Sustainability of Plastics Used in Consumer Electronics

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Objective

- Identify plastic materials and additives in consumer electronics
  - Evaluate negatively impacts to human health & the environment
  - Analysis over the product's life cycle

Image_source:https://promo.gelifesciences.com/gl/BP/UP_art4.html#.U9AAgrHLCVo

Plastic in Electronics

http://www.businessweek.com

- Exposure to humans
  - At production
  - Product end of life
- Choosing safer materials can limit harmful outcomes

Plastics are:

- Ubiquitous
- Persistent
- Frequently toxic

http://sites.stedwards.edu/nfurse/e-waste/

Introduction to Plastic

- Synthetic material: Derived from crude oil
  - Resins: different "flavors" of plastic
  - Additives: chemicals to make products usable
- Persistent Solids
  - Forms microplastics
  - Sequester harmful materials
  - Leach chemicals
  - Partial incineration - fumes

NOAA Turning the Tide on Trash

http://www.ipaspa.com

http://mabila.ua/posts/5087

Methodology

http://libraries.adelphi.edu/

Literature Review:

Search, evaluate, synthesize

Sources:

- Peer-reviewed articles
- Databases
- Government reports
- Previous Assessments: Life Cycle & Assessments Alternatives

Results

Decabromodiphenyl ether (Deca-BPE)		
Use	Flame Retardant (additive)	
Resins	Polypropylene, polyester resins, polyester resins, thermoplastic elastomers	
Product	TV/computer/ covers, cabinet backs, connectors, electrical boxes, wires	
Health Effects	Potential carcinogen	Neurological effects
	Endocrine disruption	
Exposure	In dust in homes/office	Toxic when incinerated
	In blood of e-waste workers	
	Absorbed via inhalation and dermal contact	
Bans	2009 voluntary phase out by 2014	
Alternatives	Some suggested, but none are non-hazardous	

Bisphenol A (BPA)		
Use/Resins	Monomer of Polycarbonate and plasticizer	
Product	Laptop/cell phone casings, cathode ray tubes, fax machines, plugs/ connector, printed circuit boards	
Health Effects (Animals)	Endocrine disruption	Oxidative stress
	Negative effects on growth, reproduction, development	
Health Effects (Humans)	Endocrine disruption	
	Correlation with diabetes & cardiovascular disease	
Exposure	Leaches from E-waste & landfills	
	Indoor dust accounts for <1% human intake	
Controversy	* Disputes over exposure limits and concern	
	* Special interest groups block bans in food products	
* $15 million conflict of interest was exposed after 2008 FDA report		

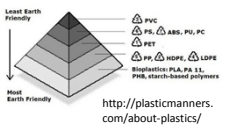
Future Work

- Continue to research different plastic resins and their additives
- Evaluate tradeoffs between material selection to support decision in product design

Material	Uses
Acrylonitrile butadiene styrene	Kitchen appliances, small appliance housings, computer housings, portable electronics
PC/ABS	Flashlights, keyboards, monitors, battery case, computers housing, mobile phones
Acrylic	LCD, cell phone screen, pc screens
Thermoplastic polyurethane	Cell phones, power tools, medical devices

What Can We Do?

- Require manufacturers to be responsible for their products after use
- Use plastics that are more readily recyclable
- Discontinue the use of known toxic plastics
- Evaluate new materials before new production



http://plasticmanners.com/about-plastics/

http://globaldesignstudies.blogspot.com

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