Tracking Separated Plastic Components from E-scrap

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1 Introduction

Consumer Electronics have high demand and a rapid turnover rate and is creating an unprecedented amount of high grade polymer waste. Additionally, recycling this plastic e-waste is difficult because of the need for separation of: inorganics, different polymer chemistries and additives, and hazardous materials.

Need:

Create an efficient, commercially viable, automated separation and recycling process for mixed e-waste plastic that reduces human health and risk exposures prevalent in the predominant current labor intensive sorting and recovery methodology.

Goal:

This work aims to review what happens to polymeric components after they leave an e-waste recycling facility, the environmental impacts of electronic products and processes, and how end-of-life impacts can be reduced.

2 Plastic E-Waste Dilemma

- Plastics account for 33% of total e-waste by weight[1]
- Global production estimated 7-8 million tonnes/year[2]
- Waste is often exported to developing countries:
  - Primitive recycling techniques
  - Burning and acid dissolution
  - Cheap
  - Detrimental to human health and environment

Improper recycling in third world countries

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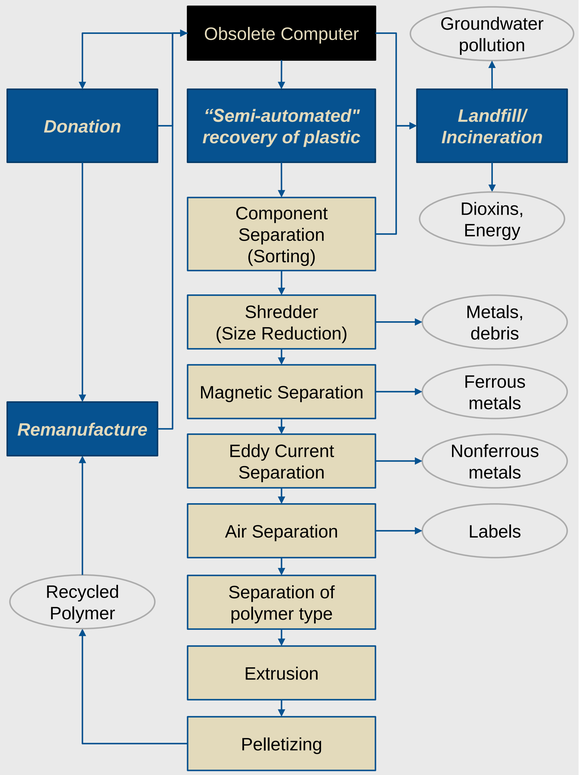
3 Plastic E-Waste Life Cycle

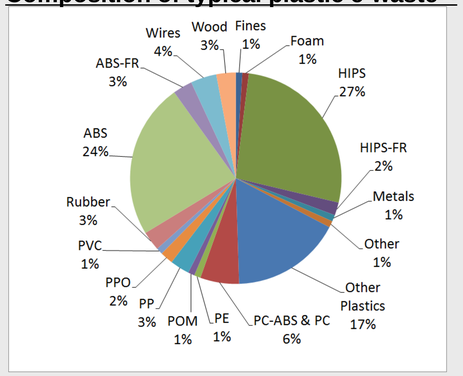


4 Polymer Types

Plastic E-Waste contains more than 15 types of resins, the most common are:

- Acrylonitrile Butadiene Styrene (ABS)
- Polycarbonate (PC)
- High-impact polystyrene (HIPS)
- Polyphenylene oxide blends (PPO)

Composition of typical plastic e-waste[3]



5 Challenges of Recycling E-Waste Plastics

Mechanical separation difficulties

- Removal of paints/coatings
- Size reduction
- Foreign material separation
- Identification and plastics sorting

Unacceptable properties of mixed plastics

- Purity < 99% affects mechanical properties
- Purity < 85% affects viscosity
- ~65 % of collected plastics meet a rejection criterion for high grade customer specifications

Contain brominated flame retardants (BFRs)

- Identification – No cost effective method for identification of these materials (Flame test)
- Removal – Not readily applied, treated as a different resin type

"Chicken and the Egg" scenario

- Limited volume of clean recycled plastic to supply manufacturers with a stable feedstock
- People aren't recycling plastics because there's no market for them

6 Recycling Plastic E-Waste

Economics:

- Unsorted mixed plastic = low $
- ABS & PC = high $ (compared to PE)

At the recycler:

- Most metals get recycled
- <10% of high value plastics are recycled[3]

Issues with recycling plastics

- Similar density and properties
- Variety of colors and grades

Typical properties of e-waste plastics[3]

	Density [g/cm^3]	Melt Flow Rate [g/10 in.]
HIPS	1.15	7.5 (200°C/5kg)
ABS	1.18	17.7 (230°C/3.8kg)
PC	1.20	15 (230°C/3.8kg)
PC/ABS	1.2	11 (230°C/3.8kg)

7 Thoughts from Recyclers

What could be done to make separation of plastic easier?

- Manufacturers reducing polymer types
- Eliminate parts embedded with foreign materials
- Eliminate mixed plastics fastened/glued together

What becomes of the recycled polymer?

- 80% goes back to commerce / 20% to landfill
- Low grade application
- Goal: use remaining stock for asphalt fillers

Future for plastic E-Waste Recycling?

- Large volume, high speed sorter
- Sorting similar density materials i.e. 'skin flotation'

8 References

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