen Reynolds

OBJECTIVE

The goal of this experiment is to simulate a Precious Plastic collection point for a small operation, where only “safe” plastics (♻2: HDPE, ♻4: LDPE, ♻5: PP) can be used.

Working with other plastic types requires a specific ventilation system with dust and active carbon filters, as well as special equipment like gloves and gas masks.

The different types of plastic will be collected separately and weighted at the end of the week. If a week of data is not relevant enough, we may extend this experiment to a full month.

We will collect only plastic items we use ourselves. No external items will be introduced.

With all this plastic, our idea is to extrude filaments for 3D printers. Ideally we would be able to print structural beams to replace lumbers used to build open source houses[1] designed by the Open Building Institute[2] and Open Source Ecology[3] for instance.

[1] https://wiki.opensourceecology.org/wiki/Seed_Home_v2
[2] https://www.openbuildinginstitute.org/
[3] https://www.opensourceecology.org/

COST & REVENUE

Cost

We estimated the setup cost based on the bills of materials provided by Precious Plastic.

We decided to go for the basic version of the machines, since we are just imagining a small local collection and processing point.

Bill of materials:

3x 200 Gal. Heavy-Duty Builders Bulk Bag	60€
1x Storage Shelf, 5 tiers, heavy duty	100€
12x 15L transparent containers	75€
Shredder	400€
Extruder	200€
TOTAL	**835€**

This is absolutely doable for a small operation or even a hobbyist project. This is basically the cost of a modern smartphone. At the time of writing, the smallest iPhone 12 is priced at $799 + tax.

Also note that the price of the machines is for the parts only, most of them being second hand or coming from the scrapyard. It does not include any labour, tools that are required to build/assemble the machines, or the access to a fablab. All these factors would contribute to the increase of the starting price of this project.

We also assumed that the space is owned or does not need to be paid for. 24m^2 / 260 sq ft was the minimum recommended (i.e. a one car garage).

It was also assumed that the containers would arrive, cleaned, label-free and pre-sorted. A washing station would otherwise also be a requirement for the space, adding to initial investment.

Going Pro

However, if we decided to go for the “Pro” version of the machines, planning ahead for growing the operation, this is a completely different picture, multiplying the initial investment by almost 10!

Bill of materials for the Pro machines:

Shredder Pro	3650€
Extruder Pro	2740€
TOTAL	**6450€**

Going for Pro would require either a way more comfortable hobbyist budget (i.e. a leisure second hand motorcycle) or to plan for some sort of return on investment.

Revenue

While our initial plan is not to generate revenue, it would be nice to be able to offset some of the cost.

If we follow our initial idea to only make 3D printer filament, the market price is around $20/Kg. Therefore we would only need to sell 41Kg of filament to break even.

We are not sure how doable it is to collect this amount of plastic, nor to sell this amount of finished product.

LOGS

Monday, July 26th 2021

Off to a great start, we emptied a bottle of HEB grapefruit juice that we usually drink for breakfast! Unfortunately, it is a type 1 plastic (♻1: PET), like most drinking containers. While it is totally possible to recycle them in general, our small operation does not have the setup in place required to process them safely. This is already sad since we assumed they would be the most common items we use.

A few hours into this experiment and we noticed another issue: **half of the time the recycling information is only written on the label, and not embossed on the container**. This means that if we find a container on a beach, a field or the street, and the label got detached due to outdoor conditions, we would not be able to recycle this item.

Second problem, **for multi-part items, the plastic type is not always identified on each part**, causing a similar issue to the previous one. Also meaning that we have to assume that the same plastic was used for each part, which we know is not always true (e.g.: plastic bottle and caps).

Tuesday, July 27th 2021

Day two into this experiment. We thought we were very conscious people and very aware of the plastic problem but we were still so far from reality!

Since yesterday, we noticed that **all our plastic food containers are ♻1: PET** (liquid containers, vegetable containers, cheese containers, etc.). This made us question our decision of starting to work only with safe plastic. So far, to be efficient, we should absolutely set up the infrastructure to be able to process more “unsafe” plastic, especially type 1 as they seem to be used everywhere by the food industry.

Another issue we are facing is the **plastic wrapper problem: what to do with them?** They are everywhere from cookies, to cheese, to vegetables. Even products we order via Amazon are wrapped in some sort of cling wrap, and the boxes often contain bubble wrap.

Wednesday, July 28th 2021

Another question got raised: **what to do with plastic caps?** For instance, carton milk/juice bottles have a plastic cap, but we have no idea of the type of plastic used for it.

As a side note, after 3 days, we are still at 0 safe plastic items in our recycling bag, versus half a dozen items in the non safe plastic bag. We decided to put the caps and wrappers in the landfill trash can.

Thursday, July 29th 2021

We got our first 2 recyclable items: 2 yoghurt pots ♻5 (15g!)!

While it was not a problem for these 2 yoghurts, and we mentioned in our hypothesis that the items would arrive clean, we realized that **for a full scale operation, washing the items could become a concern**. Imagine if you received a 60 gallon bag full of dirty plastic items!

