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Environmental Technical Brief: HDPE

*An overview of High-density Polyethylene's
environmental profile*

HDPE

An Overview

HDPE, SPI resin code #2, is a member of the polyolefin family of plastics, which includes low-density polyethylene (LDPE), linear low-density polyethylene (LLDPE), and polypropylene (PP) (APME, 2006). Polyethylenes are a class of thermoplastics based mostly on the monomer ethylene. The different types of polyethylenes are distinguished from each other by the degree of molecular linearity or branching and crystallinity within the polymer, which affects their density. Because of this HDPE has a higher chemical resistance, is stiffer, stronger, and more abrasion-resistant than LDPE (Strong, 2000).

Common applications

Packaging applications like juice bottles, milk and water jugs, bleach, detergent and shampoo bottles, motor oil containers, and plastic grocery bags (Miller, 2005).

Reusable pallets, crates, trash carts and chemical storage tanks (Strong, 2000).

Recovery statistics

In 2007, HDPE represented 18% of all plastics in the MSW, 10% of which was recovered. Recovery of HDPE packaging was 14% in 2007 (U.S. EPA, 2005). Used HDPE is highly-recyclable and suitable for a variety of recycled applications. ***See graph to follow**

Production methods

The main component of HDPE is the monomer ethylene, which is polymerized to form polyethylene. The main catalysts are aluminum trialkyltitanium tetrachloride and chromium oxide (Brown & Cole, 1993).

Polymer production process

The polymerization of ethylene and co-monomers into HDPE occurs in a reactor in the presence of hydrogen at a temperature of up to 230 degrees Fahrenheit. The resulting HDPE powder is then fed into a pelletizer to make pellets (Brown & Cole, 1993).

Resource intensity of raw material production

Boundary assumption: The energy, water, and waste information in this brief is limited to data from the extraction of the raw materials (oil or natural gas) through production of HDPE pellets. The impacts from the specific package fabrication i.e. blow molding, and from consumer use and disposal are not included.

Energy consumption, virgin material production

About 59.2 million Btus per ton is used to manufacture HDPE (Franklin, 2007). The primary source of energy for virgin HDPE production is either oil or natural gas. While some of the energy is consumed during production, a significant amount (about 46.7 million Btus per ton) is embedded in the HDPE resin itself and can be reclaimed in the future (Franklin, 2007). ***See graph to follow**

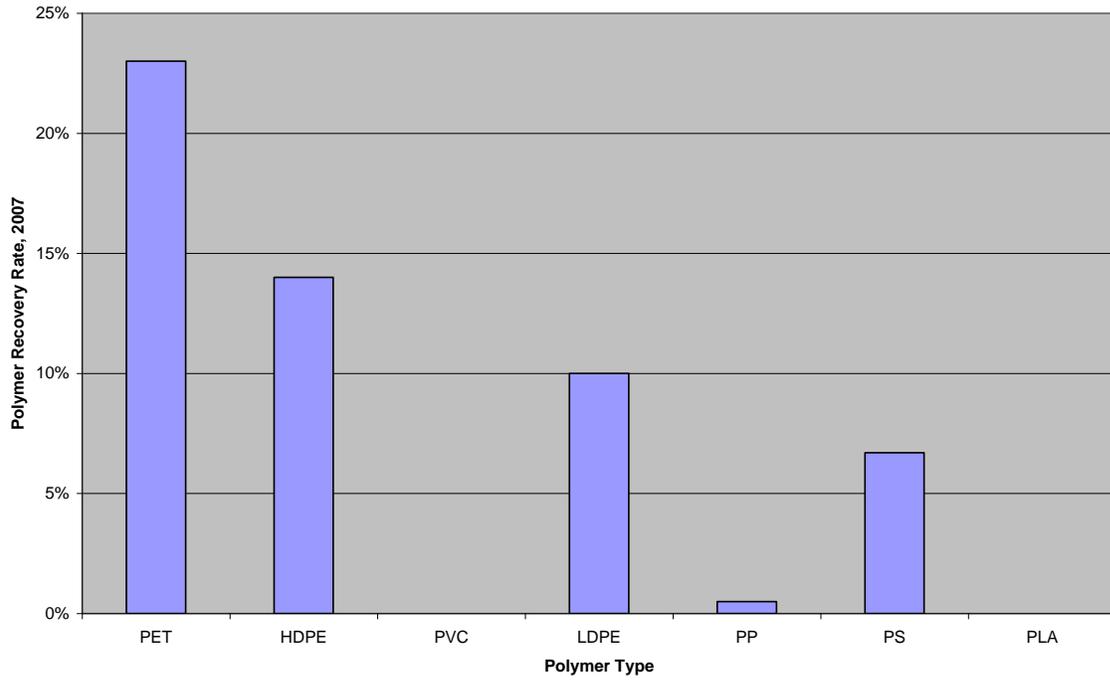
Greenhouse gas emissions

About 1,478 lbs carbon dioxide equivalents per 1,000 lbs HDPE are generated during HDPE production. 79% of the greenhouse gas emissions are fuel related and 21% are process related (Franklin, 2007). ***See graph to follow**

