

Plastics & Recycling

Holland Professional Club

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Jay True

Slide 2

Most of us are old enough to remember this Dustin Hoffman moment.

Slide 3

Why this subject? My father was a chemical engineer for Chevron who managed a polyester resin plant while I was growing up. Other than surfboards, I had no idea what it was used for.

In college, I majored in Environmental Engineering although I never worked in the field. It was so long ago that the big concern was global cooling. Since then, I have been immersed in the plastics culture. With conflicting messages out there, I decided I should dig into this subject and share it with you.

Slide 4

It is worth understanding plastics and their origins to be able to consider their impact on our world. These synthetic organic polymers, made mostly from petroleum, are ubiquitous today.

Slide 5

Plastics as a group have several valuable properties: they are inexpensive, light weight, and durable. This combination of qualities offers advantages over alternative materials but also some drawbacks.

Slide 6

Plastics are not as simple and consistent as other common materials like glass, metals, and wood. The list on the slide is not exhaustive and leads to a lot of difficulties in reuse and recycling.

Slide 7

Celluloid was the first modern plastic. First used in making combs and later film, it is a mixture of wood and camphor resin, a petrochemical made from coal tar and led to cellophane tape. Bakelite, the first fully synthetic plastic, combined formaldehyde and coal tar under heat. It resulted in the first thermoset plastic, molded into solid, dark colored, light weight, insulating, and long-lasting products like old desk phones. During the great depression leading up to World War II, many more plastics were discovered and perfected. The war effort depended on plastic alternatives to otherwise expensive, heavy, and difficult to source products.

Slide 8

By the mid-50's plastics were everywhere, leading to this cringe-worthy Life Magazine article glorifying inexpensive single use products. The irony was evidently lost on them as they celebrated the new abundance and prosperity of the post-war USA.

Slide 9

This classification system was developed by the Plastics Industry Association in response to the environmental movement that started with the first earth day in 1970. It might lead you to believe that there are 7 types of plastic, and all are recyclable. While possibly true in the abstract, there is no currently feasible way to

recycle thermoset plastic types 3 & 6. Type 7 is a catchall for dozens of unique plastics, many of which are seldom recycled.

Slide 10

These rudimentary chemical descriptions of the primary types of plastic are representative of their formulations. The lower case “n” at the end of most of the formulas indicates that the lengths of the polymer chains are highly variable, depending on the desired qualities. You will also note that HDPE (2) and LDPE(4) have the same formula. Generally, HDPE is processed differently to make more solid products like household bottles and LDPE is used to make films and clamshell packaging. Before you get comfortable, this Meijer’s bag is HDPE. Here are some other samples of single use plastics. Speaking of Meijer’s bags, here is a “plarn” tote that my wife knitted from about 60 bags.

Slide 11

Total global production of plastics is about 400 million metric tons. These percentages are approximate.

Slide 12

What I’m calling an alphabet soup is just a peek into the rest of category 7 “other”. Some of these are instantly recognizable and others are tongue twisters. Their recyclability varies and they must only be re-processed with like materials or they will contaminate other formulations.

Slide 13

Here are even more plastics, both old and new, and even ones made from biomass, usually cellulose and starches. The catch with bio-plastics is that they mimic

petrochemical ones but contaminate the recycling process and compete with food production.

Slide 14

I am getting out over my skis discussing psychology, but many in the field have pointed out the symbolism of plastics, industry marketing messages, and the responses of our brains. There is much more research being done, including on cultural variables.

Slide 15

Recycling

Slide 16

Here are two definitions of recycling. The second is more recent and emphasizes the “shoulds” of recycling.

Slide 17

Originally material goods were recycled to preserve scarce resources. Today, we recycle to reduce landfill, avoid litter, and consume less. However, plastics pose their own challenges.

Slide 18

Modern recycling has made a transition from scarcity to abundance. Early 20th century recycling of glass was necessary because the high cost and weight of the bottles made it uneconomic to throw them away. Now both those applications have been replaced by plastic ones that weigh less than one-twentieth of the old ones. In addition to the 9% recycled plastic, about 12% was incinerated, and 79% went to landfills or litter, world-wide in 2015. Incineration has the advantage of

eliminating many of the un-recyclable types of plastic. However, burning PVC for example, emits hydrochloric acid, corroding the kiln and causing acid rain.

Slide 19

Recycling in general is an economic issue. Somebody must spend money to do it. I got to start my research by visiting the Padnos recycling facility in Grand Rapids with Jeff Padnos. There, they were primarily reprocessing pre-consumer plastic by segregating materials, chopping, washing, grinding, heating, and extruding pellets using large, expensive machines (think imported from Europe), and skilled workers. They generally need to do this for less than 50 cents per pound of finished material. It is nearly impossible to do this and pay for the raw scrap they work from. They also need to be alert for contaminants that can degrade an entire batch to where it is worthless. And the market is fickle; if recycled content is not valued by the user, or the price of virgin raw material is less, recyclers can be stuck with finished products and looking for a buyer.

Slide 20

On a psychological level, recycling is a complicated mix of incentives, sanctions, costs, and motivations. What happens to recycled material is not what we think. For example, in the city of Holland's yellow bag recycling, up to 60% ended up in landfills due to torn bags, dirty materials, and difficulties sorting. Processing single stream, curbside pickups has been highly labor intensive, but automation and AI are improving the efficiency of sorting and reducing costs at places like Kent County's Materials Recycling Facility.

Slide 21

The nationwide recycling movement grew out of anti-litter campaigns. Along the way, various incentives and systems were developed. For a while, it looked like China would be our savior until they stopped taking huge amounts of plastic in 2018 due to poor quality inputs and their own sanitation and disposal problems.

Slide 22

The Good, The Bad, and the Ugly

Slide 23

Most of us remember this climactic scene from the movie. I don't mean to identify any of the participants in plastics recycling with the movie characters. I just love the scene and the title fits the plastics situation.

Slide 24

There is good news in plastics recycling. Governments, research institutions, producers, and consumers are better informed and making better decisions than ever before. One seldom discussed advantage of plastics is that they are so much lighter and less bulky than the products they replaced. So, volumes going to landfills are far less than they would be without plastics.

Slide 25

On the other hand, we face some incredibly difficult problems across the globe. Events like Covid 19 and Russia invading Ukraine contribute to the problems. Even the sources of plastic pollution are being debated.

Slide 26

Turtle with straw video – and now for the ugly.

Slide 27

You may have seen videos of other sea animals entangled in plastic. Ocean plastics is a huge problem that we in America have little impact on. The harvesting movement is impractical because even in the garbage patches, the plastic is mostly widely separated and spread out over huge areas. The materials are the epitome of unsorted and are difficult to recycle. If we burn it, that contributes to climate change. The biggest sources are in impoverished countries with neither the means nor the will to change. Ironically, fishermen are the people most impacted by ocean waste but also the source of 10% or more of it. Littering leads to more littering.

Slide 28

Unfortunately, there is no silver bullet. It's a technically and culturally "wicked" problem. These are some things we can do. There is a broad consensus that more recycling alone will not solve our problems but that does not mean we should give up. We can do better at it. Strategies like these, applied appropriately, with incentives, sanctions, awareness, and technologies can bend the path we are on toward a more sustainable future. We need to be honest with ourselves and our descendants.