We asked a few friends and none of them wash their containers before recycling them. This is however a requirement for recycling plastic! For example, the city of Austin, TX requests to rinse and dry the items before placing them in the recyclable bin[4].

Based on the volume of collected items, we would probably need to set up a system with a dishwasher. Then, the question of the water consumption for this operation could be raised.

Saturday, July 31st 2021

Before-last day of this experiment, and we got 2 more discoveries to share!

First, we went to a coffee shop and ordered coffee to go. The cup itself was cardboard but the lid was plastic. It was number ♻7… However, under the sign we could read “PLA”. Which is a type of bio-plastic, which supposedly means compostable plastic! So there is hope! Unfortunately, after doing some research, **in the landfill or in the wild, the conditions are not met for this type of plastic (♻7 PLA) to decompose**[5]. In addition to that, this plastic type is often not supposed to be mixed with other plastic types, and therefore

[4] https://www.austintexas.gov/department/austin-resource-recovery/faq
[5] https://mcgillcompost.com/blog/recycling-number-7-pla-plastics

not to be put in the recycle bin (most of the time - check with your local collection program)!

Second, we broke one of our food storage containers, so we took this as another recycling opportunity! This container was also a number ♻7, but of the type “TRITAN” this time. This type of plastic is manufactured by Eastman Chemical Company[6] and is appreciated by consumers as it is BPA free. However, a neuroscience professor at the University of Austin Texas, George Bittner[7], was involved in a court case against Tritan to demonstrate that there were a lot of other dangerous components involved in the process of making this type of plastic[8][9]. Also to note that the lid did not have any indication of the plastic type, and contained rubber. Finally, it seems that these containers are not recyclable anyway and ended up in the landfill trash bag.

Sunday, August 1st 2021

Last day of the experiment. Nothing much to add to what we already discovered earlier. We added a few items where the lids/caps were unmarked (toothpaste ♻2, pasta sauce ♻5, etc.) into our safe plastic bag.

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[6] https://www.eastman.com/Markets/Tritan_Safe/Pages/Attributes.aspx

[7] https://ils.utexas.edu/component/cobalt/item/67-icmb/390-bittner-george-d?Itemid=1243

[8] https://www.npr.org/sections/health-shots/2015/02/16/385747786/beyond-bpa-court-battle-reveals-a-shift-in-debate-over-plastic-safety

[9] https://www.motherjones.com/environment/2014/03/tritan-certichem-eastman-bpa-free-plastic-safe/

SUMMARY

This experiment was really eye opening. We totally thought we were model citizens, thinking sustainably and helping with reducing the plastic problem at our level, when in fact we were so far from having an impact by simply following city recycling guidelines.

While starting such an operation at the individual level is absolutely doable, it would only truly work at a community level, involving a critical mass of people to produce a meaningful output. Even more so if we were trying to generate some revenue. Working with local businesses should also be part of the solution.

We used about 4x more non-safe plastic compared to safe plastic. Therefore it would be relevant to invest into a ventilation system and into the equipment required to process all plastic types. However this would add several thousand dollars to our initial investment (Laboratory Steel Portable Fume Exhauster 19"Wx25"Dx51"H, second hand: $850 - new: $2600 | 3M 6000 gas mask + active charcoal cartridges: $230), making this operation less doable/viable. This would certainly make more sense if we were going “Pro” and aiming to develop a true business model around this operation and processing a larger amount of plastic.

No products are designed for their after-use life. There should be policies in place forcing companies to use only plastic types that are easily recyclable. Plastic products should be conceived to allow easy fixing. For instance if we break a leg of a plastic stool, it should be possible to disassemble it and exchange it against a new one. The manufacturer would simply shred the broken leg and make a new one from it.

To conclude, the plastic problem is even worse than we thought. Consumers are not educated enough to fully understand the recycling process, and can even be lured by labels such as “compostable plastic”.

Recycling is a method which should be used to clean what we can from the mess we already created, not as an excuse to create more.

Stats

- Amount of safe recyclable plastic: 78g
- Amount of non-recyclable plastic: 310g
- We would need 10 years to break even from the initial investment

Follow up questions

- What to do with wrappers?
- What to do with plastic caps?
- Should we be ethically concerned with the amount of freshwater used to wash the items to recycle since we're trying to stay sustainable (i.e.: not depleting a resource for cleaning up our mess)?
- How to stop misleading consumers with compostable plastic?
- How to better educate consumers about recycling?

Resources

Precious plastic: https://preciousplastic.com/

Precious plastic community: https://preciousplastic.com/solutions/community-platform.html

Precious plastic academy: https://community.preciousplastic.com/academy/intro.html

Precious plastic youtube channel: https://www.youtube.com/watch?v=dP1s7viFZHY&list=PLtYgsstkMPuXdOmvoUYAc0oDoFlk_Ztsp

Bye Bye Plastic bags: http://www.byebyeplasticbags.org/

Austin “what do I do with” recycling app: https://austintexas.gov/department/what-do-i-do-0