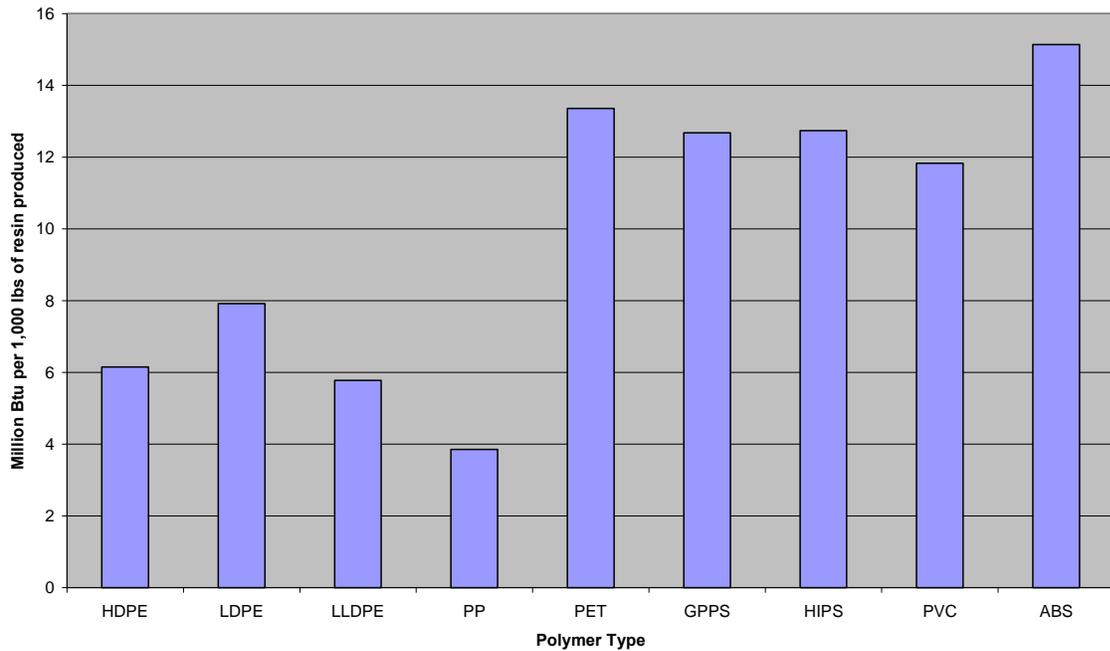
Material health

There are no known human or ecological health issues specific to HDPE production, use or disposal, beyond those typically related to polymer production.

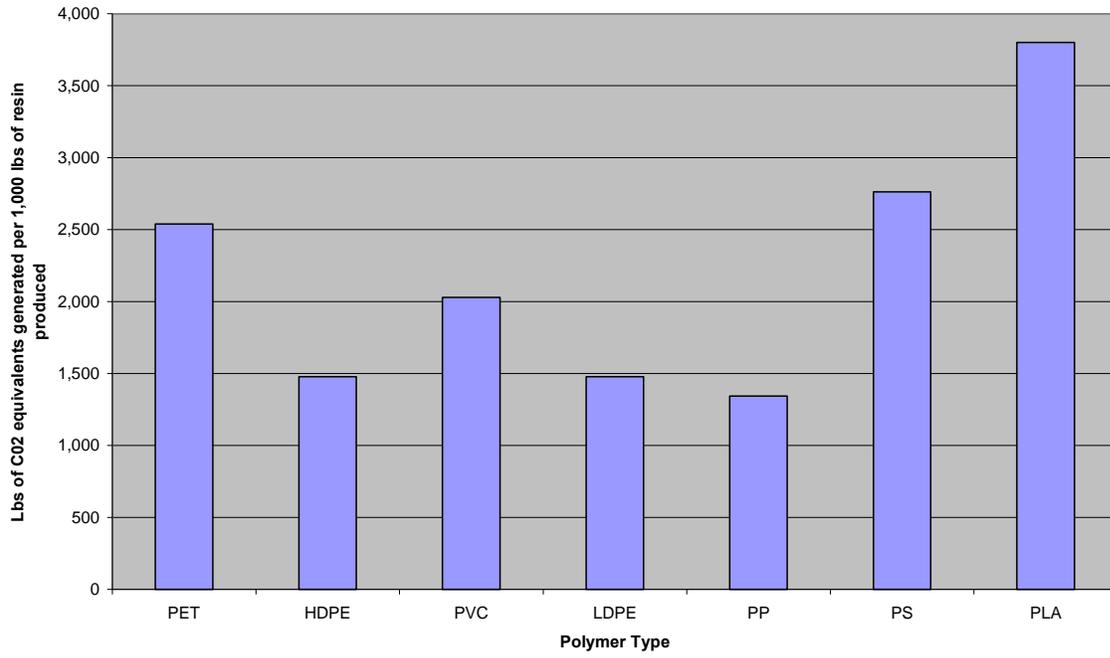
U.S. MSW Data: Common Packaging Polymers Recovery Rates, 2007 (U.S. EPA, 2008)



Energy Required for Production of Common Packaging Polymers (Franklin Associates, a Division of ERG, 2007)



Greenhouse Gas Emissions Generated in Polymer Production
(Franklin 2007 & Vink et al 2007)



References

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