Polypropylene

5 PP Polypropene

LOMP
Lake Ontario MicroPlastics Center

Production and Use:

Did you know?

Candy wrappers and **diapers** are made of the same type of plastic! Chemicals are added to plastics to change their properties and slow degradation by light, heat, or oxygen. This allows a single plastic polymer to be used in many ways.

Polypropylene is the second most produced plastic resin, behind only polyethylene.

- identified with Resin Identification Code 5 ("#5 plastic")
- commonly made into packaging and consumer products; also used in construction and transportation industries
- ~70 million tons produced and 55 million tons of waste generated globally each year[1]
- ~21% of global non-fiber plastic production[1]

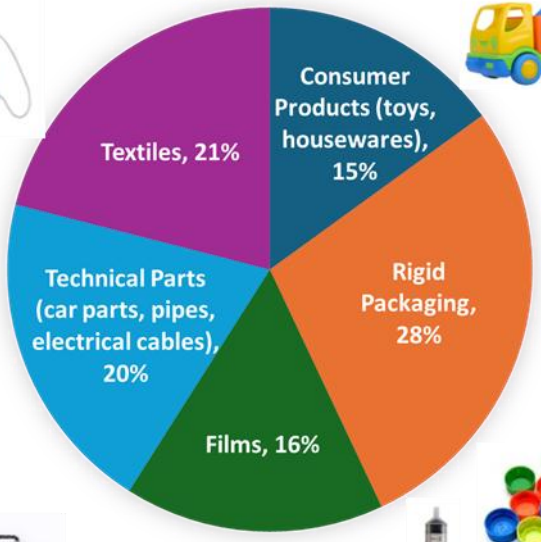
Polypropylene is processed in many ways to make diverse products.[2]



- stretched into **films** for packaging
- spun into **fibers** for textiles
- **molded** or **extruded** into 3-D objects
- may be mixed with other materials (e.g., metal)



Polypropylene Uses by Industry (2016)[2]





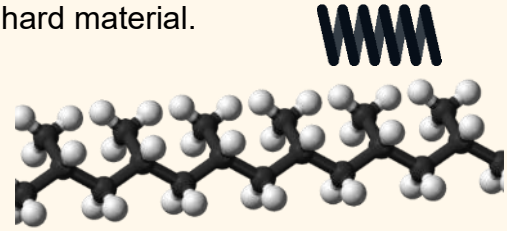




Characteristics:[3]

- naturally white and opaque; very versatile
- does not absorb moisture
- can be molded easily
- not brittle – can be flexible

Their asymmetrical structure causes polypropylene molecules to arrange into helixes, making a hard material.



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Waste:

Typical mechanical recycling degrades polypropylene, reducing quality, introducing contamination, and limiting how it can be used.[4]

Over **8 million tons** of polypropylene waste – more than the weight of 22 Empire State Buildings – was collected in the US in 2019.[5]

- only 3% was recycled[5]
- 88% ended up in the landfill and another 9% was incinerated[5]
- made up 19% of the total plastic waste collected[5]

Other polypropylene waste is not collected and ends up in the environment.

Polypropylene items can break down into microplastics over time, from wear and tear during use (especially textiles) or after being discarded. Some items, like snack wrappers, bottle caps, and hygiene supplies, are commonly littered.[6] Polypropylene floats in water because of its low density and may travel with currents. In the environment it can be degraded by sun, wind, water, and microbes.

Researchers in Rochester are studying polypropylene

Researchers at the Lake Ontario MicroPlastics Center (LOMP) study how plastics get into and move around the environment. One way they do this is by collecting and sorting litter in storm drains. Polypropylene packaging like snack wrappers and bottle caps are some of the most common plastic items they find.[6]

University of Rochester photo / J. Adam Fenster

LOMP researchers are also working to understand what happens to polypropylene in the environment. By “aging” polypropylene snack wrappers in controlled environments[6,7] that mimic natural conditions, they are learning how these items change in the environment.

Advancing microplastics research

Plastic in the environment is broken down by microbes, sunlight, heat, and other environmental conditions. This process can change the properties of the plastic: big pieces can break into microplastics of different sizes and shapes, chemical additives can leach out, and pollutants from the environment can stick to the plastic. Bacteria and other organisms can even live on plastic.[8] These changes make microplastics move around the environment differently or even become more or less toxic.[9] LOMP is working to understand what happens to plastic in the environment and why that matters for the health of humans and the environment.

Learn more at LOMP.urmc.edu.

[1]Geyer et al. (2017) *Sci Adv* 3(7):e1700782. [2]The Essential Chemical Industry – Online. Poly(propene) (Polypropylene). [3]International Association of Plastics Distribution. IAPD Thermoplastics Rectangle. [4]Eriksen et al. (2019) *Waste Manag* 96, 75-85. [5]Milbrandt et al. (2022) *Resour Conserv Recycl* 183, 106363. [6]Arieno, P. (2024). Thesis. Rochester Institute of Technology. [7]Batte, E. (2025) Thesis. Rochester Institute of Technology. [8]Bangkong, C.M. (2023). Thesis. Rochester Institute of Technology. [9]Chomiak, K. (2021). Thesis. Rochester Institute of Technology.