

Cellulose Acetate

LOMP

Lake Ontario MicroPlastics Center

Did you know?

Cigarette butts are the most commonly littered item in the world - **and they contain plastic.**

The filters in cigarette butts are made of **cellulose acetate**. People usually think of plastics as made from fossil fuels, but they can be made from other materials—like cellulose.

Naturally occurring cellulose from plants is processed into cellulose acetate and mixed with chemical additives like plasticizers to give it properties similar to other plastics. This creates a **semi-synthetic** material that can be tough and durable and able to be melted and molded into different forms.



Most cellulose acetate is spun into **plastic fibers** and packaged into bundles called “tow” used in cigarettes. The bundles, wrapped in tipping paper, make up the butt that is thrown away after use.

- Globally, **over 80%**¹ of the 800,000 tons of cellulose acetate made annually² is made into cigarettes
- **4.5 trillion** cigarette butts are littered every year³

Cigarette butt litter sheds plastic microfibers into the environment.

Cellulose acetate cigarette butts do not break down fully over short timespans (~2 years) under simulated natural conditions.⁴ Research suggests they may take **more than a decade** to break down in the environment.⁵



University of Rochester photo / J. Adam Fenster

Each cigarette butt contains approximately 15,000 microplastic fibers.⁶ When exposed to water, they immediately release loose fibers and continue to shed them if submerged.⁷ As cigarette butt litter breaks down these fibers are released into and can move around the environment. These fibers contain **toxic chemicals** including nicotine, tar, and other chemicals from cigarette smoke that can then get **released into the environment.**⁸

Cellulose acetate is **not commonly recycled.**⁹

- **High risk of contamination:** cellulose acetate is usually combined with other materials and additives that can contaminate recycling batches
- **Complicated:** a high melting point makes it hard to separate from other materials
- **Unavailable:** few recycling programs accept it

More about cellulose acetate:¹⁰

Historically had a **wide range of uses**, but has been replaced by cheaper, more durable plastics in many products. Today it is most often mixed with other plastics in products like:

- Silk-like textiles
- Tool handles
- Eyewear frames
- Photographic film



Versatile; can be given different **characteristics** during production:

- Can be brittle or flexible
- High melting point range (additives can lower it)
- Lightweight
- Typically transparent

Researchers in Rochester are studying cellulose acetate

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 streets and storm drains. Cigarette butts are one of the most common items they find.¹¹

LOMP researchers are also working to understand what happens to cigarette butts in the environment. They are “aging” cigarette butts in controlled environments that mimic natural conditions to understand how these materials change in the environment.^{12,13}

Researchers aim to study the effects of these aged cellulose acetate fibers on ecosystems and health.



Advancing microplastics research



Plastic is ubiquitous in modern life, including in many products that may not seem like they are made of plastic. Paper cups, metal cans, many textiles like clothing and carpets, tires, teabags, wet wipes, cigarette butts, and more likely contain some plastic. Plastics can also be made from many different materials – like cellulose or corn starch.

These materials may be biodegradable in their original form but turning them into plastics gives them qualities (like being durable or waterproof) that also make them harder to break down. Studying these materials and how they change after use or in the environment will help us understand what kinds of microplastics humans are exposed to.

LOMP combines research on microplastics with education and community engagement to inform strategies to prevent negative impacts of microplastics on human health. LOMP

resources aim provide information relevant to local communities in the face of scientific uncertainty about microplastics and human health.

View LOMP resources and get involved at LOMP.urmc.edu.



¹Transparency Market Research (2015). Cellulose Acetate (Cellulose Acetate Tow and Cellulose Acetate Filament) Market. ²Puls, J., Wilson, S.A. & Hölter, D. (2011). *J Polym Environ* **19**, 152–165. ³Novotny, T. E., & Zhao, F. (1999). *Tox Control* **8**(1), 75–80. ⁴Yadav, N. & Hakkarainen, M. (2021). *Chemosphere* **265**, 128731. ⁵Joly, F.-X. & Coulis, M. (2018). *Waste Manag* **72**, 349–353. ⁶Belzagui, F. et al. (2021). *Sci Total Environ* **762**, 144165. ⁷Vasseghi, G., & Atkinson, J. D. (2026). *Journal of Hazardous Materials: Plastics*, **2**, 100036. ⁸Green, D.S. et al. (2023). *Sci Total Environ* **865**, 161256. ⁹Slejko, E.A., Tuan, A. & Scuor, N. (2024). *Waste Manag Bull* **1**(4), 67–73. ¹⁰Marinho, E. (2025). *Sustain Chem Environ* **11**, 100283. ¹¹Arieno, P. (2024). Thesis. Rochester Institute of Technology. ¹²Batte, E. (2025) Thesis. Rochester Institute of Technology. ¹³Krebs, L. (2025) Thesis. Rochester Institute of Technology.